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Electrical World

A Review of Current Progress in Electricity
and Its Practical Applications

Volume LXX

July 7 to December 29, 1917

146688
31/7/18

McGRAW-HILL PUBLISHING COMPANY, Inc.
Tenth Avenue and Thirty-sixth Street
NEW YORK CITY

London

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July—December 1917

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Electrical World

The consolidation of ELECTRICAL WORLD and ENGINEER and AMERICAN ELECTRICIAN
Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, JULY 7, 1917

No. 1

Destiny of the Engineer

THE presidential address delivered by H. W. Buck before the American Institute of Electrical Engineers last week is reprinted in full in this issue. To it all engineers should turn, for his remarks on the narrowing effect of exclusive specialization are timely and to the point. The rigorous austerity and bigotry of restricted science is as much to be avoided as implicit reliance on the classics and the softening influence of the humanities. Happiness rests with neither. Science in its true sense is not specially concerned with one class of phenomena or with one subject of investigation, but pertains alike to all branches of knowledge. Of what use is an engineer who in specializing gleans and verifies observations, combines experiments, weighs probabilities and discovers facts and partial laws, if his work cannot be turned to account in enlarging the resources of human life and happiness? President Buck pleads for a firm and proud sentiment of duty on the part of the engineer, a genuine public spirit and a noble idea of what an engineer owes to himself. We need in these times more men of the type of Huxley and Tyndall, who, versed in the letter as well as in the spirit of science, changed the popular conception of natural knowledge and became leaders who to this day are recognized, respected, followed with confidence, and who conscious of their responsibilities carried the burden as well as the advantage with dignity. Specialization there should be, for a man like a machine is more powerful for being more special, but the engineer must not permit himself on that account to become only a self-centered piece of mechanism. He should know science, art, language and literature so that his innate nobility may receive a more wholesome and complete development. He should improve his condition, have confidence in his worldly destiny, and widely expand his faculties; having done which he should fulfill his proper function in the community and take his place as a leader and guide of men and of civic affairs. This is the moral we draw from President Buck's address, and we commend its wholesome advice to all engineers.

The Wireless Situation

DESPITE persistent efforts at the repression of unauthorized wireless plants, it is reasonably certain that a good many are still in operation within our borders. The number of those already discovered by the investigations of the United States authorities would probably surprise the public were it disclosed. It is sufficient to say that they have been found adroitly hidden in all sorts of ways. For the most part such con-

cealed plants do not have large sending capacity, but it is possible to relay from one to another over considerable distances and to receive messages from plants outside of United States territory. It is well known that German wireless activities have been in evidence in the countries to the south of us and communication can be made through these via the concealed plants now in existence. We know of no better way in which electrical men can do service to the country than by keeping eyes and ears open for any signs of local activity in wireless.

The government could well organize as part of the Home Guard a large group of experts equipped with detecting apparatus who should make it their business to trace from city to city any dispatches apparently sent from other than the authorized stations. Electric light companies may well make it part of their business to keep watch for suspicious loads upon their lines, and particularly any installations of motor-generators. It is of fundamental importance that news concerning, for instance, the sailing of troops and munition ships should not be allowed to pass without the limits of the United States either by wireless or by any other means which can be prevented. The southern border of our country, from which wireless information might reach Mexico or even clear across the Caribbean, should be watched with particular alertness. It is time to remember that we are at war and that treasonable communications with the enemy ought to connote an open grave and a firing squad.

Analyze Your Rates

INFLEXIBILITY of rates in the face of rising costs is to-day the greatest danger menacing public utilities. Fortunately for electrical properties, their rate-making permits greater flexibility than that of other properties; their efficiency has made greater progress. It is the railroads on which a heavy burden falls by reason of the failure of the Interstate Commerce Commission to let higher costs be met by proportionally higher rates. This commission has missed an opportunity to strengthen the business structure. Every form of commercial activity, whether commodity or service, excepting only that rendered by the utilities, is making prices high enough to meet total costs; most of them are adding a round amount for extra profit. What the railroads will now have to do is to curtail unprofitable service in order to let economies give as much protection as possible to net revenues. The time has passed when appeal to the Interstate Commission will be effectual without a new series of hearings, a new presentation of the blighting effect of ascending costs and descending or

stationary rates. State commissions throughout the country are in closer personal touch with real operating conditions; they know the difficulties of local utility plants and we believe will give relief which the Washington authorities deny to carriers.

Rounding Up Isolated Plants on the Coast

THE number of isolated plants still in existence in the West has been rapidly diminishing year by year, and despite the recruits added to the list from time to time, central station commercial departments are figuring on the day, not far distant, when isolated plants in the larger cities shall be no more. In California cities the central stations have recently had unprecedented success in rounding up the remaining isolated plant business, improving the opportunity which the oil situation there has brought about. About three years ago it was the custom of the isolated plant to contract for fuel oil at 60 to 65 cents per barrel, and on these terms, with the added inducement offered by steam heat, building owners were wont to put in their own generating plants in spite of all the central stations might do. Now these conditions are reversed. Fuel oil is worth \$1.50 per barrel and the oil companies are making no contracts; you may have it to-day at the current price and take your chance on what you will pay to-morrow. Under these conditions building managers have become heartily sick of the isolated plant idea, and as fast as their long-term oil contracts expire almost without exception the isolated plant business is being added to the central station load.

Universal Power Supply for England

FROM time to time we have published accounts of some of the big power networks which have here by private enterprise been put in operation over considerable areas. In England the electric power supply committee of the Board of Trade has issued a report calling for a more general and adequate supply of electricity derived from great plants and distributed over wide territory. In addition a government committee is reported as having near completion a scheme for bulk production of electricity for the entire country. The Board of Trade committee also calls for such a comprehensive system, pointing out that as things are the interconnection of existing electric supply stations would be entirely inadequate. The government committee apparently looks toward general government control, dividing the whole country into seven areas with a company formed in each to merge existing plants and furnish whatever new supply may be necessary. It is reported also that some headway is being made in laying out the plan for corporate action. Thus far the project would not seem to contemplate actual government ownership, but rather a recognition of the fact that electric power supply is a natural monopoly, working out the most advantageous results for the public when unified under single control.

Municipal supply undertakings in England have been measurably successful, but whether, considering the very diverse conditions to be met, government ownership would offer reasonable prospect of success on the scale contemplated seems rather doubtful. Government control of power would seem to be a most probable solution of the difficulty. It would be, in fact, somewhat of an improvement over the situation with which some of our own large power networks have to contend—of a widely spread system of supply supervised not by one government body but by the commissions of several states. From a physical standpoint the English situation presents much less difficulty than is normally met here. The distances are shorter there, the density of service is greater, and while water power is almost a negligible quantity, there is admirable opportunity for great steam generating plants situated at the mines' mouth and turning out power almost or quite as cheaply as the average hydroelectric plant in this country, reinforced as it has to be by steam auxiliaries. The recognition by the Board of Trade committee that bulk supply of electric power will be necessary for cheap manufacturing after the war is quite in line with judgment and experience here, and the project as a whole looks sound and sensible.

Workshop Lighting

THE adequate lighting of machine shops and foundries is to-day one of the important branches of artificial illumination. Professor Clewell's paper on this topic is specially important in showing the relations existing between natural and artificial lighting and the frequent necessity of making preparations for the latter in order to secure all-day efficiency. The foundation of his investigation is the measure of working illumination in terms of the "daylight factor." This daylight factor—that is, the ratio of the inside to the outside illumination—impresses one at first thought as somewhat indefinite, yet it is the best measure which we have of the practical efficiency of the lighting arrangements in a given shop. Outside, in full daylight, the illumination may be of the order of one or several thousand foot-candles according to the day, the hour and the time of year. Within the building there is comparative darkness, perhaps 20 to 50 foot-candles in very favorable locations, a tenth of this or less in the darker parts of the shop. The daylight factor is merely the ratio of the average illumination inside to what it would be if walls and roof could be deftly lifted off. The measurement of this factor, involving as it does the averaging of interior conditions, is a somewhat laborious matter. Possibly it could be considerably facilitated by the use of an actinometric method; but however measured it does express the broad facts, and the startling thing about it is the very small value of the factor usually found, very rarely 10 per cent, not infrequently down to 1 per cent or even a tenth of this small quantity. In other words, in full daylight one may easily have only one or two foot-candles at certain points within the building. Hence it happens that

on dark and cloudy days and during the weak light of winter one may often have within a workshop far less light than is necessary for efficient operation.

Now, it seems to be a well-established fact that with modern gas-filled lamps well arranged, particularly where off-peak rates can be obtained, the cost of artificial light is less than the overhead on extra space required to increase output, so that in more cases than one would at first suppose artificial light may be economical where only a day shift is in operation. Professor Clewell, starting from this basis, shows the application of modern lighting units—both the gas-filled lamps and mercury arcs—to shop and foundry lighting, with numerical data on the results obtained. A fairly strong and well-distributed light can be secured at a very moderate expense. The intensities which seem to be necessary generally are from 2 to 4 foot-candles, with for special purposes excursions to considerably higher figures. The method most effective is general overhead illumination giving the nearest approximation to the distribution of light obtained by day.

The most difficult practical problem is that which often arises in the case of large working spaces of which portions are inadequately lighted. The mixture of daylight and artificial light is not altogether agreeable, and perhaps only for psychological reasons there is often a feeling that the artificial light is inadequate when it is really quite as strong as that previously obtained by day. The contrast between light near the windows and light within the interior of a shop lighted only from the sides is of course striking. Shops with monitor roofs and plenty of light from above fare better, but the general indication is that an artificial lighting equipment powerful enough to give a night shift opportunity to work to its highest efficiency is an extremely good investment.

Progress Toward Metric System

THE world war is making many and rapid changes. Old landmarks and established modes of thought are disappearing. In the general agitation the effete tends to be supplanted by the efficient. The archaic makes way for the modern, under the pressure of necessity, when the modern has proved its worth. The good old system of pounds, shillings and pence is joining hands in Great Britain with the ripe old system of bushels,

acres and inches to bid the world farewell. So many hundreds of thousands of young Englishmen have gone to somewhere in France that Englishmen have seen a great light in the simple workings of the decimal and metric systems. They are urging the abolition of needless and brain-wasting multiplication of units at home.

The annual report of the Decimal Association in London begins by reciting a list of twenty-eight public bodies in the United Kingdom that have recently advocated the decimalization of coinage weights and measures. One of these bodies acts as representative of 367 county and town councils throughout the kingdom. In addition, the Association of Chambers of Commerce of the United Kingdom last March passed resolutions calling for parliamentary legislation to decimalize the currency and also to metricize weights and measures. Similar resolutions have been recorded recently by the Court of Common Council of the city of London, the County Councils Association, the Incorporated Association of Head Masters and the Institution of Electrical Engineers.

Powdered Coal as a Fuel

THE possibilities of burning coal so finely pulverized as to be treated under the boilers almost like an oil spray improve with rise in the price of fuel. Methods which are unavailable in competition with ordinary cheap coal may be extremely valuable at the prices now existing and impending. The main point in working powdered coal successfully seems to be keeping it from moisture and air as effectively as possible until it is actually burned. It is particularly sensitive to moisture and must be dry to feed readily. Perhaps the practical difficulty of keeping up the supply of fresh dry coal dust is the most serious one in the whole matter.

In one case recently recorded in our columns the coal used was really a lignite with very high volatile contents. The boiler was equipped with an extended oven to give space for proper combustion, and into this furnace the fuel was blown by motor-driven fans. The thermal value of the coal was 11,760 B.t.u., and the evaporation from and at 212 deg. was 8.6, pushing the boiler efficiency to 71 per cent and showing very satisfactory results. Dust-fed furnaces seem to give the same facility in forcing the load as would be found in the use of fuel oil.

WHERE producer gas or any other gas suitable for burning in furnaces is readily available central station companies may find it economical to increase the ratings of their boilers by burning gas in conjunction with coal. The results of an investigation made by one company before adopting the practice will be presented in the next issue of the ELECTRICAL WORLD. Other fuel problems will also be discussed. The seventh installment of Professor Clewell's series on lighting will contain a discussion regarding the illumination requirements of office spaces and the relative advantages of

The Coming Issues

direct, semi-indirect and indirect lighting systems. The shortcomings of existing equipment for outdoor switching and transformer stations will be taken up in the July 21 issue in connection with suggestions that should relieve the situation considerably. The final issue in July will present the results of an investigation into the practices of central station properties regarding the sale of appliances and energy to employees. Considerable data have been gathered which will be analyzed so that the majority practices may be revealed. Other articles of particular interest to central station executives will appear.

Position of the Engineer in National Affairs*

Commanding Influence and General Recognition of Men of Scientific Training in the World of To-day—Interdependence of All Branches of Engineering and Drawbacks of Overspecialization

BY H. W. BUCK

President American Institute of Electrical Engineers

THERE has been much discussion concerning the position of the engineer in modern times, but conditions are changing so rapidly and points of view are undergoing such a fundamental evolution that it is well from time to time to review the relations of the engineer to his surroundings and to secure if possible the proper orientation.

THE ACCOMPLISHMENTS OF THE ENGINEER

The change and improvement in the engineer's position in the world in recent years have been so rapid as to surprise even those who were the optimists in the under-dog days of the engineering profession. In the middle of the last century, when the engineering and technical schools began to be formed in this country by men of far-seeing vision, the classical scholars looked on askance and took pains to differentiate these upstart institutions from their own traditional schools of learning and to ostracize those who pursued the new courses by classifying the professions as "learned" and technical.

Times fortunately have changed. The engineering profession is coming into its own. To-day the engineer is being swept along by a tide which he himself has created with an irresistible force, and it is well therefore for the engineer to take his eyes off his work occasionally and to observe his constantly changing surroundings. A flood of scientific and technical accomplishment has swept over the face of the earth, revolutionizing life, commerce and international destinies. Even the turmoil in which the world now finds itself can probably in the last analysis be traced to the over-acceleration of world affairs resulting from the work of the scientist and engineer.

In all this development period of the engineering profession during the last century the engineer has worked his way along alone and in silence, so to speak, seeking his reward rather in the joy of accomplishment and in the realization of his dreams than in worldly recognition and accumulation. The very inherent greatness of the pioneers who have laid the foundations upon which we now build prevented them in a way from acquiring a more worldly position in affairs. This tradition, however, is not a virtue beyond a certain point, and the engineer by nature is too willing to give way to others. The time has come when he should take a more worldly position in the world which he himself has created.

In our general relations to intellectual development we may consider that we are just emerging from a classical period where tradition, custom, prejudice, ignorance and dogmatic religion were the controlling forces. Movements which took place in world affairs were largely political, following the paths best suited to

the advantage of the ruling classes. There was little real progress, because there was no development of scientific knowledge and its application in engineering. Scientific truth held no standing. The worship of tradition caused a powerful reaction against any scientific discovery which might necessitate a readjustment of established habits of thought and life.

For centuries before the dawn of the scientific and engineering era great changes took place throughout the world, but little real progress occurred. Races rose and fell, always falling back to the starting point, for there can be no upward trend in racial development without the solid basis of scientific knowledge to grow upon. China made great progress and developed its early civilization under scientific activity, but during recent centuries it has lived under the worship of classical tradition and has become inert.

A constant change in point of view, which is so largely brought about through developments in scientific knowledge, seems to be necessary for progress in civilization. Our civilization to-day differs from that of a century ago in proportion to the scientific and engineering evolution which has taken place during the period through its reactions on life in all of its phases. Such discoveries in science as the law of gravitation, the evolution of species, the laws of electromagnetic induction, etc., have probably had a more profound effect upon the development of the human race than any other acts in history.

THE ENGINEER IN HUMAN AFFAIRS

The engineering profession has passed through the preliminary stages of its growth and has reached a position where the engineer should work and act not only with proper attention to his work itself but with full consciousness of the important relation of his work to human affairs in general. Among the early pioneers in engineering were many notable instances of men of great breadth of view—men like Watt, Fulton, Whitney, McCormick, Erickson and others. Specialization had not at that time begun to work its narrowing influences. Of recent years, however, under the stress of commercial development and economic conditions, increasing specialization has taken place and the engineer has become obliged to compass his mind with an ever-narrowing horizon. This specialization produces extraordinary proficiency in particular fields, but has the objectionable effect of narrowing the character and outlook of the man and of reducing his value as a citizen. We must take care lest commercial considerations and the modern mania for efficiency in the narrow sense force our engineers to lose sight of the world around them in their concentrated attention to the part rather than to the whole. This excessive specialization is a danger which threatens the future standing of the engineer.

*Address at special meeting of American Institute of Electrical Engineers, New York City, June 27, 1917.

It is interesting to recall in this connection the results of a recent canvass made by a joint committee on education on the qualities which, in the opinion of about 5000 leading men, engineers and others, best fit a man for a successful career as an engineer. As a result of this vote only thirteen points out of a hundred were assigned to purely technical knowledge as an essential, the other eighty-seven points being allotted to broader qualifications, such as judgment, character, human understanding, etc. This is merely a quantitative statement of the many general demands now being made of the engineer, and it illustrates how his work has broadened out. It is an interesting and encouraging symptom.

A most significant movement of recent times in the engineering world has been the development of co-operative action among engineers of all classes, and this tendency will, I believe, serve to offset the evils of specialization. It is the growing recognition of the fact that all branches of engineering are interdependent. We electrical engineers, I believe, are well aware how much we need the assistance of other branches of engineering for the successful fulfillment of our purpose.

THE ENGINEERING COUNCIL

This co-operative movement has quite recently been given tangible expression in the formation of the Engineering Council, an act, I believe, of far-reaching consequence. Under this organization as a beginning the Civil, Mechanical, Mining and Electrical societies, together with the United Engineering Society, are tied together for co-operative action through a joint body of twenty-four representatives. This body will meet at frequent intervals and will deliberate on matters of general interest to engineers. It is an encouraging beginning toward universal co-operation among engineers in all branches of work.

In this Engineering Council we have for the first time an engineering body representing about 30,000 engineers of sufficient scope and standing to create an engineering public opinion. Its influence is likely to be far-reaching in building up the prestige of engineers in both technical and civic affairs. A further development which has reached full recognition only in recent times is the mutual appreciation which has grown up between the engineer on the one hand and the worker in pure science on the other.

The engineer looks to the scientist to provide him with raw materials of knowledge with which to work out his applications, and the scientist must look to the engineer to make his discoveries so fruitful that the full effectiveness of his work on the frontier of research can be sustained. Both are working together in order to unfold nature in the most effective way for the benefit of man.

We electrical engineers, I think, feel a particularly close bond with the pure scientist in that recent developments in physical science have disclosed an intimate relationship between electrical phenomena and the nature of energy and matter.

All of the important movements taking place at the present time which center around the engineer and his work mean, I believe, that the engineer is soon going to leave his position of isolation in independent fields of work and realize that he owes an obligation to the com-

munity broader than his daily engineering work and will contribute to the general welfare his talents and experience. It matters not whether the problems before him are political, sociological, industrial or technical, I believe that the engineering type of mind, if the proper breadth of view has been acquired, is best fitted to undertake them.

RESOURCEFULNESS AND IMAGINATION OF THE ENGINEER

It is not necessary, perhaps, in important administrative positions to have civil, electrical or mechanical engineers as such, but we do need men in those positions who have had training of the type which engineering gives, with the mental balance, the power of analysis which such a training develops, the resourcefulness and the faculty of recognizing and properly apportioning the various elements in a problem. There is a quality of mental honesty which engineering experience highly develops which is sorely needed in public life. The scientific and engineering professions should rise up and furnish such men from their ranks for the welfare of the country.

The classicist contends that a world dominated by scientists and engineers would be cold, materialistic and atheistic, and lacking in those qualities of art and sentiment and the imaginative outlook which every civilization so highly prizes. To this doctrine and its injustice to the engineer I want to take emphatic exception. The world to-day may be inclined toward materialism, but it is not dominated by the engineer—far from it—but by other classes.

The engineering mind, on the other hand, numbers among its characteristics a highly developed creative imagination and possesses to a high degree exactly those qualities of mind and temperament best suited to combat materialism. There have been many instances in history of great artists who have been great engineers and vice versa, and I believe that the two temperaments lie in close relationship. Furthermore, scientists and engineers as a class have a strongly developed spirit of international understanding and sympathy which may serve as an important safeguard against excessive nationalism and excessive aggression as well.

DESTINY OF THE ENGINEER

And so, gentlemen, I believe that we can confidently look forward to a new era for the proper fulfillment of the destinies of the engineer. Out of this world chaos we now see men of engineering and scientific training rising to positions of commanding prominence on all sides. It is simply the working of the inevitable law of the survival of the fittest.

In this great movement not only must the individual engineer play his part, but the great engineering societies must realize the power of influence which they are developing in an ever-increasing degree in the community at large and the obligations which devolve upon them.

And so I hope that the American Institute of Electrical Engineers as it passes along from one administration to another will acquire an increasing realization of its duty, not only in furthering the growth of science and engineering, but in furthering the influence of the engineer in the affairs of the country and of the world.

Foundry and Machine Shop Lighting

Relation of Daylight Factor to Artificial Illumination Requirements, Value of Uniformly Distributed Overhead Lamps, Results Obtained in Actual Practice, and Recommended Illumination Intensities

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

SUMMARY.—This article treats of one of the most important divisions of the industrial lighting field. The daylight factor of buildings is defined and discussed in order to show the importance of artificial light even in those plants which normally limit their work to daylight hours. Emphasis is also placed upon the present attitude toward the use of overhead lamps of sizes adapted to the mounted height required in machine shops and foundries. Differences in the distribution of illumination from one large lamp and a number of smaller lamps, for the same area, are made the basis for showing the superiority of moderate-size units over very large lamps for many shop installations. The peculiar difficulties in lighting foundries are discussed and methods explained for obtaining a sufficient degree of illumination on working surfaces other than those on a horizontal plane. To illustrate the requirements in a shop, reference is made to representative working spaces including assembly rooms, flat bench work and other operations which require considerable light from the side. The limitations imposed by very high and very low shop bays are touched upon. Special attention is directed to the excellent list of photographic views included in this article.

the order of 2 per cent. Near the center of some work-rooms where dependence is placed on lateral windows this factor falls as low as 0.01 per cent. In other

TABLE I—LIGHTING DATA RELATING TO FOUNDRIES USING MERCURY-VAPOR LAMPS*

Number	Total Square Feet	Watts per Lamp	Watts per Square Foot	Height Above Floor in Feet
1	15,200	725	0.52	22
2	12,400	725	0.23	27
3	24,000	725	0.24	45
4	28,180	725	0.34	22
5	5,000	725	0.29	42
6	44,000	400	0.20	27
7	44,500	400	0.55	12
8	16,300	400	0.30	20
9	30,800	400	0.31	23-35
10	6,900	400	0.31	15
11	13,400	400	0.28	16
12	90,500	400	0.34	18
13	12,000	400	0.26	18
14	28,350	200-400	0.29	18

*Reported in *Transactions I. E. S.*, annual convention, September, 1915, by W. A. D. Evans.

words, the illumination in the last-mentioned position is only one ten-thousandth of the value which would obtain if the walls and roof were removed.

RELATION OF DAYLIGHT FACTOR TO ARTIFICIAL LIGHTING REQUIREMENTS

Within limits the daylight factor for any specific installation is constant² whatever the time of year or the nature of the external conditions. Thus it is an important basis for the study of artificial-light requirements during the day shift. If this factor be known for any point in a shop, it is possible to determine the value of the outside illumination necessary for producing a minimum illumination at this point. Hence if the outside illumination in certain parts of the winter months or on dark cloudy days of the summer falls below this quantity, it follows that, if this minimum inside value of the illumination is essential at all times, the addition of an artificial lighting system is imperative. Of course, this statement should be modified if there is any way in which to increase the efficiency of the window lighting—by changes in the building construction to provide more window area, by the use of some form of prisms for directing the daylight more effectively into the buildings, or possibly by more frequent window cleaning.

The proportion of outside light which reaches a point on the inside of the factory building has been shown in the British report previously quoted seldom to reach as much as 10 per cent. More often it is 1 per cent or one-tenth of 1 per cent, which indicates that the outside illumination may easily reach values a thousand or even more times the inside values at the work. On a

THE requirement of a factory building for artificial light during daylight hours can perhaps be best understood after a study of the efficiency of window lighting. In other words, the proportion, daylight factor¹, of the light incident on the outside of the buildings that reaches the work inside should be ob-

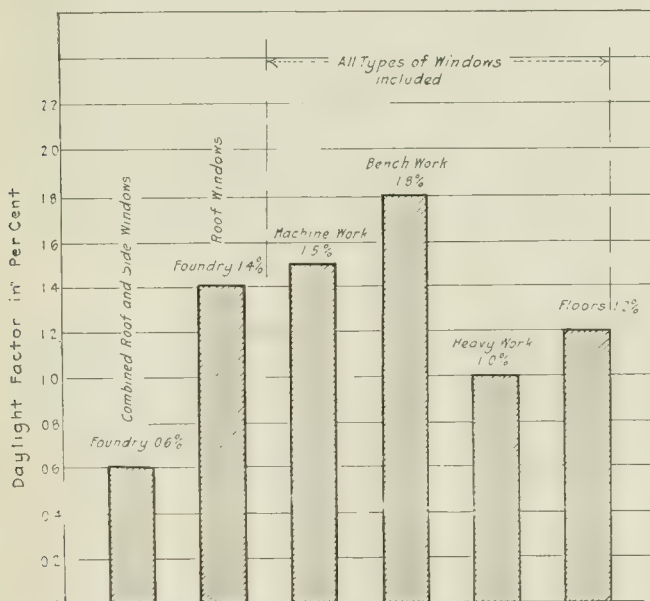


FIG. 1—RATIO OF INTERIOR TO EXTERIOR DAYLIGHT ILLUMINATION FOR VARIOUS TYPES OF BUILDINGS

served. The measurement of the outside illumination corresponding to an inside measurement should be equivalent to measuring the illumination at the inside point but with walls and roof removed. Tests show that this factor for some roof-lighted buildings is on

¹The "daylight factor" is defined as the ratio of the inside to the outside measurement of illumination at a given time of day, expressed as a percentage.

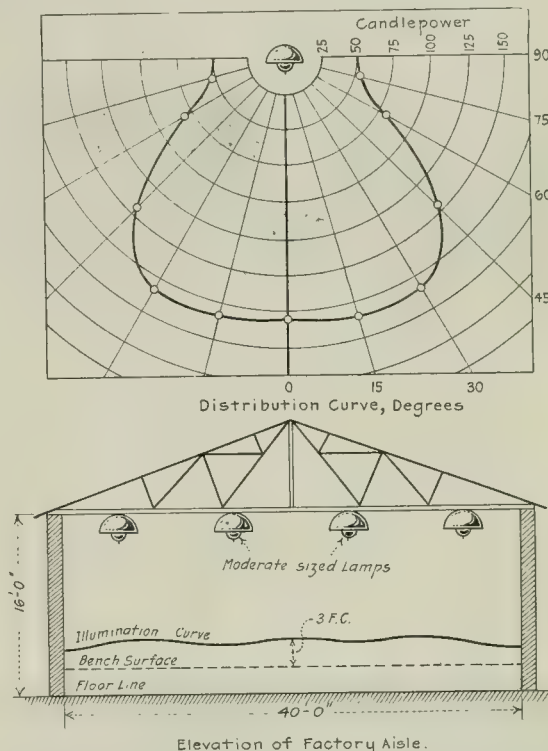
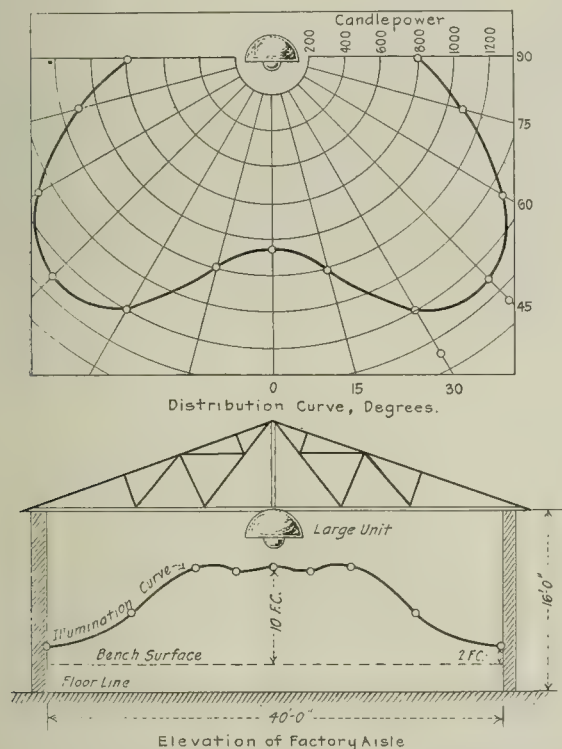
²First report of the departmental committee on lighting in factories and workshops under governmental appointment in Great Britain and issued in 1915. Reference is made in these notes to pages 38 and 63 of this report.

bright summer day, when the outside intensity amounts to say 5000 ft.-candles, work will be possible on the inside of the building with a daylight factor of one-tenth of 1 per cent, that is to say, when the intensity is thus 5 ft.-candles. The British tests show, however, that on an average December day the outside intensity does not exceed 750 ft.-candles even at noon. Hence in a building with a daylight factor of one-tenth of 1 per cent at certain parts the inside intensity will be less than 0.75 ft.-candle during practically all daylight hours of the winter. While this case may be somewhat extreme, it illustrates forcibly the point involved, and the values of this factor (Fig. 1) for various buildings

adds to the value of the plant by making it possible to use it for manufacturing purposes during the entire twenty-four-hour period of each day in cases where increased orders make it essential to add a night shift. This procedure will probably be more economical than to attempt to employ day shifts only and to enlarge the actual floor space devoted to manufacture.

PRESENT ATTITUDE TOWARD OVERHEAD LIGHTING

The reasons why the overhead system and moderate-size lamps have received such general approval for machine-shop and foundry illumination are demonstrated in a fundamental way in Figs. 2 and 3. The intensity



FIGS. 2 AND 3—DISTRIBUTION CURVES OF ONE LARGE LAMP AND ONE SMALL ONE, SHOWING ILLUMINATION INTENSITY ON HORIZONTAL PLANE THROUGH BENCH SURFACES

may be studied with profit in connection with the average exterior daylight intensities throughout the year.

RECENT TESTS IN THIS COUNTRY

Recent tests³ in factories in this country show that even when the daylight intensities near windows amount to several hundred foot-candles the corresponding intensities at actual points of work range from 1 ft.-candle to 20 ft.-candles, the average of the minimum values being 4 ft.-candles and that of the maximum being 18 ft.-candles. Obviously on dark cloudy days and at many times during the winter these intensities may fall much below the values required for effective workmanship.

It has also been shown by Ward Harrison that the cost of artificial light during off-peak hours with modern lamps is less than the rent or fixed charges on additional factory space and equipment which a plant may find necessary to enlarge its output. These facts demonstrate therefore that artificial light will usually be required where a day shift only is employed. Furthermore, the presence of an adequate lighting system

of the illumination obtained on bench surfaces with one large lamp having a distribution of candle-power curve as indicated at the upper portion of diagram is shown. This single large unit might be an arc lamp, for example, with a first cost so high as to make it necessary to install the lamps far apart. The excessive intensity at points under the lamp and the inadequate values at the ends of the benches should be noted. In contrast Fig. 3 indicates the results obtained by the substitution of smaller uniformly distributed lamps. The much superior distribution of the light on the bench surfaces is apparent from the approximate illumination curve shown in the diagram.

Day and night views at the McCormick works of the International Harvester Company are shown in Figs. 4 and 5. The installation in this foundry is particularly interesting, consisting of 300-watt nitrogen-filled tungsten-filament lamps housed in Benjamin steel socket-reflector units. The building is about 1400 ft. (426.7 m.) long by 70 ft. (21.3 m.) wide, thus representing an unusually large working space. The lamps are mounted about 18 ft. (5.4 m.) above the floor.⁴

³Article by J. R. Cravath, discussing tests by Ward Harrison and associates. *ELECTRICAL WORLD*, Vol. 69, No. 22, page 1077.

⁴Figs. 4 and 5 are shown by courtesy of O. L. Johnson of the Benjamin Electric Manufacturing Company.

Dark surfaces and an atmosphere often filled with steam make such spaces rather more difficult to illuminate properly than the average machine shop. It is especially important to mount the lamps well overhead and to use reflectors for reducing glare. The lamps should be close enough together to produce sufficient

directly beneath. A similar result may sometimes be secured by lowering the lamps somewhat, although this practice is undesirable if glare is produced. Light-colored walls and columns also help produce the desired effect.

A night view of a forge shop in the Stearns foundry



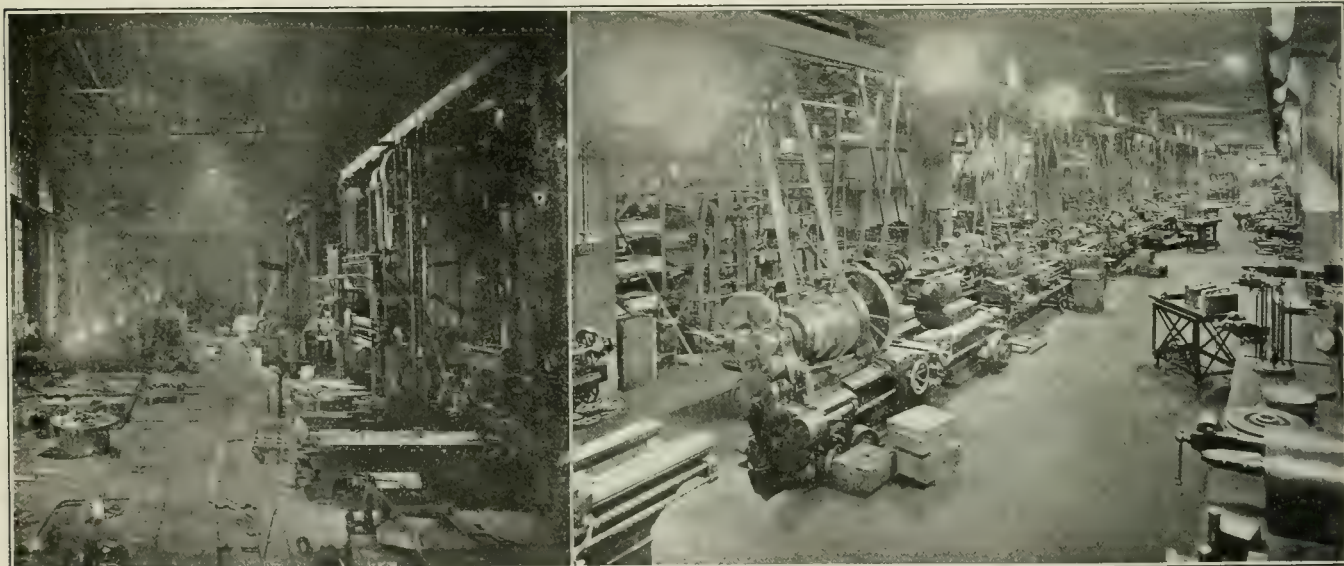
FIGS. 4 AND 5—DAY AND NIGHT VIEWS OF FOUNDRY AT THE M'CORMICK WORKS OF THE INTERNATIONAL HARVESTER COMPANY

The foundry is illuminated by 300-watt nitrogen-filled tungsten-filament lamps equipped with reflectors. The lamps in the central aisle are placed 20 ft. apart and are mounted at a height of 18 ft. above the floor illuminated.

light for the worst atmospheric conditions that are likely to occur during the average working day, and the lamps and reflectors should be cleaned frequently.

The nature of foundry work usually makes it very important to have high-intensity side and other directional-component illumination besides an adequate intensity on horizontal surfaces only. It does not follow that the most effective lighting system as measured by

at New Orleans, La., where 1000-watt nitrogen-filled tungsten-filament lamps are used in conjunction with X-Ray "Jumbo" reflectors⁵, is shown in Fig. 6. This view is typical of a smaller foundry than that shown by Figs. 4 and 5, the building here being 310 ft. long by 50 ft. wide (94.4 m. by 15.2 m.), with a distance of 42 ft. (12.8 m.) between the floor and the lower cord of the roof trusses. The lamps are suspended directly



FIGS. 6 AND 7—NIGHT VIEWS IN THE FORGE SHOP AND MACHINE SHOP OF THE STEARNS FOUNDRY, NEW ORLEANS, AND DODGE BROTHERS' PLANT, DETROIT

The Stearns plant is illuminated by 1000-watt nitrogen-filled tungsten-filament lamps equipped with reflectors requiring about 0.25 watt per square foot. The Dodge plant is illuminated by mercury-vapor lamps arranged in two rows 20 ft. apart and 12 ft. above the floor. About 1.5 watts per square foot is required for illumination purposes.

a photometer on a horizontal plane will result in a sufficient intensity for side surfaces in the molds. To increase these side components, it may be necessary to employ reflectors giving a broader distribution of light than those which produce merely uniform illumination

from the trusses and are above the traveling crane. About 0.25 watt per square foot is required. Although this value is rather low, the illumination is sufficient.

⁵Figs. 6 and 9 are due to J. L. Stair of the National X-Ray Reflector Company, who has also furnished the installation data.

Mercury-vapor lamps are also widely used for foundry purposes. Because of the absence of illustrations relating primarily to the use of this type of lamp in the foundry, Table I is included to show typical data.

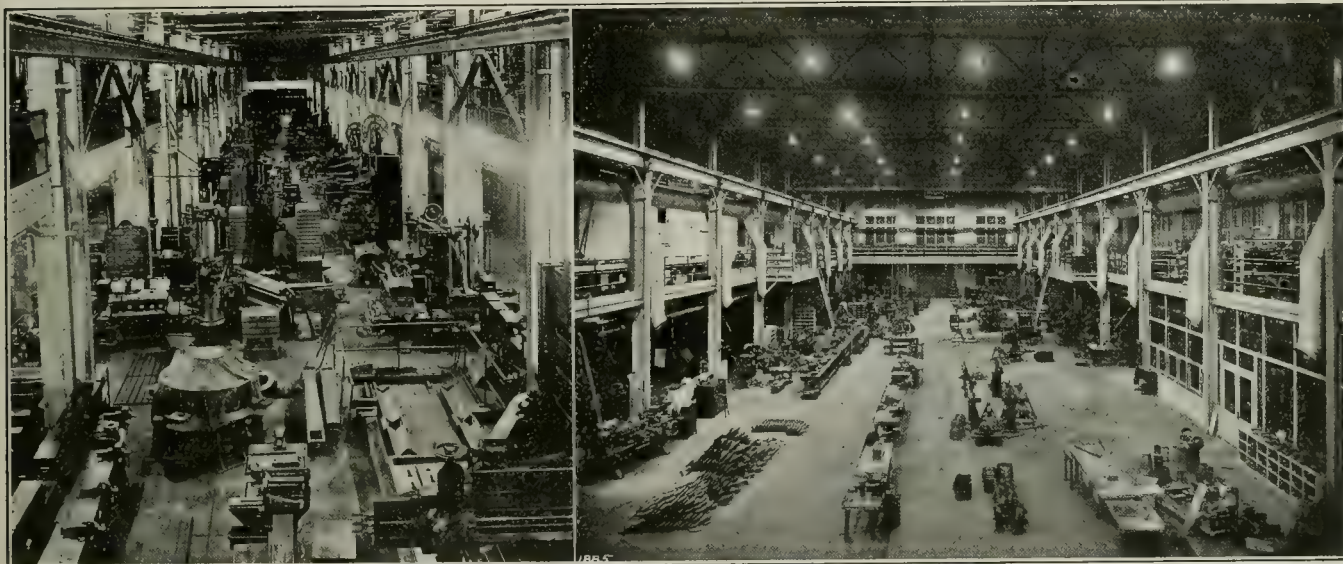
An excellent illustration of the effect produced by mercury-vapor lamps in a typical shop is shown in Fig. 7, this view relating to a portion of the Dodge Brothers plant at Detroit where lathe work is performed. The lamps are of the "F" type and are arranged in rows 20 ft. (6 m.) apart, the units being 12 ft. (3.6 m.) above the floor. About 1.5 watts per square foot is required. The complete absence of drop lamps and the fact that the work on the benches receives adequate light from overhead lamps⁶ should be noted.

It should be remembered that the machine-tool work illustrated in this view often calls for a strong side component of the light, which in this case is aided by the low mounting height of the lamps and by the light-colored surroundings. The work on the benches may be flat, so a high intensity of vertically downward light is chiefly required. However, work in a vise, for exam-

TABLE II—INTENSITIES COMMONLY RECOMMENDED FOR FOUNDRY AND SHOP WORK*

FORGE AND BLACKSMITHING		Ft.-candles
Ordinary anvil work.....	2.0	— 4.0
Machine forging	2.0	— 3.0
Tempering	2.0	— 4.0
Tool forging	3.0	— 5.0
FOUNDRY		
Bench molding	1.0	— 3.0
Floor molding	1.0	— 2.0
MACHINE SHOPS		
Assembling	4.0	— 7.0
Drills	2.0	— 4.0
Millers	3.0	— 6.0
Planers	3.0	— 5.0
Rough manufacturing	1.25	— 3.0
Fine manufacturing	3.5	— 6.0
Special cases of fine work.....	10.0	— 15.0
STOCK ROOMS		
Rough materials	1.0	— 3.0
Fine materials	2.0	— 4.0
Ordinary storage	0.25	— 0.5

*Given in the author's lecture on factory lighting before the University of Pennsylvania, I. E. S. lecture course, September, 1916.



FIGS. 8 AND 9—NIGHT VIEWS IN PLANTS OF THE FORD MOTOR CAR COMPANY AND PYLE-NATIONAL COMPANY
In the craneway of the Ford company are the floors; about 0.8 watt per square foot is required. Tungsten lamps equipped with
mercury-vapor lamps mounted 15 ft. above
rippled-glass reflectors are used in the Pyle company's shops.

ple, as well as other bench operations, and also various operations in assembly work, will often require a high side component, which may be obtained as previously outlined.

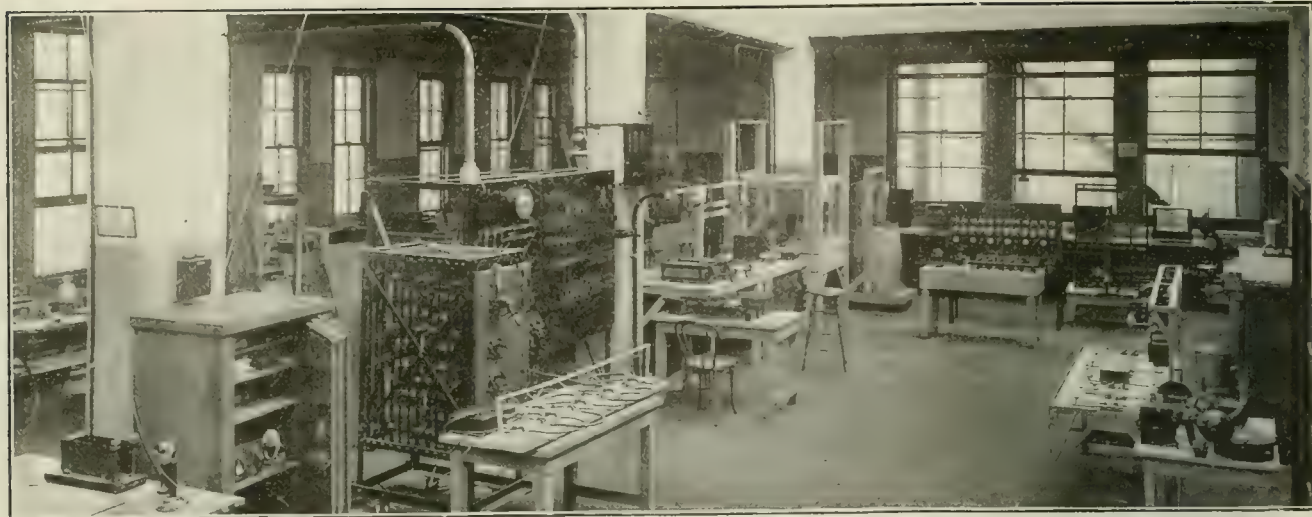
Where the ceiling clearance is very low, say 8 ft. or 10 ft. (2.4 m. or 3 m.), small or moderate-size lamps—60-watt or 100-watt tungsten lamps, for example—should be used if uniform illumination and absence of glare are to be expected. With very high bays, where the building construction and the presence of an overhead crane make it necessary to mount the lamps very high, larger units may be used to advantage (Fig. 6).

In Fig. 8 a high crane runway is shown in one of the machine shops of the Ford Motor Car Company. Here it has been possible to arrange the lamps on the sides of the aisle, 15 ft. (4.5 m.) above the floor. The use of angle reflectors directs the light effectively to the center of the aisle. This crane runway is 600 ft.

(182.8 m.) long by 24 ft. (7.3 m.) wide, and is lighted entirely by mercury-vapor lamps. The work consists mostly of large machine tools used in tool-making processes. Smaller work is conducted in the side bays. In this installation each lamp illuminates about 480 sq. ft. (43.2 sq. m.), about 0.8 watt per square foot being required.

An excellent example of the use of tungsten lamps for large shop spaces is shown in Fig. 9. This view refers to the main shop of the Pyle-National Company of Chicago, manufacturer of locomotive headlights. The central aisle of this building is 60 ft. (18.2 m.) wide by 35 ft. 9 in. (10.8 m.) high to the roof trusses. Each bay is 20 ft. (6 m.) deep. The side bays are 30 ft. wide by 13 ft. high (9.1 m. by 3.9 m.) on lower floor and 14 ft. high (4.2 m.) on second floor. Each central bay has four 200-watt nitrogen-filled tungsten-filament lamps with X-ray No. 575 reflectors. The side bays are each equipped with two 100-watt gas-filled lamps and X-ray No. 570 reflectors.

⁶Figs. 7 and 8 and the data and notes on these installations are included through the courtesy of W. A. D. Evans of the Cooper Hewitt Electric Company.



Underwriters' Laboratories' New Testing Station

Features of New Laboratory at City Hall Place, New York City
—Some Unusual Facilities and Novel Apparatus
—Importance of Electrical Department

BY EDGAR P. SLACK

Assistant Electrical Engineer, Underwriters' Laboratories

THE Underwriters' Laboratories are an institution established for service—not profit—which examines and tests devices affecting fire hazard and accident prevention, these investigations resulting in recommendations to insurance organizations. The main office and testing station occupy an extensive plant in Chicago, equipped for tests under service conditions on numerous materials and devices. By many electrical men the Laboratories are regarded as dealing only with electrical appliances. This is not unnatural, since at the start, over sixteen years ago, only electrical tests were made, and in fact the early name of the organization was the Underwriters' Electrical Bureau. From this small beginning, however, the work has broadened rapidly to include sprinklers, fire doors, extinguishers, gasoline engines and the like, and a recently established casualty department investigates safety appliances such as machinery guards, goggles and elevator locks, in co-operation with the Workmen's Compensation Service Bureau.

The electrical department, while neither the only nor the largest department of the Laboratories, is of importance both because of the great bulk of electrical production and because of the close scrutiny of electrical hazards by inspection departments. The work of the department covers electrical appliances of all sorts for connection to lighting and power circuits. Originally this work, like the other engineering work of the Laboratories, was done at the principal testing station in Chicago. Five years ago, however, a laboratory was opened in New York, prompted by the large production of electrical appliances in the East.

The New York testing station is an equivalent of the Laboratories' electrical department in Chicago, devices being similarly tested and reported on when submitted in either place. Until the present time the New York office had been on William Street and the testing station

on Vandam Street, in a substation building of a large public service company. This arrangement, although advantageous in the nearness of the substation, the facilities of which were frequently extended to the Laboratories, had a drawback in the separation of the testing station from the office. To provide increased efficiency and more space a new location was chosen combining the office and testing station.

THE NEW LABORATORY

The new quarters are near Brooklyn Bridge, at 25 City Hall Place, on the top floor of the Evening Mail Building. This is a fireproof building of twelve stories, the *Evening Mail* occupying six and the rest being used largely for printing and light manufacturing. The building is 60 ft. wide by 100 ft. long (18.2 m. by 30.4 m.), with windows on all sides and a roof skylight about 18 ft. by 50 ft. (5.4 m. by 15.2 m.). Part of the floor is reserved for office purposes, leaving a rectangular room of about 2400 sq. ft. (222.8 sq. m.) for the testing station.

In arranging the laboratory equipment the sources of power were placed centrally within easy reach of the entire room, and the test apparatus was grouped around the outside. The apparatus is designed mostly as separate units on wheel bases, which can be moved to the best position for test. This laboratory, where tests are made on widely varying devices and frequently under extreme conditions—with which the Underwriters are chiefly concerned—requires large and varied power supply, ample facilities for power absorption and a large variety of unusual equipment for special tests.

The main power supply is from a 120-240-volt Edison three-wire direct-current power line of 450-amp. rating, running to a switchboard at the center of the room. The switchboard carries switches and cut-outs of graded sizes, to any of which the device under test may be con-

nected. For testing alternating-current appliances a single-phase, 60-cycle line is provided. This is a 25-kva. circuit entering the building at 2750 volts and transformed at the service to a 110-220-volt three-wire line running to a second panel beside the direct-current switchboard. This panel also is arranged with graded switches and cut-outs for the direct connection of the device to be tested.

Besides the two incoming lines a motor-generator set is provided, comprising three machines, a 15-hp., 220-volt direct-current motor at the middle driving a plating generator at one end and an alternator at the other. The plater has two commutators for connection either in series or multiple and can deliver 600 amp. at 12 volts or 1200 amp. at 6 volts. This machine is used for tests requiring heavy currents, and can also be thrown in series with the incoming direct-current line to boost the voltage to full 125 volts or 250 volts when desired. The alternator is a 10-kva., 60-cycle, 250-volt machine which serves as an independent supply for test purposes and also excites a 16,000-volt transformer used for high-potential tests. These machines are operated from a control table carrying all switches and control rheostats. The motor has an automatic starter controlled by a push-button, thus enabling the operator to shut off the power instantly without moving from his position. The plater current is adjusted by varying the excitation, coarse and fine field resistances being provided for this purpose. The alternator, too, has coarse and fine field adjustment, used in raising the voltage of the transformer for high-potential tests.

Recently a 1-kva. sign-lighting transformer has been purchased for providing alternating currents up to 100 amp. at 11-22 volts. This source is more economical than the motor-generator set and is used for rating tests on small fuses and for similar heating tests.

LOADS AND RESISTANCES

On account of the widely varying capacities of the devices to be tested a number of different loads have been provided. For most wiring devices a lamp bank is used, containing about 100 carbon lamps, divided into two sections on a three-wire supply and controlled from a specially wired panel. The arrangement is such that after making tests at 250 volts throwing a single switch automatically gives double current at half voltage. This change is accomplished by shifting the connections from series to multiple, and is convenient in testing switches commonly having double ratings such as 5 amp., 250 volts, or 10 amp., 125 volts.

Where loads of larger capacity than the lamp bank are desired a rheostat is used. This rheostat has a capacity of 160 amp. at 230 volts, adjustable in 2-amp. steps. It is made of grids and tubes in an iron frame with casters and having a slate front with contact dials, switches and circuit breaker. For still larger loads a water barrel on a portable stand is used. Graphite disk rheostats are also used for low-voltage work in connection with the plating generator and the low-voltage transformer.

Sockets and switches are subjected to an endurance test of 6000 operations while connected as in service to a supply line and load of their rated capacity. For this purpose special machines are used. For push-button switches six samples are mounted on frames and adjusted in position facing six sets of plungers. These

plungers are alternately pushed in and withdrawn mechanically, operating the switches ten times a minute. The motion is derived from a small motor operating through a worm and gear, the number of operations being recorded by a revolution counter. For pull-chain sockets a motor-driven mechanism travels up and down and operates the sockets by hooks clipped on the chains. Key sockets and rotary switches are similarly operated by forked shafts which turn the keys or buttons. The machines are separate and any one can be wheeled to the test panel. This panel is specially devised for these tests and supports six dimmer rheostats with separate control switches and suitable terminals for the connection of the line and load. Each circuit includes a lamp to indicate visually the operation of the device under test.

For rating tests on plug fuses a portable table is provided, carrying a sign-lighting transformer connected to the line by a flexible cord. The low-voltage side supplies two test circuits. Each circuit includes six single-pole cut-out bases mounted on the table top and permanently wired with shunting switches to be closed in the event of a fuse blowing. Each circuit includes a compression disk rheostat for varying the current from 4 amp. to 100 amp. Short-circuit tests on fuse plugs are made from a 2000-amp.-hr., 125-volt storage battery isolated in the substation of a large public service company. From the battery leads extend through a closing switch to the fuse under test, a "Nichrome" rod with a sliding contact being included in circuit to adjust the resistance to a low specified value. A 2000-amp. toggle switch, operated by a rope on the handle, is also placed in circuit. This switch is an emergency device for clearing the circuit in event of sustained arcing at the fuse.

For voltage-breakdown tests a 10-kva. oil-filled transformer is used. This transformer is energized from an alternator, the desired voltage being obtained by adjusting the generator field without introducing resistance or reactance into the transformer circuit. The high-tension winding comprises eight coils, each producing a maximum emf. of 2000 volts and capable of being connected in various combinations of series and parallel, giving full transformer capacity at voltages of 2000, 4000, 8000 and 16,000. The voltage is measured by a separate coil on the transformer core connected to a voltmeter reading 100 volts at full secondary voltage. The transformer is being mounted in a glass-walled case with a sliding door. The door is interlocked with a switch in the primary circuit and if opened automatically "kills" the transformer.

While the above equipment is sufficient for most of the test work, there is occasional need for lines of other voltages, frequencies or capacities, or for special apparatus for which in this work there is but limited demand. In these cases the Laboratories have availed themselves of the courtesy and co-operation of three large public service companies which have kindly offered their facilities. Special tests have also been conducted at a nearby engineering school. These outside facilities have been used for testing several devices, including fuses, auto-starters and cable connectors.

The electrical department is under the direction of Dana Pierce, vice-president and electrical engineer. Mr. Pierce also has personal charge of the New York office and testing station, assisted by Edgar P. Slack, H. C. Mathey and C. H. Holway, assistant engineers.

Making the Rates Carry the Coal Cost

Extra Burden Put Upon Electrical Utilities by the Heavy Advance
in Fuel Prices and the Continued Scarcity in Supply
Lead to Higher Schedules for Power

OPERATING costs and the power rates which show a slender margin of profit demand vigilant analysis from central station properties. It is so difficult to control expenses and the outlook for material and labor costs is so uncertain that companies will have to check results very carefully in order to avoid dangerous losses on some classes of business.

At present the acute point is of course the coal situation. Costs in this direction have passed completely beyond the control of the individual central station company. During last winter ownership of mines and contracts with established mining companies were only partial safeguards because of car shortage, locomotive shortage and the congestion of traffic which combined to paralyze railroad service. Purchases in the open market were necessary to maintain central station service and exorbitant prices swelled expense accounts.

Foreseeing continued large requirements for power, apprehensive of still higher cost of coal and other materials, it is logical that the companies should take steps to protect themselves by increasing rates, particularly rates on energy used for power purposes. The method adopted by many companies, which is direct and effectively provides for higher coal cost, is to introduce a coal clause into power schedules. This makes changes in rates precisely as coal cost advances or declines from a normal base cost.

Without some such arrangement in rate schedules, companies will face the coming winter with doubts which may develop into burdens seriously reducing their net earnings. It is not alone a question of a promise or guarantee that they shall have their necessary coal supply at an agreed price, for to a large extent they had that last year. They want to be certain that service shall not be crippled because of breakdown in transportation or any other link of the chain from mine to boiler room.

GREAT WORK AT WASHINGTON

Central station companies need to provide as full protection as possible against exigencies in any part of the coal situation. They naturally welcome the great work of the committee on coal production of the Council of National Defense. The confident expectation is that the activities of this committee, in co-operation with other government authorities and the coal producers, will relieve the situation materially.

It may be asserted with just as much confidence, however, that the executives of electrical companies do not feel that the menace in either price or supply of coal has been removed entirely by the results of the recent conferences at Washington. If runaway markets are prevented, if adequate supplies are made available, these accomplishments will be of incalculable value in the maintenance of electric service unimpaired. The critical coal conditions just at present are so far from entirely normal, however, that expectations are not being raised too high.

Undoubtedly optimism has been created by the announcement from Washington that in general a base price of \$3 per ton for bituminous coal on cars at the mines might be expected. This looks attractive to the operator who paid \$7 and \$8 for part of his supply last winter. It should be recalled, however, that the low price named is stated frankly as tentative and that later intimations are to the effect that this is a summer figure, subject perhaps to revision when cost sheets are scrutinized. Almost directly after the Washington announcement was made coal operators in one district in Illinois (Decatur) increased their price 55 cents a ton to a total of \$3.90, advancing as a reason higher cost of production.

WORLD-WIDE HUNGER FOR COMMODITIES

In coal as in other raw materials the country faces the hungry grasp of a world in sharpest want for commodities. Government control of production and price by co-operation with industry, as in the case of coal, will enlarge output, will tend to limit profits, but it cannot overturn the general principles involved in the law of supply and demand. Whatever help is given from the government or volunteered by the coal operators will alleviate conditions but it will not restore the old scales upon which rate schedules of electric central station properties are based.

If coal should be held to a reasonable level, the power user whose rate fluctuated squarely with coal cost would derive full advantage of the improvement; while sharp advances would not find the central station suffering financially because of inflexibility in rates to consumers.

It is true that costs of other materials, as well as of labor, show similar large advances in price and present the same problem of scarcity; but, excepting labor, they do not enter so largely into pure operating expenses, they have to do more with capital expenditures. Higher coal cost can be provided for in no other place than operating expenses; it is an outlay which is gone forever. A construction expenditure enters into other elements of the whole plant, and is averaged with them into a figure of cost which, although permanent, is lightened by combination with other expenditures made when costs were lower. Nearly all other elements of operating expense are higher and replacements involve heavy expense, but they do not present as serious a problem as coal.

Interests with large electrical properties express the opinion that in the future coal costs will be higher than the average of the past. Men with excellent sources of information and experience on which to base their judgment believe that, looking beyond the critical time while the nation is at war, coal will inevitably be at a higher level for a period of years. They believe furthermore that coal will never be as low in price as the figures which prevailed widely a few years ago.

It is full realization and acceptance of the conditions outlined in the foregoing summary which have given so strong an impetus to the movement toward higher rates.

Conditions are not the same as when existing rate schedules were made; they will not be the same at any time which can be forecast definitely. Therefore the argument of a company which asks a state regulating commission for authority to advance rates in proportion as cost changes is incontrovertible.

In England, as a result of higher costs of coal and other commodities and of labor, 222 electricity supply undertakings have increased rates since the beginning of the war. That country has confronted abnormal conditions due to the war so much longer than this nation that it has gone farther in adjusting rate-making than properties in the United States. Owing to differences in ownership, methods of operation and marketing, conditions in the two countries are not fairly comparable on the same basis, but it is significant that so many of the English undertakings have adjusted rates to correspond with the new conditions.

Advices to the ELECTRICAL WORLD from different sources show the following partial list of properties which are making increases or inserting coal clauses in parts of their rate schedules, principally for power, applications to commissions pending in some cases:

Massillon (Ohio) Electric & Gas Company.
Cleveland Electric Illuminating Company.
Plymouth (N. H.) Electric Light Company.
Seattle municipal plant.
Westfield (Mass.) municipal plant.
Colonial Power & Light Company, Manchester, Vt.
Rockford (Ill.) Electric Company.
Utica (N. Y.) Gas & Electric Company.
Virginia Railway & Power Company.
Wheeling (W. Va.) Electric Company.
Virginian Power Company, Charleston, W. Va.
Tiverton (R. I.) Electric Light Company.
Troy (Ohio) municipal plant.
Companies in Indiana, combined action to increase rates.
Toledo Railways & Light Company.
Columbus (Ohio) Railway Power & Light Company.
Taunton (Mass.) municipal plant.
Northwestern Ohio Railway & Power Company.
New York Edison Company.
United Electric Light & Power Company.
Edison Electric Illuminating Company, Brooklyn.
Atlantic City Electric Company.
Duquesne Light Company, Pittsburgh.

NEW ENGLAND CENTRAL STATION RATE SITUATION

The adoption or consideration of coal clauses in New England central station power contracts is widely in vogue at present. Many companies are now paying \$10 or more per ton for bituminous coal delivered either by water or by rail, and in general it may be said that the present average price of newly purchased coal is more than double the normal price of recent years. Few companies have so far undertaken to increase rates outside of their power schedules.

Following is a list of the companies (by cities) having coal clauses or contemplating their early use:

Agawam, Mass.; Amherst, Mass.; Beverly, Mass.; Brattleboro, Vt.; Claremont, N. H.; Concord, N. H.; Danbury, Conn.; Easthampton, Mass.; East Hampton, Conn.; Exeter, N. H.; Fall River, Mass.; Fitchburg, Mass.; Turners Falls, Mass.; Gas & Electric Improvement Company, 77 Franklin Street, Boston (North Adams, Clinton, etc.); Great Barrington, Mass.; Greenfield, Mass.; Hartford, Conn.; Haverhill, Mass.; Lowell, Mass.; Ludlow, Mass.; Lynn, Mass.; Malden, Mass.; Marion, Mass.; Middletown, Conn.; New Bedford, Mass.; North Abington, Mass.; Palmer, Mass.; Pawtucket, R. I.; Pittsfield, Mass.; Portland, Me.; Portsmouth, N. H. (approved by commission); Plymouth, Mass.; New London,

Conn.; Revere, Mass.; Salem, Mass.; Springfield, Mass.; Stamford, Conn.; Waterbury, Conn.; Worcester, Mass. (New England Power Company).

Below are representative coal clauses:

New England Power Company, Worcester, Mass.—All new contracts for power service have coal clause. If cost of coal at tidewater in Providence, R. I., exceeds \$4.50 per long ton, price of electricity increases by 0.01 mill per cent increase above \$4.50. Similar reduction below \$4 base. This is regarded as unusually fair to the small consumer, being based on an actual coal rate of 2 lb. per kilowatt-hour.

Brockton, Mass.—Increase of \$0.00006 for each 5-cent increase in price of coal over \$5 per ton.

East Hampton, Conn.—Increase of \$0.0015 per kilowatt-hour for each \$1 increase over \$4 per ton.

Pittsfield, Mass.—Increase of 1.25 mill per kilowatt-hour above \$4.50 base per \$1 increase in coal price.

Portsmouth, N. H.—Increase approved by New Hampshire Public Service Commission, June 26, 1917. Consists of \$0.00045 per kilowatt-hour for each whole 10 per cent or 40 cents increase above \$4 per ton (long) f.o.b. company's wharf. Corresponding deduction. Coal clause does not apply to contracts prior to June 13, 1917.

Plymouth, Mass.—Increase of \$0.001 per kilowatt-hour per \$1 over \$5 base.

New Bedford, Mass.—Increase of about 2.5 mills in power rate.

No general rate increases in prospect at this date in Boston, Worcester or Springfield. A rate increase is expected at Providence, R. I.

Hartford, Conn.—Increase in lighting rate of 4-5 mills per kilowatt-hour, by sliding scale. Company has coal clause.

IN PENNSYLVANIA

P. E. Fickenschner, acting chief bureau of rates and tariffs, Pennsylvania Public Service Commission, writes in reply to an inquiry that twenty-nine companies have filed tariffs recently. All the changes have not been analyzed yet, but the general trend is to make some increase in rates. The companies are:

Allegheny Valley Light Company, Pittsburgh.
Ambler Electric Light, Heat & Motor Company,
Berkshire Electric Company, Sinking Springs.
Cherry Tree Electric Heat, Light & Power Company.
Citizens' Light, Heat & Power Company of Pennsylvania.
Citizens' Light & Power Company, Oil City.
Coalport Light, Heat & Power Company, Coalport.
DuBois Electric Company.
Hanover Light, Heat & Power Company.
Harwood Electric Company, Hazleton.
Hyndman Electric Light, Heat & Power Company.
Jefferson Electric Company, Punxsutawney.
Lehigh Electric Light & Power Company.
Mansfield Electric Company.
Montgomery & Muncy Light, Heat & Power Company.
Ortanna Electric Light & Power Company.
Northern Cambria Light, Heat & Power Company.
Northwestern Electric Service Company, Erie.
Penn Electric Service Company, Johnstown.
Penn Central Light & Power Company, Altoona.
Rossiter Electric Company, Clearfield.
Schuylkill Gas & Electric Company, Hazleton.
Scranton Electric Company.
Sherman's Valley Electric Company, Loysville.
Steffen Electric Company, Township of White.
Union City Electric Company.
Warren Light & Power Company.
Waynesboro Electric Company.
Weimer Electric Light & Power Company, Lebanon.

Results of April Light and Power Operation

Income of \$38,000,000 Shows Increase Over Previous April of
13.9 per Cent—Output Amounted to 2,180,000,000
Kw.-hr., an Increase of 22.8 per Cent

DURING the month of April last the earnings of the central stations of the United States from the sale of energy only were approximately \$38,000,000, according to the returns received and compiled by the ELECTRICAL WORLD. For the same month the output sold was 2,180,000,000 kw.-hr. The increase in income, in comparison with April, 1916, amounts to 13.9 per cent and in output to 22.8 per cent.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percent- age of Industry Represented	INCOME FROM THE SALE OF ENERGY			Kw.-Hr. OUTPUT		
		1916	1915	Per Cent In- crease	1916	1915	Per Cent In- crease
May.....	64	20,345,000	17,559,000	16.0	1,170,143,000	944,681,000	24.0
June.....	64	20,254,000	17,551,000	15.4	1,170,679,000	968,724,000	21.0
July.....	64	19,760,000	17,301,000	14.2	1,174,374,000	976,704,000	24.4
Aug.....	64	20,502,000	17,861,000	15.0	1,262,575,000	1,015,805,000	22.4
Sept.....	64	21,432,000	18,600,000	15.2	1,268,339,000	1,037,976,000	21.2
Oct.....	64	22,882,000	20,164,000	13.5	1,347,502,000	1,125,132,000	19.9
Nov.....	64	24,819,000	21,744,000	14.4	1,396,537,000	1,148,221,000	21.7
1917		1917	1916		1917	1916	
Dec.....	62	25,306,000	22,029,000	15.0	1,345,883,000	1,112,280,000	21.0
Jan.....	63	27,408,000	23,969,000	14.4	1,495,829,000	1,180,884,000	26.7
Feb.....	63	25,204,000	22,295,000	13.1	1,240,995,000	1,036,014,000	20.0
March.....	62	23,897,000	20,865,000	14.5	1,406,065,000	1,136,652,000	24.3
April.....	58	22,011,000	19,342,000	13.9	1,265,340,000	1,031,407,000	22.8

Summing up for the first few months of the current year, it is found that the income from light and power sales amounted in round figures to \$160,000,000. At this rate it becomes evident, barring a reversal of ex-

isting conditions, that the central station industry will pass the half-billion mark for the first time in 1917.

TABLE III—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED BY SIZE

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April
INCOME:										
Group 1.....	13.8	13.9	15.0	11.6	13.0	15.0	12.0	12.5	13.0	12.0
Group 2.....	16.8	15.7	20.4	19.2	17.7	16.6	19.0	19.7	20.7	20.0
Group 3.....	19.5	20.9	18.4	18.5	18.2	15.2	15.2	12.5	15.1	15.1
Group 4.....	9.0	9.5	11.3	13.5	12.8	12.3	15.5	10.3	19.1	17.0
Group 5.....	12.2	14.9	13.3	16.0	12.8	9.5	20.2	57.5	16.1	19.2
OUTPUT:										
Group 1.....	18.1	21.4	18.5	16.6	18.2	18.7	22.5	19.0	20.0	19.0
Group 2.....	22.9	33.0	32.9	31.1	27.2	20.2	30.5	24.0	35.7	38.0
Group 3.....	27.8	31.1	19.3	24.0	32.0	28.8	34.4	14.8	25.1	24.9
Group 4.....	16.1	23.0	26.0	20.4	19.7	21.0	30.5	20.2	26.1	28.0
Group 5.....	11.6	16.8	15.3	18.3	33.0	25.4	21.3	21.7	44.0	22.7

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April
INCOME:										
Group 1.....	12.6	9.6	16.5	12.1	13.5	12.5	12.5	12.3	7.0	13.8
Group 2.....	20.6	15.1	25.5	21.3	20.0	30.2	16.1	18.4	18.2	18.7
Group 3.....	21.2	15.0	20.5	18.0	19.4	16.5	17.8	15.7	16.5	24.3
Group 4.....	6.2	11.1	10.5	15.4	16.0	16.0	22.0	12.8	25.8	24.0
Group 5.....	14.9	17.5	18.3	18.2	18.6	12.2	24.0	15.1	21.0	
OUTPUT:										
Group 1.....	19.2	31.3	34.0	17.5	18.0	10.8	20.7	19.6	24.0	18.2
Group 2.....	14.1	32.0	37.7	35.0	24.7	18.2	24.8	18.5	21.1	23.2
Group 3.....	31.4	45.5	32.4	42.6	35.9	22.0	20.9	35.7	34.5	38.2
Group 4.....	26.6	39.4	32.9	48.9	40.0	55.2	73.8	38.1	32.7	58.0
Group 5.....	13.5	21.3	27.4	22.0	17.0	35.7	29.2	26.8	76.0	29.0

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

		Month	Percentage of Indus- try Represented	New England States			Percentage of Indus- try Represented	Atlantic States			Percentage of Indus- try Represented	Central States (Illinois Excluded)			Percentage of Indus- try Represented	Pacific and Mountain States		
				1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase
INCOME	{	May.....	65	2,103,000	1,788,000	17.0	67	8,226,000	7,131,000	15.4	56	6,085,000	5,123,000	18.7	88	3,874,000	3,469,000	11.6
		June.....	65	2,208,000	1,906,000	16.0	67	8,045,000	6,905,000	16.5	56	6,007,000	5,143,000	16.9	88	4,017,000	3,539,000	13.5
		July.....	65	2,130,000	1,875,000	13.7	67	7,832,000	6,621,000	16.4	56	5,926,000	5,095,000	16.3	88	3,755,000	3,493,000	7.6
		August.....	65	2,203,000	1,935,000	13.7	66	8,000,000	6,875,000	16.4	56	6,195,000	5,266,000	17.7	88	3,883,000	3,582,000	8.4
		September.....	65	2,315,000	1,982,000	16.8	66	8,631,000	7,445,000	16.0	56	6,505,000	5,537,000	17.8	88	3,979,000	3,644,000	9.2
		October.....	65	2,684,000	2,331,000	15.2	65	8,887,000	7,930,000	12.1	56	6,968,000	5,895,000	18.2	87	4,213,000	3,889,000	8.3
		November.....	65	2,912,000	2,516,000	15.7	65	10,061,000	8,859,000	13.5	56	7,410,000	6,313,000	17.4	87	4,246,000	3,947,000	7.5
		December.....	65	3,203,000	2,814,000	14.0	66	11,059,000	9,348,000	19.6	56	7,898,000	6,997,000	13.0	75	2,987,000	2,735,000	9.3
	{	1917		1917	1916		66	1917	1916		56	1917	1916		86	1917	1916	
		January....	64	3,181,000	2,762,000	15.1	66	11,400,000	9,874,000	15.6	56	8,081,000	7,013,000	15.2	86	4,602,000	4,020,000	9.5
		February....	64	3,039,000	2,686,000	13.1	65	10,249,000	9,021,000	13.6	55	7,471,000	6,530,000	14.4	86	4,284,000	3,926,000	9.2
		March.....	62	2,809,000	2,499,000	12.4	64	10,203,000	8,902,000	14.7	55	6,692,000	5,754,000	16.5	86	4,193,000	3,780,000	11.0
		April.....	59	2,620,000	2,235,000	17.2	54	8,150,000	7,358,000	10.7	53	7,041,000	6,012,000	17.5	82	4,044,000	3,609,000	12.0
KW.-HR. OUTPUT	{	May.....	65	84,719,000	64,318,000	31.8	67	409,529,000	333,585,000	22.0	56	345,860,000	275,328,000	25.6	88	328,793,000	266,599,000	23.2
		June.....	65	87,829,000	69,506,000	27.6	67	396,630,000	327,541,000	21.2	56	350,015,000	288,982,000	21.2	88	328,996,000	277,915,000	18.6
		July.....	65	85,317,000	71,160,000	19.8	67	401,179,000	333,771,000	20.3	56	350,708,000	287,407,000	22.2	88	325,647,000	279,285,000	17.4
		August.....	65	97,197,000	72,900,000	33.4	66	433,129,000	344,730,000	25.7	56	374,327,000	295,866,000	26.5	88	333,468,000	279,976,000	19.1
		September.....	65	98,350,000	73,343,000	34.2	66	446,534,000	369,815,000	20.8	56	387,626,000	307,485,000	26.2	88	335,817,000	288,332,000	16.4
		October.....	65	107,756,000	83,705,000	28.8	65	426,151,000	373,705,000	14.2	56	408,364,000	324,509,000	25.9	87	355,014,000	306,828,000	15.8
		November.....	65	111,873,000	89,015,000	25.7	65	533,252,000	424,746,000	25.6	56	415,491,000	334,044,000	24.4	87	346,847,000	293,518,000	18.2
		December.....	65	117,763,000	97,387,000	21.0	66	535,410,000	444,923,000	20.4	56	425,510,000	354,258,000	20.0	75	256,006,000	206,838,000	23.8
	{	1917		1917	1916		66	1917	1916		56	1917	1916		86	1917	1916	
		January.....	64	120,211,000	93,163,000	29.1	66	564,699,000	429,432,000	31.5	56	437,923,000	351,335,000	24.5	86	363,094,000	298,990,000	21.4
		February.....	64	110,114,000	88,324,000	24.7	65	418,407,000	341,877,000	22.5	55	373,988,000	323,158,000	15.8	86	326,891,000	274,079,000	19.3
		March.....	62	118,370,000	92,714,000	27.9	64	539,028,000	425,376,000	27.0	55	383,046,000	311,841,000	23.0	86	365,541,000	301,721,000	21.3
		April.....	59	101,861,000	80,696,000	26.3	54	418,827,000	337,338,000	24.2	53	386,216,000	314,120,000	23.0	82	347,417,000	290,667,000	19.4

Output for the first four months of 1917 was 8,780,000,000 kw.-hr. The increase in income over the corresponding period of the previous year amounts to 13.8 per cent, or in round figures to \$20,000,000. The increase in output amounts to 23.4 per cent, which in the aggregate is approximately 1,660,000,000 kw.-hr.

LARGER VOLUME OF INCREASE

All sections of the country generally reported consistently favorable results. The great increase in power load is very evident in the maintained high rate of increase

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED BY SIZE

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April
INCOME:										
Group 1.....	16.8	16.1	16.2	10.7	13.7	18.8	15.0	13.0	14.3	8.8
Group 2.....	18.5	21.6	19.0	21.0	22.5	21.7	28.3	27.3	27.0	22.5
Group 3.....	14.2	15.0	14.0	14.6	13.0	13.4	12.5	10.4	15.1	13.9
Group 4.....	10.0	14.4	9.8	13.5	13.1	14.4	14.0	11.3	20.5	16.2
Group 5.....	13.0	19.4	8.9	14.3	16.0	14.3	11.1	11.8	12.5	6.3
OUTPUT:										
Group 1.....	23.4	28.5	23.6	19.2	20.8	21.5	32.5	22.0	21.3	22.2
Group 2.....	27.4	32.5	26.7	33.0	31.9	28.2	42.6	31.2	63.2	36.5
Group 3.....	11.5	16.0	24.7	4.5	19.0	15.9	27.2	21.2	21.6	25.5
Group 4.....	16.3	29.5	18.6	17.5	14.6	16.0	25.4	18.8	20.2	25.0
Group 5.....	13.5	20.4	1.3	1.5	5.8	6.9	9.4	17.0	3.2	10.0

over the previous years. Last year was a tremendous year, and the increase over 1915 was large, but in spite of that 1917 is outstripping 1916 far more in volume of business handled than 1916 did 1915. The percent-

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED BY SIZE

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April
INCOME:										
Group 1.....	15.8	16.5	16.6	18.0	16.5	13.0	15.5	14.5	16.0	16.6
Group 2.....	17.3	21.8	21.5	21.0	17.0	16.0	17.8	18.7	21.0	21.7
Group 3.....	18.6	18.4	13.4	10.9	13.0	1.8	6.0	0.5	4.4	5.7
Group 4.....	17.5	10.7	20.0	19.7	16.8	15.5	19.8	16.3	18.9	22.0
Group 5.....	6.1	11.8	11.0	18.4	14.3	†	19.3	16.7	11.0	31.3
OUTPUT:										
Group 1.....	21.0	24.3	22.3	24.9	24.8	22.3	25.4	19.2	22.0	19.5
Group 2.....	25.7	36.4	40.0	31.7	29.7	24.4	29.0	23.6	32.4	44.4
Group 3.....	26.0	25.7	20.7	17.3	19.7	1.2	5.8	30.0*	4.5	3.0
Group 4.....	21.1	23.0	33.8	26.1	21.2	21.4	24.5	13.0	25.7	22.0
Group 5.....	8.6	6.1	13.7	28.2	16.8	9.9	15.5	17.1	23.5	17.9

*Decrease.

†Results omitted owing to insufficient returns.

ages of increase remain practically the same, but the quantity of increase is much larger.

So rapidly has new power business come to central stations that in a number of cases it has been found

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April
INCOME:										
Group 1.....	4.7	5.5	6.2	4.2	4.5	4.0	5.4	7.2	8.5	11.3
Group 2.....	0.6*	0.7	4.9	1.3	3.0	3.6	7.5	5.5	0.6	3.4
Group 3.....	28.3	32.5	28.5	32.4	31.0	30.0	27.6	23.5	22.8	17.7
Group 4.....	1.0	0.5	11.5	7.2	0.4	0.6*	8.6	2.0	13.2	8.3
Group 5.....	13.2	13.0	11.7	13.5	17.1	11.1	20.3	14.9	15.2	9.5
OUTPUT:										
Group 1.....	10.0	6.3	7.1	5.2	8.0	8.6	11.0	22.3	15.6	15.8
Group 2.....	2.0	6.5	7.8	9.7	11.4	8.7	11.8	16.2	8.9	16.1
Group 3.....	56.1	57.5	60.0	63.7	61.3	48.0	59.5	36.8	36.3	29.7
Group 4.....	4.0	7.5	12.0	*0.5	4.2	2.6	15.2	14.0	27.9	20.0
Group 5.....	10.8	16.5	7.0	14.7	42.3	5.4	19.1	9.4	21.6	20.5

*Decrease.

necessary to call in the power salesmen owing to the lack of generating facilities. The coal situation has played the most prominent rôle in this connection. Not only have prices been extremely high but it has been

very difficult to obtain a sufficient quantity of fuel at any price. Should the government approve of the action taken last week by the coal mine operators cheaper fuel can be expected.

It is doubtful if the income figures for April reflect the increase in power rates prompted by the seriousness of coal supply and cost. In subsequent months,

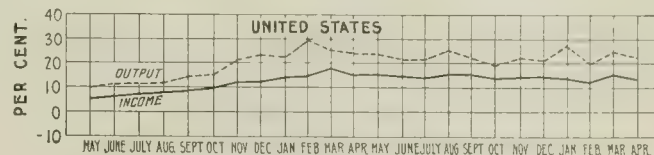
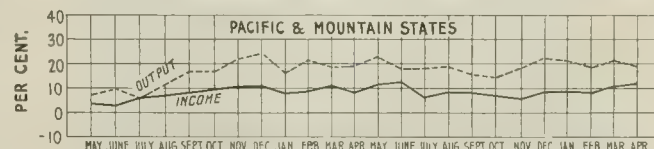
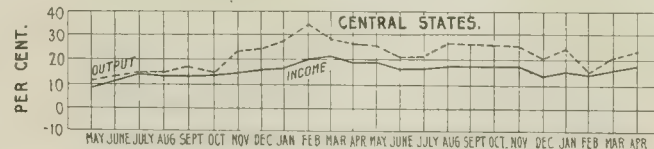
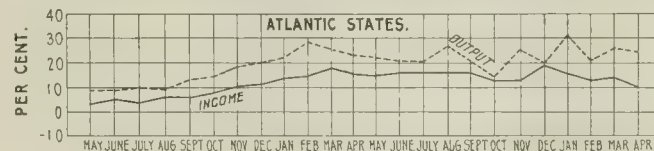
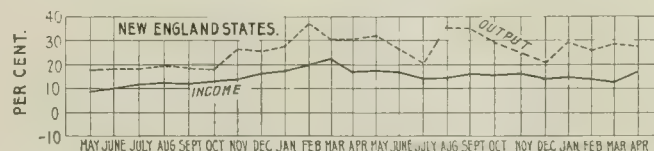


FIG. 1—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES

however, this factor will probably become increasingly evident.

From the condition of the manufacturers' order books, showing vast volumes of unfilled orders for energy-using apparatus both for domestic and industrial application, there is every reason to believe that, provided always there is sufficient room in generating equipment for growth, similar large percentages of increase can be expected for some time to come. That the central stations expect it is evident from the state of the turbine market for larger sizes. The market is practically sold out until well into 1920.

The accompanying curves show graphically the percentages of growth both in income and output as contained in Tables I and II. The remaining tables give the percentages of growth in income and output for the companies grouped according to the size of the com-



FIGS. 2 TO 5—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

munity served. Thus group 1 represents those companies operating in cities having a population of over 100,000 inhabitants, group 2 those operating in cities having between 50,000 and 100,000 inhabitants, group 3 cities between 25,000 and 50,000, group 4 between 10,000 and 25,000, and group 5 those between 5,000 and 10,000.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

BUS RACK CONSTRUCTION FOR DISTRIBUTION LINES

How This Type of Work Is Used by an Ohio Public Service Company in Order to Save Space on Poles

As a means of eliminating objectionable buck-arm construction, of providing adequate climbing space for linemen, and of making a line which is easy to wreck for reconstruction purposes, the Northern Ohio Traction & Light Company, Akron, Ohio, has adopted the types of bus rack construction shown in Fig. 1. Ordinarily the three-pin racks are mounted at the ends of the arm (Fig. 2), with the bus wires strung between them. Taps from the secondary leads to the bus wires are made and service lines are then attached to the racks. The advantages of moving the connection points of service leads away from the pole are apparent when considered from the standpoint of the convenience and safety of linemen and trouble men. Furthermore, this type of construction, especially where drops extend

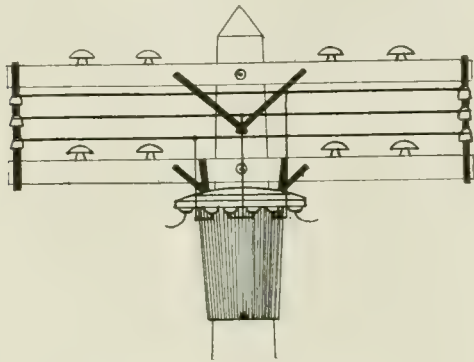


FIG. 1—METHOD OF MOUNTING BUS RACKS BETWEEN FIRST AND SECOND ARMS TO SAVE SEVERAL FEET OF POLE SPACE

tion & Light Company, Akron, Ohio, has adopted the types of bus rack construction shown in Fig. 1. Ordinarily the three-pin racks are mounted at the ends of the arm (Fig. 2), with the bus wires strung between them. Taps from the secondary leads to the bus wires are made and service lines are then attached to the racks. The advantages of moving the connection points of service leads away from the pole are apparent when considered from the standpoint of the convenience and safety of linemen and trouble men. Furthermore, this type of construction, especially where drops extend



FIG. 2—FRONT OF A POLE WHICH WOULD REQUIRE BUCK ARMS FOR SERVICE IF RACKS WERE NOT USED

in both directions from the pole, tends to assist in attaining proper pole and arm alignment without guys.

In order to reduce the pole space necessary on poles where transformers are hung the company has lately been experimenting with bus racks fastened between

the outer ends of the two top cross-arms. The vertical channel sections of the racks, as they are received from the manufacturers, are not long enough to reach from one arm to another. To get around this trouble cross-arm braces are bolted from arm to arm at the outer ends, and the racks are then bolted to these braces as is shown in Fig. 1. This permits the bus wires to be raised enough so that the transformer can be mounted directly on the second arm. Secondary taps from the transformer can be connected directly to the bus. Considerable pole space is gained by this scheme. The plan is particularly valuable in joint pole construction, since it may permit an actual reduction in the height of pole necessary to carry both lighting and telephone lines.

W. E. Salber, who has worked out this plan for the Northern Ohio Traction & Light Company, suggests that manufacturers of pole-line hardware might well consider making racks with vertical channels long enough to span the distance between the two top arms of a two-arm lead.

MOVING A HEAVY ROTOR WITH BLOCK AND TACKLE

Ropes Stretched Between Two Sets of Block and Tackle and Wound Around Rotor Served as Motive Power and Brake

BY J. C. RUTHERFORD

A simple method of using blocks and tackle to move a rotor into place was employed recently with a considerable saving in time and money compared with other methods. In the opinion of the writer the method is deserving of more frequent application. The rotor, which weighed about 50,000 lb. (22,679.6 kg.), crated in a box of heavy timbers and securely braced and blocked, had been brought to the place where it had to be installed on a horse-drawn truck. As the station floor was about 15 ft. (4.6 m.) above the street level an incline was built of timbers to facilitate moving the machinery from the street to the station floor. Although the transom over the doorway had been removed, there still remained about 1 ft. (30.5 cm.) of brickwork which obstructed the entrance of the rotor and its crate.

Tearing out this brickwork meant more than it actually implied, because at one side of the door a number of 2200-volt circuits passed through the brick wall almost immediately above the transom. Careful measurement showed that if the crate holding the rotor were removed and the rotor let down so that the periphery came within about 1 in. (2.54 cm.) of the floor it would not be necessary to remove any of the brickwork. Consequently the crate was carefully centered in the doorway, and the supporting timbers on the side of the crate

in the direction of travel were cut at an incline so that when the rotor was rolled in toward the station it would gradually descend toward the floor.

Next a timber staging was built, upon which planks were placed to make a smooth runway for the shaft from the crate to the bedplate. Then a set of blocks and tackle was hitched to some of the structural steelwork in the direction of travel and to a rope wound around the outside of the rotor about four times. The other end of the rope was attached to another set of blocks and tackle which was fastened in the rear. When the rope was kept taut the friction around the rotor prevented its rolling backward by gravity. However, by drawing in the forward tackle and letting out the rear tackle the rotor was made to roll up the staging to the bedplate. Once inside the station it was a simple matter to raise the runway to a height that permitted lowering the rotor into the bearings when it reached them by means of jacks.

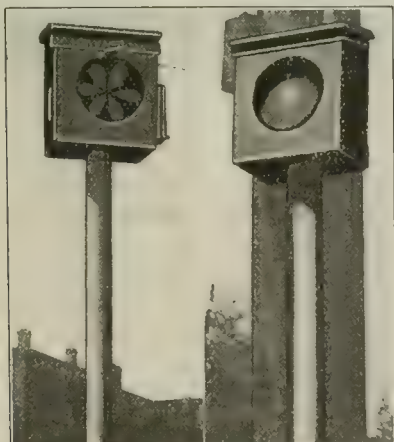
UTILIZING FANS TO VENTILATE MANHOLES

Box Containing Ordinary Fan Is Mounted at Top of Pipe Which Is Connected with the Manhole Requiring Ventilation

BY N. NESBITT TEAGUE

Augusta-Aiken Railway & Electric Corporation

Manholes on the system of the Augusta-Aiken Railway & Electric Corporation are exceedingly hot in the summer owing to loaded transformers and climatic heat, temperatures of 118 deg. Fahr. (47.8 deg. C.) being not infrequent in the holes. For this reason this company has ventilated the manholes where this is possible. In addition to providing the usual holes in the manhole cover, a 4-in. (10.2-cm.) pipe is connected with the manhole and extended above ground several feet. On the upper end of each of these pipes is placed a small wood box with a hole cut in the front as shown in the accompanying illustration. Just back of the opening in the box is an ordinary 12-in. (30.5-cm.) electric fan which forces air into the manhole, where it



VENTILATING FANS MOUNTED ON STANDPIPE AND ON POLE

is allowed to discharge through openings in the manhole cover. By this method it has been possible to lower the temperature of the manholes about 22 deg. Fahr. (12.3 deg. C.). In this way the manholes have been made more comfortable to work in and the

transformers are kept cooler, thus permitting the carrying of heavier loads. These ventilating fans are operated all winter for circulating the air and keeping the manholes in a dry condition.

METHOD OF LAYING OUT BLOW-OFF PIPING

Construction of Brick Blow-off Pits as Well as Basins Serving Separate Blow-off Pipes—Some Factors to Consider

BY T. W. REYNOLDS

Blow-off piping can be made up with bends, Y-fittings and stop valves, as shown in the sketch, so the discharge will be always in one general direction. The upper blow-offs are provided with T's and check valves, to serve as

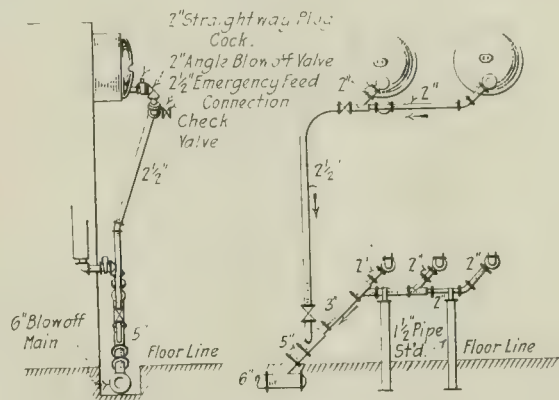


FIG. 1—BLOW-OFF PIPING ARRANGED TO DISCHARGE IN ONE GENERAL DIRECTION

emergency feed connections or so they may be used when a test is run. Each blow-off outlet from the boiler is provided with one straightway plug cock and one angle blow-off valve.

The main blow-off pipe is run in a concrete trench back of the boilers and is covered with a cast-iron checkered plate divided into short sections. The discharge opens outside the plant into a buried circular brick blow-off pit having a concrete bottom and cast-iron manhole frame. Iron rods in the brick walls serve as steps when cleaning out mud and scale from the pit. Failure to clean out or inspect the basin at proper intervals may result in a clogged outlet and an explosion even though the stoppage is only momentarily. Directly under the entering blow-off pipe is a cast-iron plate embedded in the concrete which prevents erosion of the concrete bottom.

The blow-off pipe should enter the pit at a point higher than the outlet to the sewer, while the latter should be extended full size to the sewer main. Failure to do so may result in dangerous and destructive water hammer when blowing off, as water may back up into the blow-off pipe. Where more than one blow-off pipe enters a basin, the sewer outlet should be of greater area than the total area of all entering pipes. The deeper the tank the less steam will be blown into the sewer. A 30-in. (7.6-cm.) space should be left between the water line and top of tank, into which steam can discharge.

Where the law requires that each blow-off from a boiler be run independently to the blow-off basin, a vertical iron tank may be sunk in the floor at the rear of the boilers where it will be centrally placed. The blow-

off pipes may enter through inlets flanged around a circle in the top header, leaving blanked inlets for future connections. The number of pipes, together with a manhole in the center, determine the diameter of the

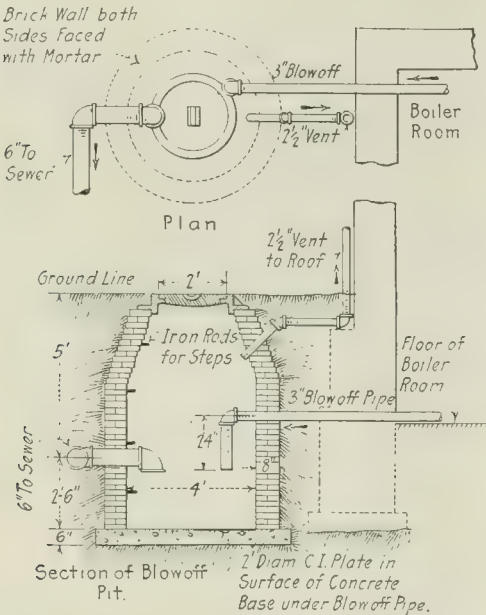


FIG. 2—CONSTRUCTION DETAILS OF BLOW-OFF PIT

basin. The manhole should be equipped with a yoke and gasket, discharge and vent pipes being provided as previously described. Sudden pressure from a blow-off valve opening quickly, or from more than one opening at a time, are the principal causes of temporary excess pressures. For this reason and to allow for the corrosion of the iron it is imperative that tanks be constructed of ample thickness. Pipes should not be run above the floor at the back of boilers since floor and wall spaces at the rear of boilers are important in an emergency.

RECORDING LOCATION OF PORTABLE METERS IN USE

Method of Keeping Record of Persons Using Portable Meters That Involves No Elaborate Bookkeeping

All portable meters of the Mahoning & Shenango Railway & Light Company of Youngstown, Ohio, when not in use are kept in a cabinet in the meter laboratory. The rating of each meter and its number are written

○ No. 1-A.

RECEIVED BY	DATE OUT	DATE IN	CHECKED IN BY
Thomas	4/16/17	4/27/17	NHC

SHIPPING TAG USED AS PORTABLE-METER RECORD

on a card which is permanently fastened near the position devoted to the corresponding meter. Near each identification card is hung an ordinary shipping card also bearing the meter number and having spaces on

which the name or initials of persons drawing out the meter can be entered with the date of issue and return. For instance, if the line foreman wants an ammeter he writes his name and the date on the corresponding shipping tag. When he has finished using the instrument he returns it to the cabinet and one of the metermen in the laboratory puts the return date and his initials on the card to signify that the meter was received in good condition, to all outward appearances.

The advantage of this plan is that it eliminates book-keeping and minimizes the amount of necessary record keeping. At the same time it gives a record of the location of all meters at all times and prevents men from keeping them out unnecessarily long. When the tags are filled on both sides they are filed, thus affording a complete and continuous history of each meter.

WOOD-FRAME LOADING CRANE

Apparatus by Means of Which One Man Handles 5-Ton Loads at Oregon Lumber Mill

To facilitate loading heavy timbers and general yard lumber on flat cars, the Booth-Kelly Lumber Company, Eugene, Ore., has installed a wood-frame traveling crane which is capable of transferring loads from the motor trucks to cars in two lifts. With this apparatus two men can transfer 5000 ft. (1524 m.) of lumber from motor truck to car in approximately



LOADING LUMBER ON FLAT CARS AT THE RATE OF 10,000 FT. AN HOUR

twenty minutes. Allowing for delays, etc., the crane thus has a capacity of at least 10,000 ft. (3048 m.) per hour. The crane proper has a span of 25 ft. (7.6 m.) center to center of tracks. The runway is 28 ft. (8.5 m.) long, thus allowing the loading of two cars by shifting a little. Owing to the lack of space no batter brace posts could be used. Instead 8-in. by 8-in. (20.3-cm. by 20.3-cm.) posts were put up behind the main posts with 8-in. (20.3-cm.) packing blocks between to give the crane clearance. A 22-ft. (6.7-m.) clearance is provided above top of rail. The crane proper is carried on four 16-in. (40.6-cm.) single-flanged wheels, which run on 30-lb. (13.6-kg.) railroad rails. Bolted on top of the wheel trucks are two beams which carry very light rails for the trolley to run on. The trolley and the crane are designed to handle 5-ton (4.5-t.) loads with one man operating.

CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

COST OF ADVERTISING FOR LIGHTING UTILITIES

Gas and Electric Companies Spend About 1 Per Cent of Gross Business, Including Both Appliance and Energy Sales

In a paper recently presented before the Empire State Gas and Electric Association, Thomas R. Elcock of the United Gas Improvement Company of Philadelphia referred to the cost of advertising, pointing out that utility companies spend much less than department stores in proportion to the sales. While the latter spend from 3½ per cent to 6 per cent of their gross business, gas and electric companies spend about 1 per cent of their gross business, including the sales of appliances and the sale of gas or electricity.

A LOG OF HOUSEHOLD ELECTRICAL DEVICES

Detailed Figures Showing Daily Use of Appliances and Total Consumption of Electrical Energy by Family of Two

BY JOE E. KING

Assistant Engineer for Nevada, the Nevada-California Power Co.

A little over a year ago it occurred to the author that a complete log of certain representative electrical devices as used in a typical middle-class home would furnish data of unusual interest to the central station industry.

The home of the writer is certainly representative of a large class, and in addition possesses an unusually extensive array of popular electrical devices, all of which had been in use for at least a year prior to the commencement of this log. Twelve such devices are in general use, covering quite closely the field of electricity in the home.

Additional interest in this record may be lent by the fact that all cooking and heating of water is done electrically. In fact, an electric washing machine and a vacuum cleaner are about the only devices of wide popularity which are not represented in this log.

This record was kept accurately for a full year, starting May 1, 1915, and ending May 1, 1916. A separate meter was installed on each of ten different devices, another meter on two closely related and little used devices (percolator and samovar), and a twelfth meter on the lamps. Excepting the percolator and samovar, the energy consumption may be accepted as representative for the circumstances given. The data relative to the percolator and samovar are of doubtful value because neither tea nor coffee is used regularly.

Particular attention was given to the matter of water heating. With the apparatus installed we do not enjoy hot running water, although our immersion heater acts

rapidly enough to make a fair substitute. It was impossible to segregate the energy used for heating water, but the energy so used will be approximately proportional to the number of times the disk stove and

TABLE I—ENERGY CONSUMED FOR LIGHTING

No. of Lamps	Rating	Kind	Total Watts	Kw.-Hr. per Year
2	60-watt, 115-volt	Tungsten	120	.....
4	40-watt, 115-volt	Tungsten	160	.....
2	25-watt, 115-volt	Tungsten	50	.....
3	60-watt, 115-volt	Metallized*	180	.....
1	20-watt, 115-volt	Carbon*	20	.....
12			530	174

*Seldom used.

immersion heater were used for water heating. This indicates a total consumption for water heating of 375 kw.-hr., or 25 per cent of the total energy used for all purposes. Each meter was wired to a single outlet.

TABLE II—ENERGY CONSUMED FOR COOKING AND WATER HEATING

Name and Description	No. of Heats	Make	MAKERS' RATING, WATTS			Kw.-Hr. per Year
			High	Med.	Low	
Nine-cup percolator, machine type, El Perco.....	Single	Hotpoint	440	..	..	9
Seven-cup samovar, pot type, El Teballo.....	Single	Hotpoint	440	..	..
Toaster stove, type B.....	Single	Westinghouse	500	..	..	39
7½-in. frying pan, type A.....	Three	Westinghouse	660	330	165	122
Immersion heater, crookneck, El Boilo.....	Single	Hotpoint	600	..	..	272
9-in. disk stove, El Stovo.....	Three	Hotpoint	1200	600	300	374
Oven, type D.....	Three	Gen. Elec.	2000	1000	500	420

The use of one outlet per device worked very well with all devices except the immersion water heater, and the installation of a suitably marked double-throw switch obviated the necessity of two outlets for this device.

TABLE III—ENERGY CONSUMED BY GENERAL HOUSEHOLD CONVENIENCES

Name and Description	No. of Heats	Make	Maker's Rating, Watts, Average Input		Kw.-Hr. per Year
12-in. six-blade fan, induction, three-speed.....		Westinghouse			4
Sewing-machine motor, 1/20 hp., 1700 r.p.m.....		Westinghouse			2
Iron, 6-lb.....	Single	Westinghouse		450	51
Bathroom heater, luminous radiator.....	Three	Gen. Elec.	High Med. Low	1500 750 375	22

The dwelling in which these tests were made ordinarily houses two adult persons, the writer and his wife. When visitors making more than a one-day stay were entertained the fact has been noted. All of the watt-

hour meters used in this log were checked by the writer just before they were installed and were rechecked by him just after their return to the meter shop. All meters were well within the limit of 2 per cent fast or slow usually allowed for meters used in service of this class. No attempt was made to use specially calibrated meters. The extreme temperatures recorded during the year of this report were 98 deg. Fahr. (36 2/3 deg. C.) on Aug. 29, 1915, and 3 deg. below zero Fahr. (—19 4/9 deg. C.) on Jan. 12, 1916.

The electrical energy used falls naturally into three general classes—lighting, cooking and water heating, and general household conveniences. Tables I, II and III show respectively the number and kind of lamps or appliances and the energy consumption for these three classes. Table IV is a complete log, with a detailed record of consumption.

VALUE OF NEWSPAPERS AS ADVERTISING MEDIUMS

Doubling Space Resulted in More Than Doubling New Profits for Merchandise Sales in Average-Sized Illinois City

In the city of Bloomington, Ill., with a population of a little more than 25,000 according to the 1910 census, newspaper advertising has been found by the central station to pay. This was disclosed in a paper before the recent meeting of electrical contractors at Peoria by C. F. Snyder, superintendent of light, heat and power for the Bloomington & Normal Railway & Light Company. In connection with advertising he said:

We are absolutely converted to the fact that the newspaper medium is the best and that the careful, consistent use of newspaper space will bring corresponding returns.

TABLE IV—MONTHLY LOG OF HOUSEHOLD ELECTRICAL DEVICES

Month	CLASS 1			CLASS 2. COOKING AND WATER HEATING										CLASS 3. GENERAL HOUSEHOLD CONVENIENCES								MONTHLY TOTALS	
	Light- ing	Percolator and Samovar		Toaster Stove		Frying Pan		Immersion Heater		9-in. Disk Stove		Oven		Fan		Sewing- Machine Motor		Iron		Bath- room Heater		Con- nec- tions Made \$	Kw.- hr. for All Pur- poses
		Kw.- hr. Used	Times Used	Kw.- hr.	Times Used	Kw.- hr.	Times Used	Kw.- hr.	Times Used	Kw.- hr.	Times Used	Kw.- hr.	Times Used	Kw.- hr.	Times Used	Kw.- hr.	Times Used	Kw.- hr.	Times Used	Kw.- hr.			
1915																							
May*	10	3	..	27	3	52	9	91	32	29	29	18	38	..	..	7	..	8	4	1	..	326	125
June	8	4	1	30	4	58	11	107	37	33	28	21	44	6	1	4	..	7	3	..	..	270	137
July†	10	11	1	31	3	48	12	127	42	39	37	14	37	15	2	8	1	12	6	..	..	305	151
August	9	9	1	30	3	35	6	72	28	42	33	19	30	9	1	..	..	6	4	..	..	222	115
September	14	7	1	28	3	36	6	77	21	48	34	21	42	..	..	4	..	12	4	1	2	234	128
October	19	6	..	29	3	43	7	75	19	49	37	24	41	..	..	2	..	7	5	3	7	238	138
November	19	6	1	29	3	34	5	40	10	62	47	23	26	..	..	2	..	10	5	1	1	205	117
December	21	5	1	30	3	62	12	57	11	34	31	24	41	..	..	9	..	10	4	2	2	233	126
1916																							
January†	21	20	2	30	4	58	12	72	21	51	34	26	45	..	..	5	1	7	6	7	7	276	153
February	16	3	..	30	3	60	13	78	19	36	25	18	29	..	..	5	..	10	3	..	..	240	108
March	17	6	..	32	4	64	14	76	20	35	24	19	32	..	..	9	..	10	3	..	..	253	114
April‡	10	1	1	25	3	36	15	38	12	16	15	11	24	..	..	6	..	8	4	3	2	144	86
Total	174	81	9	351	39	586	122	910	272	474	374	238	429	30	4	61	2	107	51	18	22	2856	1498
Average kw.-hr. used per con- nection			0.111		0.111		0.208		0.299		0.789		1.803		0.133		0.033		0.477		0.818		0.464¶

*Entertained one visitor for three days. †Entertained one visitor for eight days for seven days. ‡Except lights. ¶Energy for lights excluded. †One member of family was away from home twelve days and both members were away from home

From the data observed and recorded in this log certain interesting averages have been derived. For instance, the average energy used per connection for each one of the different devices is of record and is of some value, although these figures would doubtless vary greatly with different individuals. Perhaps the most interesting figure derived from this log is what may be called the total average consumption per connection, which is 0.464 kw.-hr. For the purpose of making estimates this figure may be remembered as half a kilowatt-hour per connection.

It is evident from the data submitted herewith that such devices as fans, sewing-machine motors and heating pads when installed in a residence are of but little interest to the central station on an energy-using basis. Their only value to the central station must lie in their ability to popularize electric service on account of its adaptability over a wide range of applications.

For years central stations have looked upon newspaper advertising as a necessary evil required to placate the newspapers. Advertising has been a political and a public policy matter which might serve to temper the wind of criticism to the shorn lamb of public service, and many a central station operator has signed for a page of space with the fervent unexpressed wish that the publisher and his newspaper were in kingdom come. Doubtless advertising does in some cases have its indirect effect from this standpoint, but that is a question for managers and not for commercial departments. The fact remains, and in our case we have demonstrated it beyond a doubt, that it is a powerful selling force and that when properly used it is as necessary to a central station as it is to a department store.

In June of last year we doubled our newspaper advertising, with the result that we more than doubled our new profits from merchandise sales. In fact, we more than doubled our new-business expense with the pleasing returns of an increase of over 400 per cent in our new profits. Here are the figures of a typical month: We used to spend about \$1,860 a month with a gross of \$2,000 in the merchandise department. We jumped the expense to \$3,900 and our sales

were \$4,500, giving an average net of \$600 against \$140. Of this \$4,500 gross business all the wiring, which represents over 50 per cent, was handled through the contractors.

We try to make our advertising copy attractive and appealing and get away from the old hackneyed, stereotyped methods wherever possible. Our house-wiring advertising campaign lasts twelve months in the year with four different strong intensified campaigns, and a different feature is brought out in each drive. A liberal use of newspaper copy is made and electric light is not featured alone. We appeal to the man who is not especially interested in light by talking appliances and labor-saving devices, and the easy-payment plan is strongly featured.

To be effective newspaper copy must be continuous and well connected. Spasmodic attempts do not bring results. You have an every-day story to tell, and you must keep telling it in a convincing and attractive manner. In Bloomington in six months by means of a carefully planned newspaper campaign and solicitation we sold over \$6,000 worth of vacuum cleaners.

PLAN TO INCREASE REVENUE AFTER RATE REDUCTION

Central Station Company Offers Thirty Days' Free Trial of House-Wiring Installations and Secures 1250 Contracts in Fifty-two Days

Beginning March 1, the Union Gas & Electric Company of Cincinnati announced that it would put electricity in any home in Cincinnati on thirty days' free trial. The company's offer included wiring the house, putting in electric fixtures with glassware complete, and supplying service. If the customer was satisfied with the installation at the end of thirty days, he accepted it and paid for it either in cash or in eighteen easy monthly payments. If he was not satisfied, the entire job was removed free of cost to him. Furthermore, the company agreed to reinstall whatever lighting fixtures it had removed at the time electric wiring was placed in the home.

Arrangements were made for handling the wiring through the local contractors, the prices being such that it was possible to equip completely a five-room house, not counting halls, bathrooms and courts, for \$59.75.

As a statement of its reasons for instituting such a campaign the company said in its advertisements: "We make this offer because the maximum electric rate has been reduced to 8.5 cents per kilowatt-hour. This makes it necessary for us to have many more customers in order to maintain our past income. The easiest way to get these new customers is to let residents along our regular lines try electricity for thirty days, we assuming all expense if the service is discontinued at the end of the trial period."

In commenting upon the campaign, W. A. Wadsworth of the Union company said: "We ran the campaign from March 1 to May 15 and secured 1250 wiring contracts. I cannot too strongly emphasize the satisfactory results of this trial feature. The contracts were all turned over to local contractors, who were paid the price mentioned in the schedule less 5 per cent. We found it possible for the customer using the convenient arrangement of the wiring schedule reproduced here-with to make up his own estimate on this form."

Among the conditions are found the following:

"All wires must be concealed between the floors and walls, excepting in brick walls. In the basement open work will be used, and where it is impossible to conceal the wires over the ceiling of the attic, molding must

be used. All wires to side outlets in the attic to be concealed.

"The contractor must provide and install all necessary cut-outs. All cut-outs to be contained in a cabinet.

"The contractor must replace all carpets, rugs and flooring removed to install the wires.

"The contractor must run service wires from the point where the service enters the building to the center of distribution and make all necessary provisions for the installation and connection of the meter.

"Outlets or hardware not listed in the specifications will be installed by the contractor only on the written order of the applicant, who agrees to pay for such extra work at the rates then agreed upon.

"Prices of all fixtures include Mazda lamps, 40 watts or larger."

The following prices per outlet were quoted: Center fixture outlet, \$1.80; side fixture outlet, \$1.80; outlet and base receptacle, \$3; outlet and drop cord with key-socket, \$2.50; outlet and drop cord with chain socket, \$2.75; outlet and single-pole flush switch, \$3; two outlets and pair of three-way switches, \$7; outlet and snap switch, \$2.25; add for outlet under double flooring, \$1; add for outlet under hardwood flooring, \$3; wiring ready to run circuits (service mains, cut-outs, meter loop, etc.), \$12.

A COMPREHENSIVE CENTRAL STATION APPLIANCE LIST

Not Intended for General Distribution, but Mailed to Selected List of Customers and Given to Those Interested in More Than One Appliance

A forty-eight-page catalog of electric appliances, entitled "Modern Home Comforts," has recently been issued by the Public Service Electric Company, Newark, N. J. This catalog, which is a comprehensive list of electrical appliances for household use, is not intended for general distribution, but is mailed to a selected list of customers and is also given out by the company's sales force to those who are interested in more than one appliance. The booklet has the following introduction:

This little catalog is commended to the thoughtful consideration of every woman who would do all in her power to banish drudgery from her home and enhance its comforts.

Whether the housewife employs electric energy in cooking, lighting, auxiliary heating, or in simplifying the tedious and oftentimes health-impairing routine of housework, she may count herself fortunate indeed in having at her disposal a means that is safe, clean and easily controlled.

The accompanying pages are worthy of careful perusal because they graphically suggest some of the many ways in which electrical appliances can be used in making the modern household all that it should be.

Although industrial conditions are very uncertain at the present time, the cost of many commodities frequently advancing, we shall under no circumstances increase the prices of appliances unless absolutely compelled to do so.

Electrical appliances may be purchased under our pay-as-you-use terms—a small amount with order, the balance in easy monthly payments.

Or a discount of 5 per cent will be allowed if the entire amount accompanies your order.

In conclusion a few pages are devoted to (1) use and care of electrical appliances, (2) how to obtain electric service, (3) about the tests applied by the company to appliances, (4) about lamp purchases, and (5) definitions of electrical terms.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

AIR-BLAST RECTIFICATION OF HIGH-TENSION CURRENTS

Experiment to Rectify Alternating Currents by Discharge Between a Point and a Plate, the Arc Being Under Influence of Air Blast

THAT a partial rectification of a high-tension alternating current occurs on the passage of a discharge from a point to a plate has been known for many years. However, difficulty has been encountered in attempting to utilize this rectification, particularly

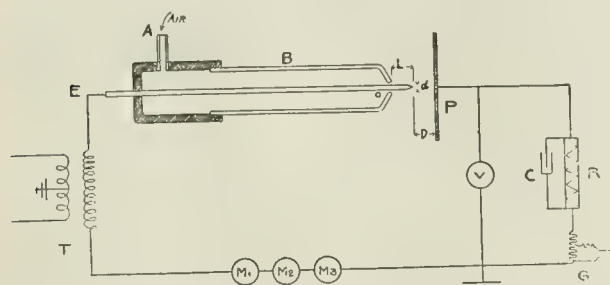


FIG. 1—ARRANGEMENT OF TEST EQUIPMENT USED

if any considerable current flows, as a heavy arc then results which rectifies but little.

In the June, 1917, issue of the *Physical Review* E. R. Wolcott and C. J. Erickson relate the results of an investigation into the effect of a blast of air on this discharge. It was found that complete rectification and smooth operation could be obtained by means of a current of air flowing from the point to the plate under such conditions.

When rectification occurred the discharge was white, rhythmic and snappy, as distinguished from the colored arc which resulted when no air was flowing. Difficulties were encountered when trying to operate at too low voltages, say only a few thousand volts, since a certain voltage is required to jump the air gap. Likewise there is a drop in voltage across the rectifier in actual operation. Satisfactory rectification has been obtained up to 350 kv., and also at frequencies up to 500 cycles per second.

With the point inside of a glass tube the discharge is more snappy, but the tendency to surge is greater. In this case aluminum electrodes seemed preferable, a larger plate was necessary, and a greater air pressure was required. With the point outside of the tube satisfactory results were obtained with iron and brass electrodes.

As the gas pressure increases from zero during the discharge, the rectification increases to a maximum, the value depending upon the setting of the electrodes and the diameter of the gas outlet. A further increase of gas pressure beyond the value which gives maximum rectification produces irregular operation.

In general the wave of the rectified current follows

the wave form of the generator, but as a certain voltage is required to start the discharge it does not include the whole half wave produced by the alternator. Furthermore, the rectified wave is more abrupt than the original wave.

The experiments were conducted with the apparatus illustrated in Fig. 1. A pointed metallic electrode *E* is mounted coaxially within the tube *B*, which is restricted at one end so that a gas entering at *A* is blown through the opening *O* toward the plate *P*. Rectification occurs when the point is some distance within the tube, at the opening of the tube, or extending some distance outside of the tube as shown. In the first two cases the tube *B* must be made of some insulating material, as of glass; in the last case it may be of metal.

Mounted for use, this rectifier was connected to one terminal of the secondary of a 2-kw., 40,000-volt transformer *T*, the other terminal being grounded. The positive current flows from the point to the plate, and no discharge results in the opposite direction when the distance between the point and plate, that between the point and air outlet, the air pressure and the voltage are suitably adjusted.

Connected between the other terminal of the transformer and the ground were three milliammeters. *M*₁ was of the electro-dynamometer type; *M*₂ was a direct-current instrument of the D'Arsonval permanent field type; *M*₃ was a hot-wire instrument.

The secondary voltage from the plate *P* to ground was measured by an electrostatic voltmeter. A General Electric oscillograph was connected directly in the high-tension circuit between the water resistance *R* and the ground.

The air condenser *C* consisted of eleven plates 8 ft. by 3 ft. (2.44 m. by 0.91 m.) and 8 in. (20.3 cm.) apart.

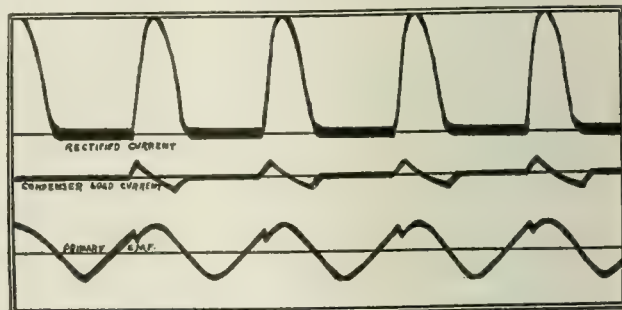


FIG. 2—RECTIFIED CURRENT OBTAINED WITH AIR BLAST RECTIFIER AND LOAD OF 104 MILLIAMP.

Its capacity was 0.00095 mfd. and it was connected in parallel with the water resistance when desired.

The diameter of the plate *P* should be large enough to prevent a discharge from the point to its edges. In the arrangement here described its diameter was 4 in. (10.16 cm.). The diameter of hole *O* in the tube *B* was 0.157 in. (4 mm.). *d*, the diameter of the metallic

electrode E , was 0.0625 in. (1.57 mm.). L , the distance between the opening O and the point of the electrode E , was 0.375 in. (9.54 cm.). D , the distance between the plate and the point, was 0.68 in. (1.76 cm.). The frequency of the alternating current was 60 cycles per second.

Generation, Transmission and Distribution

Induction Method of Localizing Faults.—A. G. BLAKE.—A way of localizing faults in underground cable by the use of a receiver attached to a triangular coil of wire, carried parallel to the faulty cable to which a high-frequency supply of electricity is applied.—*London Electrical Review*, June 15, 1917.

Bombay Hydroelectric Power System.—Second installment of article describing the construction features of the Tata Hydroelectric Power Supply Company's system, including an 88,000-hp. (ultimate) generating station and four (ultimate) outgoing transmission circuits. Only two circuits are installed so far. These extend from

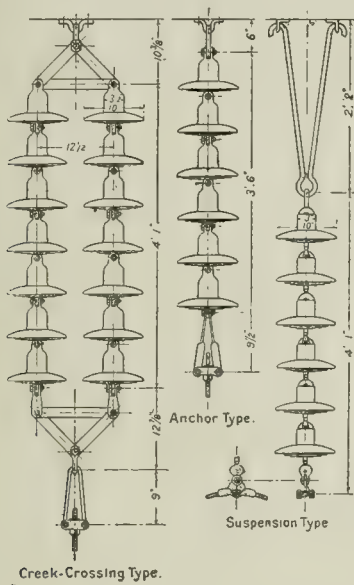


FIG. 3—TYPES OF INSULATORS USED ON BOMBAY SYSTEM

the power house at Khopoli to a receiving station in the island of Bombay. On the way the line has to traverse two tidal creeks, one of which is as much as 10,000 ft. (3048 m.) wide, with a depth of 42 ft. (12.8 m.) at high tide. The conductors for the general line are of seven strand hard-drawn copper wires, each wire having a cross-sectional area of 0.095 sq. in. (0.6 sq. cm.). The maximum resistance allowable is 0.255 ohm per 1000 yd. (0.28 ohm per m.) at 60 deg. Fahr. (15.6 deg. C.). Where the line was taken over the creeks the cables were composed of seven-strand hard-drawn silicon bronze having an area of 0.169 sq. in. (0.109 sq. cm.), and a resistance of 0.514 ohms per mile (0.321 ohms per km.). The conductors are spaced 10 ft. 6 in. (3.2 m.) apart and, in the case of intermediate towers, are arranged delta-fashion on either side of the tower, suspended on six-unit insulators. In the case of anchor towers the conductors are arranged vertically on either side of the tower and are suspended on six-unit insulators. For the creek-crossing towers seven-unit insulators are used, the conductors being arranged vertically over one another on either side. The arrangements of the insulators are shown in Fig. 3. The suspension

insulators, which are 10 in. (25.4 cm.) in diameter, are of two types—the metal-hooded type for using vertically on intermediate towers and the link type for using horizontally on the anchor towers. The threaded portions are sherardized and a special non-hygroscopic cement is used for cementing the parts. The ordinary intermediate towers are spaced 500 ft. (152.4 m.) apart, and the creek-crossing towers 1175 ft. (358.1 m.) apart.—*London Engineer*, May 25, 1917.

Traction

High-Speed Three-Phase Locomotives.—P. VEROLE and B. MARSILI.—This article relates to the locomotives supplied to the Italian State Railways. The mechanical construction, electrical equipment, control apparatus and track signaling system are described.—*London Electrician*, June 8, 1917.

Installations, Systems and Appliances

Fuel Saving.—Discussion of the saving in fuel afforded by a summer-time act, plant economies, etc.—*London Electrical Times*, May 24, 1917.

Fuel and Power Supply.—A series of papers by authorities on the transportation and economical utilization of fuels in generating stations. Coke firing and gas firing are the principal subjects discussed.—*London Electrician*, June 15, 1917.

Electrochemistry and Batteries

Developments in Electrochemical Industry.—A. G. HOWE.—Abstract of paper presented before the Canadian Electrical Association on electroplating and abrasive production.—*Toronto Electrical News*, June 15, 1917.

Electrophysics and Magnetism

Electrical Properties of Gases.—J. J. THOMSON.—In this paper the author discusses the relationship between the potential required to produce a spark, the width of the gap and the pressure of the intervening gas. The potential depends solely on the quantity of gas present between the electrodes, so that so long as the product of the gaseous pressure and the width of the gap is constant the potential needed to produce a spark is constant. It does not matter whether the length of the spark gap is small and the pressure great or the distance large and the pressure small. Hence, while in general the potential needed increases with the length of the spark, there are evidently limits beyond which (with the gas at constant pressure) it is more difficult to get a short spark than a long one. With a very short gap it becomes almost impossible to get a discharge at all.—*London Engineering*, June 1, 1917.

Effect of Distributed Capacity in Single-Layer Solenoids.—J. C. HUBBARD.—The author describes a precise method of calculating the distributed capacity of single-layer coils of various dimensions. Among the conclusions reached are the following: The distributed capacity of coils earthed at one end is not much affected by the nature of the core. The distributed capacity of such coils is a minimum and practically numerically equal to the radius of coils of length equal to the diameter, increasing, for example, by 25 per cent when the length of coil is four times its diameter. For the practical purposes of wireless telegraphy it would seem sufficiently accurate to consider the effective capacity of the coil as equal to its radius in centimeters or to $(r/9) \times 10^{-5}$ microfarads.—*Phys. Review*, June, 1917.

Absorption of X-Rays.—TYCHO E. AUREN.—Relative absorption coefficients of different elements are listed in this paper. From the values obtained the author believes that some simple relation exists between the atomic absorption coefficients and the atomic weights of the elements.—*Phil. Mag.*, June, 1917.

Wires, Wiring and Conduits

Leads for Electric Furnaces.—ARVID LINDSTRÖM.—(Translated from *Teknisk Tidskrift*.) The effective resistance of large conductors and their proper arrangement for electric furnace leads, methods of measuring the resistance and inductance of furnace leads and methods of reducing the self-inductance were subjects discussed in this paper. The author pointed out that in those parts of the circuit between the transformer and the furnace where the two leads come near together there is no difficulty in keeping the inductance or the effective resistance within reasonable limits. In such cases, where the common distance is relatively great, considerable can be gained by making the leads of two concentric tubes. The inductance as well as the increase in the resistance will thus be a minimum. In those parts of the circuit, on the other hand, where each pole has a separate path the use of a single group of laminated bars for each lead would, in general, seem unsuitable. This is especially true where large cross-sections are involved. As near as possible to the place where the leads separate, each conductor should be divided into two groups, placed sufficiently far apart with respect to the length. With not too great a current, each of these groups may consist of a single bar whose thickness should not exceed 15 mm. to 20 mm. If the current is great, so that for practical reasons a total thickness of the bars for each group of more than 20 mm. would have to be used, tubes should be used instead of bars. Otherwise the arrangements should be as stated previously. In general, a greater diameter of the tube (and consequently a less thickness of the walls) as well as a greater distance between the groups will give a better result in regard to the inductance as well as to the increased resistance.—*Met. and Chem. Eng'g*, June 15, 1917.

Units, Measurements and Instruments

Application of Oscillograph to Tests of Internal Combustion Engines.—M. CAMILLERAPP.—Description of an interesting application of the Blondel oscillograph. In studying internal-combustion motors it is desirable to record (a) the pressure variations in the cylinder, (b) the period between two explosions, giving the speed of the engine, and (c) the magnitude and duration of the ignition current. By means of oscillographic methods (b) and (c) can be readily followed. A special device has been designed for studying (a). For this purpose a microphone, in electrical connection with an oscillograph, is mounted in the cylinder. In view of the high temperature of the cylinder gases, the latter are only allowed to impinge on a mica disk which in turn communicates its vibrations through a metal needle to the disk in the microphone. In order to minimize the effect of vibrations it is convenient to mount a second microphone back to back with the microphone registering the pressure, so as to be affected by mechanical vibrations only and not by pressure fluctuations. The two microphones are then connected up on the Wheatstone bridge principle so that the vibration effects cancel out. The

three factors (a), (b) and (c) can be studied simultaneously and the oscillograph method of attack is expected to throw light on many debatable questions in this field.—Abstract from *Revue Générale d'Electricité*, London *Electrician*, May 25, 1917.

Resistance Bridge.—OSCAR DE WETTE.—Description of a bridge for rapidly testing the resistances of different articles and materials and method of using.—London *Electrician*, June 8, 1917.

Comparing Inductances.—T. PARNELL. (Abstract of paper read before Physical Society.) A method of employing an alternating-current bridge for comparing inductances is described.—London *Electrical Review*, June 15, 1917.

Book Reviews

THE NATURE OF MATTER AND ELECTRICITY. An Outline of Modern Views. By Daniel F. Comstock and Leonard T. Troland. New York: D. Van Nostrand Company. 204 pages, illustrated. Price, \$2.

This is a book on the modern physics of matter intended for the general reader and written without mathematics. The authors have collaborated by writing different parts of the book. A large number of topics are presented to the reader in semi-popular form. The treatment is descriptive, aided by diagrams and chemical formula groupings, and technical terms have been avoided as far as possible. Part I is divided into eleven chapters on the following topics: Introductory, the ultimate realities, atoms and their behavior, the nature of heat and allied phenomena, the electron and its behavior, electrons, chemical action and light, electrons and magnetism, radio-activity, the structure of the atom, recent discoveries concerning atomic structure and radiation. Part II deals briefly in turn with fifty-six subjects and in a manner somewhat more advanced than that of Part I. The book as a whole is directed to meet the demands of non-technical readers who are interested in recent physical discoveries relating to matter and electricity.

THEORY AND CALCULATION OF ELECTRIC CURRENTS. By Charles P. Steinmetz. New York: McGraw-Hill Book Company, Inc. 362 pages, 133 illustrations. Price, \$3.

This is a text-book on electrical engineering partly dealing with direct-current and partly with alternating-current phenomena. The book is divided into three sections. Section I relates to electric conduction in various types of conductor, magnetic reluctivity, hysteresis and mechanical forces. Section II discusses alternating-current waves and means for altering their shape; also means for screening them; instability of circuits in arcs and in reactive apparatus. Section III deals with constant-potential constant-current transformation, constant-potential series operation, load balance, circuits with distributed leakage and oscillating currents. Much new matter is offered in the volume, especially in connection with unstable electric circuits and with the shaping of alternating-current waves. The treatment is essentially mathematical and very incisive. The author's well-known originality makes itself evident throughout. The book is well adapted for use as a text-book for advanced students of electrical engineering or for reference by advanced practitioners.

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

ELECTRICAL REQUIREMENTS OF THE EMERGENCY FLEET

**National Government Corporation Is Now in the
Market for a Large Amount of Electrical
Equipment**

The Emergency Fleet Corporation of the United States Shipping Board is now in the market for 375 10-kw. generator sets, for 375 electric switchboards and for 375 18-in. electric searchlamps.

In the near future the corporation will also be in the market for the wiring equipment which is to be installed upon the smaller vessels.

Full specifications can be obtained upon application to the corporation, Washington.

NEW ENGLAND N. E. L. A. SECTION HOLDS A WAR CONFERENCE

**Meeting in Boston Hears Address Upon the National
Coal Situation—Arthur B. Lisle
Elected 1918 President**

In place of the annual convention of the New England Section of the National Electric Light Association, a war conference of Class A and Class D representatives was held at the Engineers' Club, Boston, Mass., on June 29. President Rollins occupied the chair, and an exhaustive address upon the national coal situation was given by F. C. Wright, vice-president Bangor & Aroostook Railroad and member of the coal committee of the Council of National Defense.

The point was brought out that the public utilities will probably have preferential coal shipments in the coming fall. A general discussion took place as to central stations which are incorporating coal clauses in their power contracts.

In the absence of Secretary T. C. Martin, George B. Muldaur of the N. E. L. A. New York office described the work of the National Committee on Gas and Electric Service at Washington, under George W. Elliott. He also emphasized the fact that through this committee contracts for the supply of electric service to cantonments had been let within two or three days in certain instances through central station co-operation.

The question of compensation to employees on military duty was discussed, but no conclusion was reached, and the matter was referred to the executive committee.

The following officers were elected for the calendar year 1918, taking office in January next: President, Arthur B. Lisle, general manager Narragansett Electric Lighting Company, Providence, R. I.; vice-president, George B. Leland, Stamford, Conn.; treasurer, Bowen Tufts, Boston, Mass.; secretary, Miss O. A. Bursiel, 149 Tremont Street, Boston, Mass.; executive committee, R. W. Rollins, Worcester, Mass.; F. A. Bel-

den, Portsmouth, N. H.; H. L. Olds, Brattleboro, Vt.; C. R. Hayes, Fitchburg, Mass.; S. B. Tuell, Pawtucket, R. I., and E. F. Lawton, Hartford, Conn.

ORGANIZATION OF THE ENGINEERING COUNCIL

**Executive Committee Will Co-operate with the
Government in Procuring the Services of
Engineers to Help in the War**

The first meeting of the Engineering Council was held on June 27. This body, as stated in a recent issue of the ELECTRICAL WORLD, is a department of the United Engineering Society.

The council is composed of five members from each of the four founder societies and four from the United Engineering Society.

At the organization meeting the following officers were elected: President, I. N. Hollis; vice-presidents, H. W. Buck and George F. Swain; secretary, Calvert Townley; executive committee, the four officers named J. Parke Channing and D. S. Jacobus.

The council discussed at length ways and means by which the founder societies through the council may be of use to the nation. The unanimous desire to help the government in the prosecution of this war resulted in a resolution instructing the executive committee to co-operate with the government in procuring the services of engineers, also the appointment of a committee consisting of H. W. Buck, A. M. Greene, Jr., and Edmund B. Kirby to consider the best means of utilizing inventive ability of members of the founders' societies.

NIAGARA FALLS DIVERSION AUTHORIZED ON LAST DAY

**Bill Signed by President Just Before Expiration of
Old Authorization—\$25,000 Appropriated
for an Investigation**

The Senate and House of Representatives have agreed to the conference report on the bill permitting the present maximum diversion of 20,000 cu. ft. of water on the American side of Niagara Falls. It was signed late on June 30 by President Wilson.

The measure carries an appropriation of \$25,000 for an investigation by the War Department.

But for the legislation just enacted, 50,000 hp. would have been cut off on the American side of the falls. Although 20,000 cu. ft. of water per second have been, and are now again, permitted to be diverted, only 19,000 cu. ft. have been used.

The War Department will probably make its investigation through General Black, chief of engineers.

ELECTRIC SERVICE FOR NEW ARMY CANTONMENTS

How Central Station Companies Are Preparing to Meet Requirements of the Camps for Our New Army

Answering inquiries from the **ELECTRICAL WORLD**, officials of central station companies give the following information in regard to plans for furnishing electric service to the new army cantonments:

DES MOINES, IOWA

From H. W. Garner, commercial manager Des Moines (Ia.) Electric Company:

This company, after negotiation with the officer in charge of cantonment construction at Washington, has secured definite instruction from the War Department to proceed with the work necessary to furnish electricity for the cantonment camp to be located in this city.

The ground to be occupied is known as Camp Dodge and covers a large area which has been used on previous occasions for a concentration camp, having been in use for concentration purposes at the time the troops were prepared for service at the Mexican border.

The camp grounds are about 8 miles (12.8-km.) from the company's nearest high-voltage circuit. We have received definite instruction to proceed with the work and we are beginning the construction of an 8-mile (12.8-km.) transmission line, energy to be transmitted at 13,200 volts and delivered to the camp grounds and to the government at this voltage. The government is to supply and has ordered, it is our understanding, three 350-kw. transformers, stepping down to 2300 volts, which will be used as the distributing voltage throughout the camp grounds.

The estimated lighting, peak load, will be in the neighborhood of 700 kw., in addition to which about 200 hp. or 300 hp. in motors will be required, chiefly for pumping the water supply and sewage disposal—also for refrigeration purposes.

All material required for the construction of the transmission line, with but few exceptions, is on hand or under order.

Contracts for the general construction of the cantonment camp have been awarded to a local contracting firm, Charles Weitz & Sons, who in turn represent the allied contractors of the city, all of whom have pledged their resources and stock in the general construction of the camp equipment. Mr. Weitz will probably undertake, under his contract, the erection of the local distributing circuit and the inside wiring required by the government. It is the understanding that all of this electrical construction work will be handled and can be properly taken care of by the local contractors, and active preparations are now going forward for the handling of the work in this manner.

PETERSBURG, VA.

From J. E. Harvell, superintendent Virginia Railway & Power Company, Petersburg, Va.:

In reference to the cantonment camp to be established near Petersburg, Va., our proposal to the government is to furnish three-phase, 60-cycle, 13,200-volt service, we to extend our lines to approximately the center of the northern line of the camp.

To furnish this service it will be necessary for us to rebuild one of our 4000-volt lines, bringing it up to standard for 13,200 volts, a distance of 3 miles (4.8-km.), and make an extension of this line 2 miles (3.2-km.) to reach the center of the camp. Our source of supply is from the water-power generating station just west of Petersburg in Dinwiddie County, Va., also a 33,000-volt transmission line connecting Petersburg and Richmond power houses together. Our plan is to install three 1000-kva. 33,000-volt to 13,200-volt transformers to supply service to the camp, and replace capacity to Petersburg on account of change in 4000-volt lines to 13,200 volts. The government is asking for service at the camp amounting to 1350 kw., on account of lack of

material. The electrical construction inside of the camp proper is being done by the Briggs Electrical Company, Charlottesville, Va.

JUNCTION CITY, KAN.

From W. A. Scothorn, general superintendent Union Light & Power Company, Junction City, Kan.:

The Union Light & Power Company has furnished electrical energy to Fort Riley for several years for interior and exterior lighting, also for power. We have installed a duplicate 2300-volt, three-phase, 60-cycle transmission line from our power house in Junction City to the reservation, about 4 miles (6.4-km.) away. This line has a rating of approximately 600 kw.; also, in addition to this, we have a 33,000-volt transmission line along the right-of-way of our railway, which connects Junction City and Fort Riley, thence along right-of-way of the Manhattan inter-urban railway, connecting Fort Riley and Manhattan, to a point near the city limits of Manhattan, thence several miles north of Manhattan connecting with the Rockyford hydroelectric plant. The hydroelectric plant is reinforced by a 750-kw. Allis-Chalmers turbine, which is used at low-water stage. The Union Light & Power Company has approximately 1600-kw. station capacity, consisting of three units, two cross-compound units direct-connected and one 750-kw. turbine. This operates over a 33,000-volt transmission line which passes through the maneuver camp. One-half of this cantonment will be supplied from the Union Light & Power Company 2300-volt line and the other half from the 33,000-volt transmission line. The total connection will be 1000 kw. to 1200 kw.

The United States government owns and maintains all lines on the reservation with the exception of all meters, which the Union Light & Power Company will be expected to install. All new construction work in the way of distribution system will be carried on through contractors and will be by the government, it being necessary only for the generating company to furnish step-down transformers for 33,000 volts.

The Fuller Construction Company is general contractor, but any one who desires to get in touch with the details should write to either Captain Herman, Quartermaster, Fort Riley, Kan., or the Fuller Construction Company. They will be able to advise authentically the quantities of material required in this new work. The cantonment structures will be two stories high, and each building will house approximately 250 men. It will be necessary to provide new buildings to take proper care of 70,000 men.

LOUISVILLE, KY.

From L. S. Streng, superintendent electric department Louisville Gas & Electric Company:

We are not yet ready to give details of our plans for furnishing service to the new cantonment. We have not yet had from the government any details as to what its requirements will be. We are now furnishing temporary service for construction and are preparing to extend two of our high-tension feeders to the site of the camp. One of these extensions will be about 2½ miles (4 km.) long and the other about 1½ miles (2.4-km.).

On June 24 and 25 we built a three-phase line about 1½ miles long through the site for the purpose of supplying temporary service. The interior wiring contract has not yet been let.

Greatest Naval Station to be at Hampton Roads

President Wilson by proclamation has taken over the old Jamestown Exposition site on Hampton Roads, about 440 acres, upon which is to be built, at a cost of \$2,800,000, what will probably be the greatest United States naval station. A great series of coast artillery batteries, electrically operated, will be constructed, as well as piers, storehouses, oil-storage tanks, training stations, etc. The government takes over all public utility rights and properties on the site.

GREAT INTEREST IN THE BOSTON CREDIT MEETING

Eighteenth Annual Meeting of the National Association Finds Membership of 557—Outlook for Credit Conditions in Future

The eighteenth annual convention of the National Electrical Credit Association was held at the City Club, Boston, Mass., on June 28 and 29. About sixty-five were present, representing all the branches except that of the Pacific Coast. The proceedings were marked by enthusiasm, great interest and an evident desire to co-operate with other branches of the industry.

Sessions were opened on Thursday morning, President Robert Edwards in the chair. When the first convention was held at Boston in 1899 there were 152 members. The present membership is 557. Sixty-four have been added in the last year.

Secretary Frederic P. Vose, referring to the present crisis, said that the electrical industry is likely to be called upon to make great sacrifices, but should take a broad view. Conventions should not be omitted.

OUTLOOK FOR THE FUTURE

At luncheon Norman I. Adams, vice-president Shawmut National Bank, Boston, spoke on "Credit Problems." He pointed out that his hearers' work is rendered difficult owing to the limited capital of many retailers. Since 1914, however, easy profits have rendered the credit situation less troublesome, but credit men should look forward to the reaction that is bound to follow present abnormal conditions. Present prices are artificial, and it behooves the selling concern to watch the debtors' inventories, which should be based on normal, rather than cost, prices of goods. There is no precedent on which to base one's predictions for the future and sudden changes may come.

Guy V. Williams of the Guy V. Williams Company, New York, in a paper advocated the formation of a national reference bureau which should be a court of conciliation and adjustment to handle differences between members and their customers.

The plan was also advocated by V. G. Fullman, secretary Franz Neilson, New York; C. P. Scott, New York; W. T. Pringle, Philadelphia; F. S. Hardy, Boston, and George J. Murphy, Boston. The latter advocated a simple standardized form of accounting for use by the contracting and other branches of the trade, and urged that credit men become broader in their relations with the buyers and do all in their power to improve their customers' credit.

It was voted that the president appoint one member from each association to meet with jobbers' and manufacturers' organizations to formulate a uniform accounting system.

THE CASH DISCOUNT

"What and Why Is a Cash Discount?" was the title of a paper by David Kerr, Lewis Electrical Supply Company, Boston. He held that the cash discount is really a separate contract, and should be lived up to strictly. Slow-paying customers can often be made prompt by encouraging them to collect their own bills promptly and not overstock goods.

Discussion was led by L. M. Creighton, Frank H. Stewart Electric Company, Philadelphia, followed by

H. E. Wilkins, Belden Manufacturing Company, Chicago.

The last paper of the day was by D. E. Crane, Macbeth-Evans Glass Company, Pittsburgh, on "Should Interest Be Charged on Overdue Accounts?" Interest charge is enforceable in most states, but it is safest to have it stipulated on the bill, statement or contract. Laxness in making interest charge, after the proper interval for payment, entails the borrowing of money with which to do business, with consequent loss. It is also unfair to burden prompt payers with the results of the remissness of others.

The discussion took place at the Friday morning session and was led by A. E. Case, Western Electric Company, Boston. A test vote resulted in the rejection of the interest-charging plan. It was felt that manufacturers are in a better position than jobbers to charge interest on overdue accounts.

A paper on "Trade Acceptance" was read by J. D. Meek, Indianapolis Electric Supply Company, Indianapolis, Ind. The author said he had used this method to advantage, and had found it better than the open account method so long employed. In the discussion, led by F. S. Hardy of F. S. Hardy & Co., Boston, the opinion was expressed that, owing to the large number of small accounts handled, acceptances are not applicable to the jobbing business. A solution recommended was rendering drafts monthly on the month's purchases.

THE MORAL RISK

R. P. Tracy, Boston, Mass., presented a paper on "The Moral Risk," pointing out that the credit manager must select the material with which he is to work. Brains cannot be supplied the contractor, but his business can be improved in scope and method. More contractors have failed because of too generous credit than otherwise. An important point is for the credit manager to size up the contractor in his place of business. Two of the difficulties mentioned are failure of the contractor to realize sufficient gross because he does not know his overhead (good accounting will solve this problem), and tendency to overstock on slow-moving lines, such as fixtures. Contractors are fair technical men, the speaker said, but poor financiers. The discussion, led by W. W. Harding, Westinghouse Lamp Company, New York, was animated.

The convention closed with a paper on "Municipal Mumps, Their Prevention and Cure," by C. A. Ten Broeck of Philadelphia, in which the credit risk of municipalities was considered. It was urged that definite information be had before accounts are taken, and that the latter be placed with the proper authorities after it is positively known that provision has been made to pay.

W. P. Pringle, Philadelphia, was elected president for the coming year; Benjamin George, Chicago, vice-president, and Frederic P. Vose, Chicago, secretary.

Holland Gift to Doherty Organization

At Fraunces' Tavern, New York, on June 21, representatives of the Dutch stockholders of the Cities Service Company presented to the Doherty Organization a grandfather's clock made at Amsterdam in 1750. Henry L. Doherty accepted it on behalf of the organization.

SURCHARGE OF 10 PER CENT ON MUNCIE (IND.) POWER RATES

Relief Granted by Public Service Commission Applies
to Large Consumers—No Opposition Found
to Advance

The Indiana Public Service Commission, in the case of the Muncie Electric Company, which had petitioned for authority to add 0.15 mill per kilowatt-hour for every 5-cent increase in cost of coal above \$1.90 a ton f.o.b. Muncie, did not grant the full relief asked, although it granted temporary relief.

The order allowed the company to make a temporary surcharge above fixed rates of 10 per cent on bills to large power consumers. The increase will not affect small consumers and will not affect any consumer of electricity for lighting. Small power consumers also are exempt from the surcharge.

The commission held two hearings and some commissioners went to Muncie to ascertain whether opposition existed to the petition. At no point was opposition apparent.

"In this case the commission does not propose to free this company from all the burdens of the present price situation," a commissioner said. "The decision is temporary, extending to Jan. 1, 1918, or until modified by the commission or revoked."

A commissioner declared that if the order did not give all the relief prayed for, certain payments to the American Gas & Electric Company—the parent company—might be curtailed until presents costs decrease.

GOVERNMENT REQUIREMENTS WILL INCREASE THE DEMAND

Application of Companies in Indiana Electric Light
Association for Authority to Add Sur-
charge of 30 Per Cent

Supplementing the article in last week's issue of the ELECTRICAL WORLD on the application of the Indiana companies to the Public Service Commission for authority to add a surcharge of 30 per cent to every bill because of the extraordinary war conditions the substance of the petition is published herewith. It is signed for the association by S. W. Greenland, president, and Thomas Donahue, and says in part:

The average per cent of increase of prevailing prices over normal prices, computed from the reports of a large number of utilities in Indiana, is as follows:

Operating Expense	P. C. of Inc. Prevailing Prices Over Normal
Coal	184
Labor	32.67
Copper	144.86
Miscellaneous supplies	65.91
Taxes	48.41
Equipment	51.14
General operating	45.50

As a temporary expedient for relieving the financial distress caused by the extraordinary prices and to make possible necessary betterments and extensions and prevent curtailment of service, said utilities ask that your commission authorize them to add to each bill a surcharge sufficient to return the difference between prevailing excessive prices and normal prices. Such surcharge is not designed to increase net profits, but is intended only for the purpose above stated, and said petitioners believe that such surcharge required for such purpose will be approximately 30 per cent.

In nearly all cases the requirements of the government will necessitate extensions, improvements and additions

to existing plants, and more intensive operations, all of which will result in greatly increased demands upon central power stations. These demands in most cases can be met only by further extensions, betterments and additions to central stations. The money with which to finance these extensions, betterments and additions cannot be obtained as long as the utilities operate at a loss.

Your petitioners are informed that the situation in regard to prices is practically the same as that which confronted the utilities in England after the beginning of war. The governmental agencies determined upon the plan herein suggested as a means of giving relief during the continuance of extraordinary conditions. Said surcharge in England as originally fixed has been increased until it now averages approximately 50 per cent upon each bill.

The following signed the petition:

Albany Water & Light Company	Mooresville Public Service Co.
Indiana Utilities Company	Mount Vernon Electric Light & Power Company
Batesville Electric Light & Power Company	Mulberry Light & Power Co.
Booneville Electric Light & Power Company	Muncie Electric Light Company
Brookville Electric Company	United Gas & Electric Company
Wabash Valley Electric Co.	Browne Mills Electric Company
Central Indiana Lighting Co.	Owensville Light Company
Danville Light, Heat & Power Company	Plymouth Electric Light Co.
Indiana General Service Co.	Poseyville Light & Power Co.
Public Utilities Company	Princeton Light & Power Co.
Northern Indiana Gas & Electric Company	United Public Service Company
Indianapolis Light & Heat Co.	Sheridan Water, Light & Heat Company
Merchants' Heat & Light Co.	Terre Haute, Indianapolis & Eastern Traction Company
Interstate Public Service Co.	Valparaiso Lighting Company
Laporte Gas & Electric Company	Union Traction, Light & Power Company
Madison Light & Railway Co.	Western Indiana Utility Co.
Martinsville Gas & Electric Co.	Oakland City Electric Company
Montpelier Utilities Company	

PRESIDENCY OF THE ASSOCIATED MANUFACTURERS

Letter of Robert K. Sheppard Shows His Earnest
Insistence Upon the Advantages of a
Democratic Organization

In sending to members of the Associated Manufacturers of Electrical Supplies a summary of proceedings of the last annual meeting Charles E. Dustin, the general secretary, transmits also a letter from Robert K. Sheppard. Mr. Dustin refers to the unanimous wish of Mr. Sheppard's associates on the board of governors that he continue as president for another year, but says that it was felt that deference should be given to his wishes, and therefore H. B. Crouse was elected to the presidency. The letter of Mr. Sheppard to Mr. Dustin, dated March 29, but just now made public, says:

The friendliness with which my fellow members on the board of governors have argued that I should continue as president of our association for another year is deeply appreciated.

You know that the prosperity and rapidly growing usefulness of this organization are precious to me. To have been chosen for its first and second president is an evidence of the trust of my comrades for which I am profoundly grateful.

In our association the presidential honor should be passed on from one man to another, each of whom sees human nature through keen and kindly eyes, each of whom has abundant intellectual and physical vigor, each of whom is accustomed to rapid action, each of whom has the courage for swift decisions and the acumen to render only wise ones. Such men will achieve mighty good results in two years. Furthermore, such men will uphold a successor's hands ably and unselfishly so that benefits to the association will multiply as ex-presidents collaborate with their active successors and boards of governors.

Now you see why I believe we should have a new president this year, and why I have asked the board to commandeer Mr. Crouse. All of us want democracy and all of us want a strong leader. In Mr. Crouse we shall have such a leader, wonderfully well known throughout our entire industry and commanding the respect of everybody.

IN STOPPING COAL PANIC
CONSUMERS CAN DO THEIR BIT

Secretary of the Interior Lane Shows Importance of Unloading Every Coal Car as Fast as It Is Received

Secretary of the Interior Franklin K. Lane, reviewing the coal situation as reported to him by statisticians of his department, said that the production of coal in the United States last year was the greatest in the history of the country. A new record, however, was set for the first six months of this year.

The limit has not yet been reached, for as railroads are able to work out better the problem of car supply and give greater facilities to mines for transportation coal will reach consumers in steadily increasing quantities. In the early months of 1917, because of railroad congestion and difficulties of transportation, production of bituminous coal fell behind the high mark of January and February a year ago. As a result of the patriotic and earnest endeavor of railroad officials and coal operators and representatives of mine workers who have volunteered services to the federal government, production has been speeded within the last few months and the soft-coal output for May, which exceeded all previous records, was surpassed in June.

Difficulty of distribution, now so great, will be intensified, however, in the winter months. Coal consumers must do their share in working out the problem by unloading every coal car as fast as it is received, and in improving plants so as to utilize to the fullest the heat value of coal that reaches their bins.

MISSOURI UTILITIES
WILL ASK HIGHER RATES

Information Compiled for Presentation to Public Service Commission Shows the Serious Problem Now Before Operating Companies

The executive committee of the Missouri Association of Public Utilities met at Kansas City on June 26 with the newly appointed committees on fuel and supplies, and rates and revenues. These committees discussed plans for securing fuel and other necessary materials for the various public utilities of the State. On account of the scarcity of supplies and the tremendous increase in cost of fuel and labor, many Missouri companies are finding it difficult to meet operating expenses. The committee plans to present an application to the Public Service Commission for an increase in rates.

These committees represent practically all utilities in

the State, including gas, electric, street railway and water companies, and it is hoped that some arrangement may be made for almost immediate relief. Preliminary data, compiled from sixty different utilities in the State, show that the prices of fuel, oil and labor have increased more than 47 per cent over 1913. Some companies report as much as 338 per cent in prices they have had to pay for coal. When more complete data have been gathered, the committees will hold another meeting at Jefferson City, when the difficulties of the companies will be presented to the commission and relief asked.

TAX ON ELECTRICITY
IN WAR REVENUE BILL

Senate Committee Report Retains Telephone and Telegraph Service Levy, but Eliminates House Provision on Electricity—Senate Now to Act

The Senate finance committee has completed its draft of the war revenue tax bill, on which it has been working since May 22, and has reported it to the Senate, retaining the taxes proposed on telephone and telegraph service in the House of Representatives' bill. It is estimated that \$7,000,000 in revenue will be raised from these sources.

The Senate draft eliminates the House taxes proposed on electric light, gas and domestic power.

This bill will come up for discussion in the Senate as soon as the food control bill is out of the way, and it is estimated that several weeks' time will be necessary in which to pass it. Almost every industry taxed in the bill has proponents or opponents in the Senate, and it is stated in Washington that there will not only be efforts on the Senate floor to eliminate the \$7,000,000 tax proposed on telephone and telegraphic service, but to restore to the Senate measure the proposed House taxes on electric light, gas and domestic power which were eliminated by the Senate committee.

HIGHER ELECTRIC RATES FOR
TROY (OHIO) MUNICIPAL PLANT
Coal Costs 112 per Cent More Than Last Year, and Wages Are Higher, Consequently Rate Advance Was Necessary

Frank Burkholder, director of public service of the city of Troy, Ohio, writes to the ELECTRICAL WORLD that on account of increased costs there was no alternative but to raise electric rates. The city is paying 112 per cent more for coal this year than last year, and it was necessary to raise employees' wages.

RULES AND RATES

The rates for light and power are as follows:
Meter rate for lighting current.....7c per 1,000 watts (1 k. w.)
Meter rate for sign lighting.....5½c per 1,000 (1 k. w.)
Meter rate for power.....4c per k. w. for first 100 k. w.
Meter rate for power.....3c per k. w. for next 300 k. w.
Meter rate for power.....2c per k. w. for next 2000 k. w.
All over 2,400 k. w. @ 1½c and an extra 5% off if 15,000 or more used and paid before 10th.
Contract rate for one to four 60 Watt lamps is 40c per month each.
500 Watt Mazda for sidewalk light, each \$1.50 per month.
Minimum charge per month for Light, 66c.
Minimum charge per month for Motors, 50c per horse power.
A discount of 10 per cent is given on all bills paid before the 10th of each month.

RULES AND RATES

The rates for light and power are as follows:
Meter rate for lighting current.....8c per 1,000 watts (1 k. w.)
Meter rate for sign lighting.....6½c per 1,000 (1 k. w.)
Meter rate for power.....5c per k. w. for first 100 k. w.
Meter rate for power.....3½c per k. w. for next 300 k. w.
Meter rate for power.....2½c per k. w. for next 2000 k. w.
All over 2,400 k. w. @ 1½c.
Contract rate for one to four 60 Watt lamps is 50c per month each.
500 Watt Mazda for sidewalk light, each \$2.00 per month.
Minimum charge per month for Light, 70c.
Minimum charge per month for Motors, 60c per horse power.
An addition of 10% will be made to all bills not paid by the 10th of each month.

MILITARY EXEMPTION RULES PROMULGATED

Full Text of Section 44 of Regulations Prescribed
by the President for Local and
District Boards

The extract published herewith is from rules and regulations prescribed by the President for local and district boards under the authority vested in him by the terms of the act of Congress to authorize the President to increase temporarily the military establishment of the United States. This act was approved on May 18, 1917. These rules and regulations may be modified at any time by the President.

Sec. 44. Procedure of district boards in cases where a district board has exclusive original jurisdiction under the terms of said act of Congress.

District boards have the exclusive original jurisdiction in respect of any person whose name has been certified to a district board as called by a local board within its jurisdiction, and who has not been exempted or discharged, to hear and determine all questions or claims for including or excluding or discharging any such person arising under the following provision of said act of Congress authorizing the President to exclude or discharge "persons engaged in industries, including agriculture, found to be necessary to the maintenance of the military establishment or the effective operation of the military forces or the maintenance of national interest during the emergency."

FILING CLAIMS FOR DISCHARGE

A claim for discharge under this provision of said act of Congress may be filed with a district board by or in respect of any person whose name has been certified to the district board by a local board within the jurisdiction of such district board as one called for service by such local board and not exempted or discharged.

Any such claim for discharge must be filed with the district board on a form provided by the provost marshal general and supplied by district boards and local boards for that purpose on or before the fifth day after the mailing by a local board of notice to such person that his name has been certified to such district board as called for service and not exempted or discharged.

The statement on the registration card of any such person that exemption or discharge is claimed shall not be construed or considered as the presentation of a claim for discharge.

Such a claim may be filed by or in respect of any such person on any of the following grounds:

1. That he is actually engaged in a particular designated industrial enterprise or in a particular designated agricultural enterprise necessary to the maintenance of the military establishment; that his continuance therein is necessary to the maintenance thereof, and that he cannot be replaced by another person without direct substantial material loss and detriment to the adequate and effective operation of the enterprise in which he is engaged.
2. That he is actually engaged in a particular designated industrial enterprise or in a particular designated agricultural enterprise necessary to the effective operation of the military forces; that his continuance therein is necessary to the maintenance thereof, and that he cannot be replaced by another person without direct substantial material loss and detriment to the adequate and effective operation of the enterprise in which he is engaged.
3. That he is actually engaged in a particular designated industrial enterprise or in a particular designated agricultural enterprise necessary to the maintenance of national interest during the emergency; that his continuance therein is necessary to the maintenance thereof, and that he cannot be replaced by another person without direct substantial material loss and detriment to the adequate and effective operation of the enterprise in which he is engaged.

The word "necessary" as used in said act of Congress shall be construed and held to mean that the discontinuance

of or serious interruption in the particular designated industrial enterprise or the particular designated agricultural enterprise in which the person is engaged would result in substantial material loss and detriment to the adequate and effective maintenance of the military establishment or the adequate and effective operation of the military forces or the maintenance of national interest during the emergency.

CONSTRUING THE WORD "NECESSARY"

The word "necessary" as used in the phrase "that his continuance therein is necessary to the maintenance thereof" in these regulations shall be construed and held to mean that the withdrawal of the labor or service of such person would directly result in substantial material loss and detriment to the adequate and effective operation of the particular designated industrial enterprise or particular designated agricultural enterprise in which such person is engaged.

Affidavits in support of or in opposition to any such claim shall be filed within five days after the filing of a claim for discharge by or in respect of any such person.

The words of the act "persons engaged in industries, including agriculture," shall not be construed and held to mean that a person engaged in a particular industrial enterprise or particular agricultural enterprise is entitled to be discharged by reason of the fact that such class of industry taken as a whole, or agriculture taken in its entirety, is necessary to the maintenance of the military establishment or the effective operation of the military forces or the maintenance of national interest during the emergency.

In order to substantiate any such claim the evidence submitted must establish that the particular designated industrial enterprise or particular designated agricultural enterprise is necessary to the maintenance of the military establishment or the effective operation of the military forces or the maintenance of national interest during the emergency.

The evidence must also establish, even if the particular industrial enterprise or particular agricultural enterprise is found necessary for one of the above purposes, that the continuance of such person therein is necessary to the maintenance thereof, and that he cannot be replaced by another person without direct substantial material loss and detriment to the adequate and effective operation of the particular industrial enterprise or particular agricultural enterprise in which he is engaged.

In order to assist in securing uniformity in decision and practice of district boards and to provide for co-operation and co-ordination between the necessities of the military establishment, the military forces and national interest, and the industries, including agriculture, found to be necessary to the maintenance of the military establishment or the effective operation of the military forces or the maintenance of national interest during the war, the President may, however, in his discretion, from time to time ascertain and determine which industries, including any agricultural industries, or classes of industries, including agricultural industries, are necessary for the purposes specified in said act of Congress, and may certify to the respective district boards, with the force and effect of regulations prescribed by the President in accordance with the terms of said act of Congress, that a designated industry, including any agricultural industry, or a designated class of industrial or agricultural enterprise, is or are necessary for one of the purposes specified in said act of Congress.

INDUSTRIAL AND AGRICULTURAL ENTERPRISES

In the event that any industrial enterprise or agricultural enterprise is included among those so certified, the evidence submitted to the district board must nevertheless establish the facts that the continuance therein of the person by whom or in respect of whom the claim is made is necessary to the maintenance thereof, and that he cannot be replaced by another person without direct substantial material loss and detriment to the adequate and effective operation of the particular industrial enterprise or particular agricultural enterprise in which he is engaged.

It shall be the duty of each district board to ascertain by its own methods the existing conditions in industries that may be claimed to be necessary within the meaning of the

act of Congress and these regulations and the agricultural conditions as a whole within its jurisdiction as they may be affected by the drafting into the military service of the men called by the respective local boards within its jurisdiction.

It shall also be the duty of each district board to ascertain as near as may be the labor supply available for such necessary industries and for agriculture outside of the men called for military service, and to take into consideration all such facts in determining such claims, and the effect of the efforts of governmental agencies to mobilize and to make such labor more efficient.

If, in the opinion of the district board, the direct substantial material loss to any such industrial or agricultural enterprise outweighs the loss that would result from the failure to obtain the military service of any such person, a certificate of discharge may be issued to him subject to the conditions of Section 45 hereof.

Within five days after the closing of proofs in any such case the district board shall decide in favor of or against any such claim.

EXPORT TRADE CONFERENCE HELD AT SPRINGFIELD, MASS.

Remarkable Opportunity Before American Manufacturers to Develop Lasting Trade and Thus Stabilize Their Operations

A conference lasting one week, and devoted entirely to the problems of export trade, closed at Springfield, Mass., on June 30. The keynote was the remarkable opportunity now before American manufacturers in South America, Europe, the Far East, and other foreign quarters of the globe, to develop lasting trade capable of affording continuity of output regardless of business depressions in this country. The consensus of opinion was that the best men should be drawn upon to build up the foreign field. Emphasis was laid upon the vital necessity of completely fulfilling specifications and promises to foreign purchasers, including shipments on dates agreed upon, and packing as required by foreign buyers. Much time was also given to reviewing credit facilities available through enterprising American banks. Among the speakers were J. W. Brooks, vice-president Pass & Seymour, Solvay, N. Y., "Starting In on Export"; Fred S. Phillips, export manager American Ever Ready Works, Long Island City, N. Y., "The Inside of Exporting"; and A. W. Gilbert, Chapman Valve Manufacturing Company, Indian Orchard, Mass., "Metal Fittings in Overseas Markets."

EXPORT TRADE NEEDS OF THE UNITED STATES

Various points brought out in the conference may be touched upon. The United States needs export trade because it is the greatest producing nation and must have foreign outlets for surplus products or suffer the evils of glutted markets at home and the detriment of capital and labor alike. From 1913 to 1916 total exports of the country increased from \$2,484,018,292 to \$5,481,423,589. Total value of firearms, explosives, etc., exported in 1916 was \$757,700,475. Manufacturing is not likely to develop rapidly in South America at present because of short coal supply, but hydroelectric power will come into play in the future. Exports to South America increased from \$186,678,122 in 1913 to \$266,895,330 in 1916. It is expected that alliances during the war will be effective for a considerable period in trade relations after the conflict. A powerful United States merchant marine is likely to be a feature in

future years. For a long time this country will probably be a chief source of funds for development enterprises in the world.

Patience is necessary in developing profitable foreign trade. Mushroom jobbers should be avoided. The government should foster co-operative efforts by competitive manufacturers seeking foreign outlets. We should freely accord long-time credits to foreign buyers. Foreign trade agencies are the eyes of export business. The trade balance of the United States in 1916 was \$2,080,000,000, compared with \$435,000,000 in 1914. Relief from restrictive legislation is needed. Co-operation and standardization are also needed in American manufacturing plants to meet foreign competition, including uniform system cost accounting where possible. Much would be gained by drafting successful business men for governmental positions. One should tell even one's competitor about foreign credit risks. To have one's bank give its acceptance on a draft against a foreign buyer, with the corresponding development of the acceptance market, is a growing satisfactory means of financing foreign shipments; this increases capital turnover. Personal travel is most important in developing trade. Foreign buyers are usually more accurate and particular than those in domestic trade. Manufacturers should not seek foreign trade which cannot be consistently carried at all times. Standards of business honesty are generally equal to those in vogue in this country. An attractive field for the loose-leaf catalog exists, the catalog being printed in the language of the country concerned, and complete in ordering and shipping instructions, with typical examples. The field in South America applies particularly to capital of \$100,000 and over, that for small capital being less favorable at present. Closer intercourse is most important with South America, including study of people and countries. American tools can be sold abroad, even in competitive countries, on the basis of superior worth, and at higher prices than apply to local competitive products. Shorter working days and higher-cost labor are expected in Europe as a result of the war.

ILLUMINATING ENGINEERING CORRESPONDENCE CONVENTION

Substitute Plan for Annual Convention—Dues Remitted for Members Who Enter the Military or Naval Service

At the last meeting of the Council of the Illuminating Engineering Society it was decided that any member or associate member in good standing when entering the military or naval service of the United States or any of its allies may upon request before Oct. 1, 1917, or if called out after that date, have his name retained upon the membership roll, without payment of dues, during the year ending Sept. 30, 1918. The council voted to invest \$1,000 in Liberty bonds.

In lieu of the regular annual convention, which has been abandoned, the society will hold a "correspondence convention." Papers prepared for this annual convention will be circulated among interested members in advance of publication in the *Transactions*, and written discussions may be submitted for publication. In this way the value of the papers and discussions will not be lessened because of cancellation of the convention.

A. I. E. E. DISCUSSES CABLE AND INSULATOR PROBLEMS

Forcing of Cables Suggested to Offset High Prices of Copper—Fused Quartz Insulators Receive Consideration

Several well-known engineers took part in the discussion of problems connected with cable operation at the recent meeting of the A. I. E. E. in New York. Among them were W. I. Middleton, Pittsburgh Wire & Cable Company; Philip Torchio, New York Edison Company; H. R. Woodrow, New York Edison Company; J. B. Whitehead, Johns Hopkins University; D. W. Roper, Commonwealth Edison Company; J. F. Bang, Pennsylvania Water & Power Company; W. S. Clark, General Electric Company; John L. Harper, Hydraulic Power Company, Niagara Falls; E. B. Meyer, Public Service Electric Company of New Jersey; C. A. Adams, Massachusetts Institute of Technology, and C. N. Rakestraw, Cleveland Electric Illuminating Company.

CABLE QUESTIONS DISCUSSED

One of the most important points brought out was that the prevailing high prices of copper can be combated to a great extent by forcing the rating of cables. In doing this particular attention should be given to the construction of the ducts, so that they will not impede heat radiation. The temperature gradient, Professor Whitehead pointed out, is the least in ducts with the largest radiating surface. If dissipation curves can be laid out for different soil conditions and different numbers of ducts and dielectric losses of cables can be obtained, a great step can be made toward standardizing cable ratings.

While operating cables under practically submerged conditions, as suggested by Mr. Harper in the paper that was abstracted in the June 30 issue of the *ELECTRICAL WORLD*, may substantially increase their ratings, there are some objections to it. For instance, if the cables have to be repaired when the ducts are filled with water the ducts have to be pumped out before anything can be done. In addition, lead sheaths will corrode quickly when water circulating past them carries very much air. Furthermore, the evil effects of electrolysis may be augmented if cables are submerged in water.

Conditions which affect cable failure were also brought out. In this connection Mr. Middleton pointed out that many cables are being used under conditions for which they were not designed, and as a result the performance obtained therewith is not what could be expected. He contended that the personal element in making cable joints is more important than the materials used and that no ready-made joint known to him is as desirable as a hand-made joint. Since the difference between the electrostatic capacities of cables and joints may have some effect on joint failure, it was advised that a study be made along this line.

Owing to the disintegration of cable insulation when cables have been in the ground a long while, the dielectric performance may be considerably different from what it was when the cable was new. Furthermore, allowance must be made for radiating additional heat. Ionization may also be a cause of cable failure, Professor Adams pointed out, where the rubber or insulating material does not completely fill the interstices between strands. This action is aggravated by terminal conditions which

may set up voltage surges. Joint trouble may be caused by the shrinkage of compound in the middle of the joint due to temperature changes, since the inner core of insulating compounds is the last to cool.

A warning was sounded against generalizing the conclusions drawn from tests, as such conclusions are subject to misconstruction. Mr. Torchio said that his experience indicated that "hot spots" are not the most frequent source of cable trouble. In one case where extra high-voltage cable was employed the wrapping of the insulation had a great effect. Reference was made to the high-tension joint described in the April 15, 1916, issue of the *ELECTRICAL WORLD*, attention being called to the fact that 290 of the joints have been used on 25,000-volt circuits for three years without failure.

INSULATOR PROBLEMS

In the discussion of insulator problems the following took part: J. P. Clark, Stanford University; E. E. F. Creighton, General Electric Company; E. M. Hewlett, General Electric Company; Percy Thomas, New York; J. B. Taylor, New York; C. F. Harding, Purdue University; John T. Barron, Public Service Electric Company, New Jersey, and A. O. Austin, Ohio Insulator Company.

In commenting on the possibilities of fused-quartz insulators, suggested in Mr. Peaslee's paper (abstracted in the June 30 issue of the *ELECTRICAL WORLD*), the point was brought out that they will withstand heavy arcing and will not crack when cold water is thrown over them when the material is heated. Mr. Clark pointed out, however, that they may become brittle at 150 deg. to 200 deg. Fahr. (65.6 deg. to 93.3 deg. C.). Mr. Taylor suggested that the properties of fused quartz along different optic axes be studied in order that the effect of different orientations of the crystals on dielectric strength may be determined.

The advantages of one-part, two-part and three-part insulators were brought out. If the cracking of multiple-part insulators does not seriously affect their breakdown value, it is not so important electrically as mechanically, Mr. Thomas pointed out, as an insulator which fails mechanically may drop a line and interrupt service in this manner. The trouble with moisture absorption is not so liable to be experienced with one-part insulators, Mr. Hewlett declared, as with multiple-part insulators joined by the cement, since the latter acts as a sort of sponge. Mr. Barron contended that if one member of a two-part insulator is destroyed, the remaining parts will not withstand the operating voltage like a three-part insulator would when only one member is destroyed. Mr. Austin said, however, that smaller strains exist in two-part insulators than in three-part insulators, so that the liability of failure is not so great.

The coloring of the glaze on insulators is not a definite indication of the porosity or vitrification temperature, Dr. Creighton contended, as it may be changed by oxidation or kiln conditions. Oscillation tests can be depended upon to a greater extent, he declared. According to Professor Harding some insulators which were soaked in water twenty-four hours showed a higher puncture voltage than when dry. This was attributed to redistribution of the dielectric flux due to the condenser action between the absorbed films of water.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Joint Wood Pole-Line Construction in Connecticut.—Rules and specifications governing joint wood pole-line construction have been put into effect by the Connecticut Public Utilities Commission. A committee had been appointed previously consisting of T. N. Bradshaw, Southern New England Telephone Company; C. M. Yale, Hartford Electric Light Company; R. E. Chetwood, Western Union Telegraph Company; H. M. Gould, Connecticut Company; D. B. Neth, United Electric Light & Water Company, and J. F. Skirrow, Postal Telegraph Company. This committee, representing various users of pole lines, worked in conjunction with John F. Trumbull and Archer E. Knowlton, commission engineers. The rules are intended to amplify, systematize, and hence supplant those on pages 133-163 of the 1911 report of the committee on overhead line construction of the National Electric Light Association, which formerly had been tacitly recognized by the commission.

New York Edison Rate Decision.—Commenting on the course of the New York Edison Company in accepting the decision of the Public Service Commission for the First District in the matter of a further reduction of rates, the commission expresses its gratification that the company has decided to put promptly into effect the 7-cent rate and corresponding reductions throughout its scale of charges, rather than exercise its right to restore the 8-cent rate in force prior to last January. By this action on the part of the board of directors of the company there is assured a total saving within the present year to consumers of electric energy in Manhattan and the Bronx amounting to at least \$1,750,000, of which at least \$750,000 will be the result of the reduction effective on July 1. The commission is of the opinion that the request with which the company couples its acceptance is reasonable and in the public interest. By the original agreement the company had reserved the right, if it thought conditions so warranted, to restore the 8-cent rate on July 1, 1917, by its own action, subject of course to the right of the commission to conduct proceedings to compel reduction. In acting upon the commission's decision the company asks that this right be considered as given also as of Jan. 1, 1918. This alternative of restoration, the company says, it would not exercise except by virtue of unmistakable emergency. The consent of the commission is accordingly given to an entry in the minutes which will modify the agreement of Nov. 2, 1916, so as to give the company the same right on

Jan. 1, 1918, which it would have had on July 1, 1917. The company's notification of intent to place the 7-cent rate and corresponding reductions throughout in scale in effect as of July 1, 1917, is filed as a part of the record in this proceeding. On Jan. 1, as was the case on July 1, the commission will be able, should it see fit, to act promptly if the company shall undertake to restore a rate deemed unwarrantably high.

Surrendering Franchises in Indiana.—The time limit under the Indiana public utility law for voluntary surrender of franchises by utilities expired on July 1, and many utilities took advantage of the "indeterminate state permit" possibilities of the law and filed notices with the commission. Some of the larger systems have surrendered franchises for their companies recently. Other utilities, however, apparently are not availing themselves of the privilege and will continue to operate under their old city and town franchises until those expire. The Public Service Commission has formally discussed the question of interpreting the status of utility companies in case they do not surrender their franchises. Chairman E. I. Lewis says that the commission will make no formal statement and will take no position regarding such questions as may arise hereafter. Legal phases of this part of the law will be dealt with whenever they arise and no general rule is to be applied at this time.

Lease of Philadelphia Conduit Approved.—The Pennsylvania Public Service Commission has approved a lease by the Philadelphia Electric Company of the conduit system of the Keystone Telephone Company at Philadelphia, at 4 cents per duct-foot. This ruling reverses a former commission decision in September, 1916, refusing the application on the ground that the price stated was too high. The commission says: "The commission has approved the lease, subject to the condition that it did not pass upon or express an opinion as to the valuation placed on the conduits by the Keystone Telephone Company in arriving at the rental to be paid for the use of the ducts by the Philadelphia Electric Company." The minimum rental will begin at \$25,000 a year and increase \$12,500 a year until \$100,000 has been reached, after which this amount will continue to be the minimum. The maximum rental price is to be \$240,000. The lease covers twenty-one years, making the minimum rental for the last fourteen years \$100,000. The electric company has the option of extending the contract for a period of fifteen years at the same minimum rental, and if desired, to claim a still further extension to 1960. In the last period the minimum rental is to be \$125,000. The lease grants the electric company the right to take over conduits it uses at the end of the agreement, at a price satisfactory to both parties. The electric company proposes to use about 60 per cent of the present available space. The system represents an investment stated to be about \$4,000,000.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Who Should Bear Expense for Meter Boxes.—That water consumers not having basements or cellars suitable for meters installed by the utility may be required to provide suitable meter boxes or vaults at their own expense is held in the Wisconsin case of *Wood vs. La Farge* (P. U. R., 1917 A, 763).

Death Caused by Line Broken by an Owl.—Where plaintiff's husband was electrocuted by broken transmission line, a requested instruction to find for defendant if the condition was caused by an owl flying against the wires was properly refused where there was evidence that even in such a case a circuit breaker would have prevented the injury, the Court of Civil Appeals of Texas held (194 S. W. 1016) in *Abilene Gas & Electric Company versus Thomas*. In an action to recover for death by electrocution, an instruction that defendant's failure to turn off the current under certain circumstances constituted negligence is erroneous, since the trial court should not instruct whether certain facts constitute negligence.

Proximate or Remote Injuries from Dam.—In the case of *Wissmath Packing Company vs. Mississippi River Power Company* (162 N. W. 846) it appeared that defendant constructed the Keokuk Dam across the Mississippi River under authority of an act of Congress which imposed upon it the obligation to make compensation to all persons whose property might be taken or damaged by its construction, in accordance with the laws of the state where such property might be situated. The owner of a packing plant near the river sued the power company, claiming that, after execution sale of the plant on foreclosure of mortgages thereon, the value of the plant was depreciated by flooding of its cellars, due to the rising of the river, and that this made it impossible to raise money to redeem the plant. Judge Evans, in giving the opinion of the Iowa Supreme Court, said: "We hold that the damages, if any, which accrued against the defendant were those only which arose proximately out of the injury to the plant by the flooding of the cellar, whether such injury was temporary or permanent; that there was no separate and divisible injury to the right of redemption as distinguished from the injury to the property, and to the ownership thereof, and to the right of possession; that the damages claimed for alleged interference with the contract and the resulting loss of the property through the failure to redeem were remote and speculative and not proximate. These conclusions have the support of many authorities."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

The Jovian Benefit Plan.—The Jovian central office has issued a brochure covering every phase of the accident and health insurance which the order is now furnishing members. The booklet was written by Mercury Ell C. Bennett. It may be obtained upon request to the Jovian Order, Syndicate Trust Building, St. Louis.

Shop Lighting Code in Wisconsin.—The Industrial Commission of Wisconsin has formed a committee on factory lighting legislation to pass on the desirability of redrafting its orders on shop lighting, issued on Jan. 20, 1913, and if found necessary, to draft a new code and recommend it to the commission for adoption. The committee is composed of gas and electric interests, jobbers, manufacturers and representatives of the medical profession. At the first meeting on June 29 it was decided that the present orders were vague and inadequate and that they should be revised. A sub-committee was appointed to draft a tentative code for discussion at the next committee meeting.

Competition Ends at Galesburg, Ill.—Weinburg Brothers, who operated the Galesburg Artificial Ice Company and the Galesburg Manufacturing Company and conducted an electricity supply and steam-heating business, have sold their entire interests to the Galesburg Railway & Lighting Company, a part of the Illinois Traction System. The central station company thus eliminates electric and steam-heating competition, acquires a desirable lake property which will aid in solving its water problem and puts itself into the artificial-ice business. The purchased plant contained 1000 hp. in boilers, 75 kw. in generating equipment, and machinery rated at 70 tons. It is planned to shut down the old plant in the summer season and to take exhaust steam from the company's large non-condensing station through a 4000-ft. main to the old Weinburg plant to make ice. The consideration was \$150,000.

Pennsylvania Hotel to Have Westinghouse Equipment.—The Westinghouse Electric & Manufacturing Company has been awarded the contract for furnishing the electrical equipment for the new Pennsylvania Hotel now being erected at Seventh Avenue and Thirty-third Street, New York. This building, when it is completed, will be the largest hotel in the world, containing 2200 rooms, each with a bath. The hotel is being erected by the Pennsylvania Railroad and will be operated under the Statler management. The electrical equipment consists of forty-four ventilating motors with a total capacity of over 800 hp.; seven pump motors

with capacity of more than 200 hp., and an additional number of motors for refrigerating machinery. The contract also includes three 500-kw. rotary converters, transformers and switching equipment, and six 250-kva. transformers for the substation, to which alternating current will be supplied from the Pennsylvania Railroad power house. The heating and ventilating contract was awarded to Baker, Smith & Company; plumbing to the W. J. Connell Company; electrical work to L. K. Comstock & Company; refrigerating to the Shipley Construction & Supply Company; general contracting to the George Fuller Company. The hotel was designed by McKim, Meade & White, architects; Tenney & Ohmes are the heating and ventilating engineers, and the electrical engineer is Charles E. Knox. All of these are of New York.

Electrical Development in Japan.—A Japanese supplement issued by the New York *Evening Post* on June 30 contains an article by Chugo Ohira showing that war has stimulated growth of electrical enterprises in that country. This says that in December, 1916, the number of electrical enterprises was estimated at 642, with a capital of 660,000,000 yen and 900,000 kw. rating. With the private plant capacity the total would be about 1,150,000 kw. Hydroelectric power has increased greatly and now comprises about 80 per cent of the total.

Oil Shortage in California.—In a hearing before the California Railroad Commission last week W. R. Scott, general manager Southern Pacific Railroad, stated that the fuel-oil shortage was such that unless there is speedy relief train service must be curtailed. Considering all oil storage and sources of relief now apparent, ninety days is the maximum period for which operation on present basis is possible. At present the company consumes 44,000 barrels of oil per week, of which 18,000 barrels are being purchased in the open market. Converting divisions to coal consumption has been considered and abandoned as unwarranted by the visible supply of coal. Another very serious problem is the freight congestion over the mountain divisions, particularly the Tehachapi Pass, where a single-track line must accommodate two transcontinental systems. The congestion is due partly to increased business and partly to absence of bottoms for transcontinental shipments via the canal route. Under these conditions speedy electrification is being suggested. The cost of electrification is believed to be less than that of double-tracking, which would be postponed by the increase of capacity due to electrification. If the railroad can adapt requirements so as to use standard electrical equipment, it is believed that as an emergency measure manufacturers could supply locomotives and at least the most critical mountain pass could be operated as an electrified division within ten months. If this is found feasible, it would at the same time relieve the freight congestion and release for uses that cannot employ hydroelectric energy the oil now inefficiently used in steam locomotives.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 47 of this number.

Electrical League of Cleveland.—The last meeting of the season for the Electrical League of Cleveland was held on June 28. The final reports of the Red Cross campaign were given.

Brooklyn Edison Section, N. E. L. A.—At a recent meeting of the executive committee of the Brooklyn company section of the N. E. L. A., G. J. Leibman was elected chairman of the section to succeed C. R. Knapp, deceased. R. J. McDonald is the new secretary of the section.

Empire State Gas and Electric Association.—The second meeting of the year of the Empire State, Gas and Electric Association will be held at the Hotel Iroquois, Buffalo, on July 13, under the direction of the electric production committee. The principal subjects for discussion will be "Power-House Organization," "Hours of Labor" and "Wages and Bonuses."

Illinois Electrical Contractors' Association.—At the convention of the Illinois Electrical Contractors' Association, June 22 and 23, the following officers were re-elected: President, J. M. Pierce, Chicago; vice-president, J. C. Marron, Rock Island; secretary, L. B. Van Nuys, Peoria; directors, M. N. Blumenthal, Chicago; J. M. Crawley, Peoria, and E. R. Pendergast, Rockford.

New York Electrical Contractors' Association.—The best means of boosting the trade during the war was one of the subjects discussed at the meeting of the New York Electrical Contractors' Association, June 12. W. L. Goodwin, New York, who represents the allied electrical interests of America, urged every contractor to assist the government in the present crisis. J. J. O'Leary of Buffalo presided.

Portland Section, A. I. E. E.—Among the papers presented at a recent meeting of the Portland (Ore.) Section of the A. I. E. E. are the following: "Description of Chart to Determine Proper Sag for Stringing Aerial Wires," by H. H. Schoolfield; "Determination of Efficient Ground Connections for Distribution Systems," by W. C. Heston, and "Reclamation Load on North Coast Power Company's Line," R. M. Boykin.

N. E. L. A. Geographic Sections.—In line with the action taken by the national body, the New England Section of the N. E. L. A. decided at its last executive meeting to abandon the annual meeting scheduled to take place at New London, Conn., Sept. 11 to 14. Plans have been laid for a meeting at Boston to discuss the problems created by the war, but the date has not yet been determined. Similar action has also been decided upon for the Iowa, Michigan and Pennsylvania sections.



H. W. BUCK

Harold W. Buck, vice-president of the engineering firm of Blackwell & Buck of New York City and retiring president of the American Institute of Electrical Engineers, was tendered a dinner by the board of managers of the Institute on June 21 in appreciation of his efforts in directing the activities of the A. I. E. E. during the past year. Mr. Buck, who was born on May 7, 1873, received his academic education at Yale, and at the age of twenty-two he was graduated from Columbia University with the degree of electrical engineer. He was first employed by the General Electric Company in the student department at Schenectady. He left Schenectady in 1900 to become electrical engineer of the Niagara Falls Power Company and its allied interests, continuing in that capacity until 1908, when he moved to New York to enter the firm of Viele, Blackwell & Buck. Besides designing a three-phase motor operating by static induction, Mr. Buck has done considerable research and experimental work, taking out many patents. In co-operation with E. M. Hewlett he developed the suspension insulator system now so widely used on high-tension transmission lines. With two associates he patented a process for the manufacture of corundum in the electric furnace, which process was developed and placed in general operation at Niagara Falls.

Paul Rambo, chief clerk at the Pomeroy office of the Pacific Power & Light Company, has been appointed acting district manager of the same office, vice R. F. Dean, who has joined the officers' reserve corps.

Roy F. Dean, district manager at the Pomeroy office of the Pacific Power & Light Company, has been appointed a second lieutenant in the engineers' section of the officers' reserve corps and is now at the training camp at the Presidio.

Prof. Vladimir Karapetoff of Cornell University is spending this summer with the Commonwealth Edison Company of Chicago. He is at present engaged, under Vice-president John F. Gilchrist on some problems in connection with coal supply and purchase.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

John P. Boyd has assumed his duties as superintendent of the Fremont office of the Ohio Light & Power Company, succeeding B. J. Shockley.

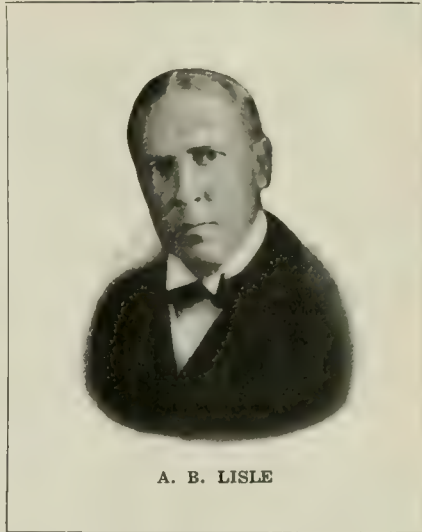
H. C. Carroll, chief engineer for the Muncie (Ind.) Electric Light Company, has resigned to accept a position with the Indianapolis Light & Power Company.

W. P. Guinan, new-business manager of the Danbury (Conn.) & Bethel Gas & Electric Light Company, has been appointed to the local committee on food supply, a branch of the State Council of Defense.

Major Ralph D. Mershon, engineer officers' reserve corps, is relieved from his present duties and will report by letter to the chairman Naval Consulting Board in Washington, for duty in connection with military research, retaining station in New York, N. Y. Mr. Mershon is a past-president of the American Institute of Electrical Engineers.

W. P. Sidley, vice-president and general counsel of the Western Electric Company and a member of the executive committee of the National War Council of the Young Men's Christian Associations of the United States, has been placed in charge of the Y. M. C. A. concentration camps' activities for the central department, which includes the fifteen States lying between Kentucky and Canada, as well as Pennsylvania and Colorado. His appointment to this position follows several years' service as president of the Chicago Y. M. C. A. He is devoting the greater part of his time to this work.

J. E. Davidson, who resigned from the vice-presidency and general managership of the Pacific Power & Light Company, Portland, Ore., some six months ago to become connected with the Electric Bond & Share Company, has been appointed vice-president and general manager of the Nebraska Power Company, Omaha, Neb. This company has recently acquired the plant and property of the Omaha Electric Light & Power Company. Before going to Portland Mr. Davidson was president and manager of the Consolidated Lighting Company of Montpelier, Vt. Both in New England and the Northwest he was very prominent in N. E. L. A. activities, having been chairman of the New England Section in 1910-1911 and president of the Northwest Electric Association in 1911-1912, besides having been elected a member of the executive committee of the N. E. L. A. at the San Francisco convention in 1915.



A. B. LISLE

Arthur B. Lisle, general manager of the Narragansett Electric Lighting Company of Providence, R. I., was elected president of the New England Section of the National Electric Light Association at its one-day session in Boston on Friday, June 29. Mr. Lisle has been on the executive committee of the New England Section for some years and was at one time its vice-president. He has been with the Narragansett Electric Lighting Company almost continuously since 1893, having been general manager since February, 1908. Mr. Lisle is also interested in the Putnam Light & Power Company of Putnam, Conn., having been its treasurer for the last ten years. He is also president and treasurer of the Central Connecticut Power & Light Company. Mr. Lisle has been an associate member of the American Institute of Electrical Engineers for approximately twenty years.

E. M. Plummer, formerly chief engineer of the Atlantic City (N. J.) Electric Company, has been placed in charge of the new Windsor station belonging to the American Gas & Electric Company.

A. L. Platt has been promoted from engineer of the power station of the Canton (Ohio) Electric Company to succeed E. M. Plummer as chief engineer of the plant of the Atlantic City Electric Company.

Calvert Townley, assistant to the president of the Westinghouse Electric & Manufacturing Company, has been appointed secretary of the newly formed Engineering Council, a department of the United Engineering Society formed for the purpose of speaking authoritatively for all member societies on public questions of a common interest to engineers.

Howard A. Holmes has returned to the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, as assistant electrical engineer. Mr. Holmes was formerly connected with that company in various capacities until about eight years ago. He was employed at the aeronautic station of the Pensacola navy yard before returning to Youngstown.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

STANDARD PACKAGE PLAN BECOMING MORE POPULAR

Now Being Used by Distributors of Certain Kinds of Merchandise with Evidence of a Broadening Application Soon

Fundamentally the reason why discounts are given to the trade is that purchases are made in large quantities. Different branches of the trade receive different discounts for the same fundamental reason. In other words, the idea of discounts and their size relative to the different parts of an industry arose from the economic principle that it costs less to sell goods in proportion to the quantity sold. To-day, however, this fundamental principle of economics is largely lost sight of, and the discount now is determined not by how much is sold but rather by the type of buyer. Thus a contractor gets one discount, a central station perhaps another, and a jobber another and ordinarily the largest.

Therefore it is not uncommon for a contractor to obtain an order for a washing machine, say, and then order one from the jobber or manufacturer to take care of the order. Although a retail transaction, the contractor not only expects but receives his discount. Hundreds of other examples of a similar nature could be cited.

In fact, since prices have become so high contractors and dealers have been buying in smaller lots from the jobber than ever before. Little stocking has been done. The buying has been as required.

Within the last two years a number of the large distributors of electrical goods of a merchandise character have felt the need for a change and consequently have discontinued the trade discount in certain lines and substituted therefor a standard-package or unit discount. Thus a standard package or unit would be composed of say six articles; these packages might come packed in lots of twelve, which would be a larger unit, and perhaps a third unit might be a car-load lot. A buyer to obtain a discount must therefore buy in units no matter who he is. If he purchases five articles, he will pay list; six articles, 10 per cent, or whatever it might be, off. If twelve packages are purchased, there is an additional discount, and if a purchaser buys the articles in car-load lots then there is probably a further discount.

There is a difference, however, as will be noted, between this plan and the plan of a discount in proportion to the amount of the purchase. Thus the plan here described contemplates only standard-package purchases. To explain, if a buyer wanted, say seven articles, then he would be charged for six at the standard package rate and one at the list price. In other words, the discount applies only to the standard packages and a penalty attaches to the breaking of a standard package.

This plan has been tried out on fans, fixtures and heating devices by one manufacturer and is contemplated on a number of other lines. In effect, the plan is quite simple and is founded on economy of production and distribution. The standard packages are easy to handle, easy to keep track of and inventory, and render theft less likely. The work of manufacture is routed through the shop in standard-package lots, and all costs are kept in these units. It is therefore less expensive to sell in these units. Furthermore, the stand is taken by those using this plan that no person is entitled to a discount who cannot buy at least a standard package.

While the use of such a plan is still in its infancy, there is every indication that its application will be very greatly broadened in the near future, particularly in the dealings of the jobber with the trade.

LOWER-PRICED LIGHTING FIXTURES OF STEEL

The Higher Wages Now Earned by the Laboring Classes Have Created a Demand That Manufacturers Are Supplying

A brisk demand for low-priced lighting fixtures has led a number of fixture manufacturers to place on the market a new line of fixtures of the same design and appearance as expensive fixtures but produced to sell at a very low price. The secret of the low price is steel. In place of brass, which is used in the more expensive fixtures, pressed steel with a brass finish is employed.

This increased demand is coming from the laboring people, who during the last year and a half or more have been earning high wages. The demand for more expensive fixtures has fallen off perceptibly, since the buyers of this class of goods are the salaried men. The laborer, however, has now more money than he ever had before, and consequently one of the trades to feel this increased buying power is the fixture trade.

FRENCH IMPORTS OF LUXURIES PROHIBITED

Useful Merchandise, Which Probably Includes Incandescent Lamps, Motors, Etc., Is to Be Limited in Amount

A recent decree by the French government prohibits the importation, except in individual cases where special permission is secured from the Minister of Commerce, of all goods regarded as luxuries. Raw material necessary for production will continue to be imported without restriction. Merchandise considered to be useful but not absolutely indispensable will be admitted to a limited degree, the limit to be designated quarterly.

American manufacturers of electrical specialties and luxuries, such as the general run of household devices, table lamps and decorative glassware, will probably find their goods in the prohibited class. Manufacturers, however, of incandescent lamps and electrical machinery and equipment for power and industrial purposes will probably fall within the class in which the importation is limited in amount. It is doubtful, however, if under existing conditions any very drastic action will be taken by the French government in connection with electrical goods of this nature.

AMERICAN WOOD PRESERVER A SUBSTITUTE FOR GERMAN

The War Has Caused the Development in the United States of a Product That Will Supply Entire Demand

Until 1914 many products were in general use in America which were produced almost exclusively abroad. Since the war, however, the American trade has learned to manufacture for itself and has proved that when actually put to it it can produce practically anything it needs right at home.

An interesting example of this is found in the so-called carbolineum, or anthracene wood-preserving oils. Until the war German products controlled the American trade. American manufacturers of wood preserver found it more profitable to act as local representatives for German agents than to attempt to compete. One of the reasons that the Ger-

man oil was so well established in America was its so-called secret process of manufacture. The oil was said to contain mysterious chemicals made by secret processes known only to the Germans. Such statements as these were made simply to keep the Americans out of the manufacturing business. Since the war, however, an American preservative has been discovered which will supply the entire demand.

IMPORTS OF ELECTRICAL APPARATUS IN JAMAICA

Mostly of American Origin Because in Many Instances Original Installations Consisted of American Equipment

American manufacturers furnish most of the electrical supplies and equipment used in Jamaica, according to a report recently submitted by Consul Ross Hazeltine to the Department of Commerce. There is no local manufacture of these products. The imports are grouped separately under two headings, as follows: (1) Apparatus necessary for generating, storing, conducting, converting into power or light and measuring electricity, and (2) telegraph and telephonic wire and apparatus. The imports of both groups fall under the list of articles admitted duty free.

During 1914 the imports of the first group amounted to \$51,252 and in 1915 to \$34,021, and the second group to \$6,966 and \$6,588 respectively. That the United States supplies such a large percentage of the electrical equipment imported into Jamaica may be attributed to the fact that in many instances the original installations consisted of American equipment. In general, the equipment is much the same as that in use in the United States, although somewhat antiquated.

PROMPT PAY FOR ARMY AND NAVY WORK BILLS

Decisive Action Taken by Government in Recognition of Extent of Working Capital That Will Be Involved

The Committee on Public Information has issued the following:

"The War and Navy Departments have both taken decisive action to make sure that contractors who are selling materials to the government are paid more promptly even than is the practice in general business. Both departments have recognized that large amounts of working capital are required in filling these contracts and are assisting in every way to prevent funds from being tied up by making payments without delay. To correct any possible misapprehensions of prospective bidders on this score the general munitions board of the Council of National Defense has authorized the following:

"In a recent memorandum to the general munitions board, as a result of reports that some proposed contractors were hesitant about government contracts because of a fear that they would be hampered by delays in the payment of bills, Quartermaster General Sharpe said:

"You are advised that immediately upon the approval of the urgent deficiency act of June 15, 1917, all depot quartermasters were immediately furnished with the funds necessary to enable them to make settlement in full with all contractors who had claims against the government for services rendered or supplies furnished the Quartermaster Corps. These outstanding obligations have now been fully satisfied, and at the present time all contractors are being promptly paid the amounts due them."

"The Navy Department intends to put the following memorandum on its notice to bidders: 'The navy desires to have contractors paid promptly for all materials furnished under contract. If prompt payment is not received, please take up the matter with the supply officer of the navy yard to which delivery is made. In case of any special delivery it will be appreciated if you will report the facts here.'"

THE WEEK IN TRADE

OF GREATEST interest to the local trade at this time is the construction of the government cantonments. Large quantities of electrical staples and much labor will be employed. Reports from Chicago indicate that very fair prices can be expected from the government, but up to the time of going to press there has been no indication as to whether supplies will be purchased locally or by the government.

Prices were generally stable during the week. Dry batteries were advanced, and late reports indicate higher prices on conduit and porcelain. Steel reflectors advanced, but it is doubtful if this is indicative of an advance all along the line in reflectors.

The volume of trade seems to be maintained generally, with an apparent slowing up in building materials. This condition, however, is felt to be temporary, and better times are looked for later in the summer.

Deliveries are now getting better. Credit conditions seem good.

Fan sales to the consumer are opening up, and the few hot days of the past week have gone a long way toward reducing stocks that are somewhat limited. It is the prevailing sentiment that a few more really hot days in the next two weeks will absolutely clean up all available stocks.

NEW YORK

There has been little change during the week. Building operations appear to be falling off somewhat, although a report in the *Record and Guide* tends to show that building operations in this locality begun during May, 1917, amounted to \$12,415,000, as compared with \$6,320,000 during May, 1916. While this represents an increase of almost 100 per cent, it will be remembered that prices have advanced to new high levels and that therefore it is very doubtful if the actual volume of new construction has increased very much. Prices were inclined to stiffen somewhat during the week.

There is a prospect of considerable electrical material to be used in the construction of army cantonments, the work on which will be of an inexpensive nature—no iron conduit or expensive fittings.

Low-priced stocks seem to be fast decreasing, and there is therefore less evidence of selling under the market.

Armored Flexible Steel Conductor.—The market is quiet with light demand.

Dry Batteries.—An advance of 15 per cent roughly was placed in effect at the end of June. The increase was caused by the high prices for the elements of manufacture.

Iron Conduits.—The market is steady, but it is difficult to obtain a quotation. Shipments are now made with prices quoted as of date of shipment.

Lamp Cord.—The demand is good, but it is hard to get a sufficient supply owing to the difficulty met by manufacturers in securing fine copper strands.

Outlet Boxes.—There has been no change in this market for boxes. It is daily becoming more evident that it is going to be difficult to obtain a proper supply of outlet boxes or other materials into which sheet steel enters as a prominent part. The need of the government for steel products makes it apparent that before long the supply available for other purposes will be greatly curtailed and limited.

Pipe Fittings.—The market for these items is controlled by the demand for pipe, which continues steady in tone.

Standard Porcelain.—A report from Trenton, N. J., states that the 1200 porcelain workers who have been on strike there for three months voted on Sunday to return to work on the next morning. On April 2 nearly 1200 quit work for better shop conditions and for more pay. A partial increase was offered and some of the men returned, but a majority held out for the original demands. At Sunday's meeting strikers accepted the offer made by

the manufacturers. Owing to general conditions stocks of porcelain are low and many manufacturers of wiring devices are having difficulty in keeping up with orders into which porcelain enters.

Rubber-Covered Wire.—Prices remain about the same. Demand is slowing up following new construction. It is difficult and becoming more so to obtain stranded wire because of the demand and the insufficient supply of stranding machines.

Weatherproof Wire.—The market being largely dependent upon central station activity, there is not so much now being used in this locality.

Fans.—Demand is excellent, stocks in the hands of distributors limited. Manufacturers have not been able to supply the entire demand.

Steel Shades.—There has been a material advance in prices.

Power Cables.—The heavier sizes for underground and submarine work are in large demand. In New York City and Brooklyn the central stations are using large quantities of underground armored cable just at present. The government is buying considerable cable for submarine purposes.

Lamps.—Demand continues strong.

Machinery.—Extraordinary demand and increasing cost of production have caused prices to advance again. Some manufacturers have put a 10 per cent increase into effect, and others are expected to follow shortly.

CHICAGO

Chicago jobbers are experiencing an excellent business. There was a time just after war was declared when it seemed that a panicky feeling might hold up buying, but this proved temporary and, as seen in retrospect, is quite analogous to the situation which existed upon the declaration of war between England and Germany, except that the panicky feeling was not nearly so pronounced this time as before. The contractors, not only in Chicago but in surrounding territory, should be viewed in two classes to analyze properly the situation in their businesses. Those who are depending on apartment-house and other speculative building are out of luck. Those who are doing industrial plant work are exceedingly busy. The foregoing situation is influenced largely by the fact that the high prices of building material are acting to limit building to that class which must build at once. The railroads are buying, but there is some doubt as to what effect upon railroad purchases the unfavorable ruling on freight rates will have. The fact that money is a little higher than it has been seems to have no effect on business in general. Jobbers' deliveries to customers are about normal and manufacturers' deliveries to jobbers are a little better than usual on the whole. Collections and credits remain excellent.

Minneapolis jobbers are fairly well stocked up. Contractors and dealers have not a very large stock and are buying from hand to mouth. No heavy buying is expected in the next sixty days.

Flood Lamps.—While not much information is available concerning government contracts, it has been learned that one concern is making a large number of flood lamps for submarine chasers. These units are made completely of brass and are special throughout. They contain a 200-watt lamp and are to be equipped with control apparatus which will permit flashing the Morse code. General business in floodlighting equipment remains good. Some of the factories are making immediate deliveries even though this entails setting orders of other lighting equipment further back in delivery.

Fans.—In the St. Louis and Kansas City territory the few hot days of the past week caused the public to start buying fans. It also caused the electrical people in that territory to try without success to add to their fan stocks. In Chicago the fan purchasing has not yet begun with vigor. It is the general belief that three or four good hot days throughout the Middle Western territory would absolutely clean out the entire fan stock.

Electrical Supplies for Cantonments.—There is a rumor abroad in the trade that the government has instituted a

new policy in connection with the electrical purchases which it is making for cantonment lighting. Rubber-covered wire and socket manufacturers were invited to come to Washington to co-operate with the quartermaster's department. This plan was adopted in order to facilitate deliveries. When the manufacturers had looked over the specifications and the government officials had learned what each manufacturer had in the way of raw material on hand, orders were apportioned in a manner that would permit early delivery of all goods. The wire, it is understood, will be supplied by about thirty factories. It is said that the price on sockets to the government will be a little less than the export price, which is better than the manufacturer's price to domestic jobbers.

Dry Batteries.—Prices have advanced about 12 per cent for small quantities.

BOSTON

Intense activity continues to characterize trade conditions in New England. Although some prospect of lower prices on coal is in sight, owners of private power plants are continuing to seek central station service, and companies with spare generating and distributing facilities are doing a land-office business in cases where an adequate coal supply is on hand. The large hydroelectric power companies are making every effort possible to increase their facilities, and the trade has not ceased to talk about the New England Power Company's proposed early expenditure of \$7,000,000 in new plant and line facilities, including important industrial substation enlargements. Jobbers are as a rule rather fully stocked. Deliveries are a little improved, owing to better organization of railroad service. In the electrical contracting field, labor supply is at present reasonably adequate, but it is uncertain how long this condition will obtain.

During the week prices advanced in brass socket material, dry batteries and conduit, as noted below. Fans are moving freely, weather conditions, while not extreme, being favorable to this class of business. It is rumored that further advances in the price of porcelain and of lamps for foreign trade are to be expected, but nothing definite had materialized up to Monday. On the whole, the bulk of electrical supplies remain at about the previous price levels. Increasing confidence in the stability of the electrical trade is apparent, but a note has been sounded by jobbing interests to the effect that improved credit conditions among small electrical contractors would help the general situation materially. Collections are somewhat tight. Very little improvement is to be seen in the motor market.

Electric Flatirons.—Volume of business holding well, no price changes.

Lamps.—Intended advance rumored on lamps for export trade, but not yet announced. No prospect of advance on domestic lamps. Volume of lamp business holding steadily, and factory enlargement is a feature of this class of production. Immediate deliveries can now be made on many standard lamp units.

Reflectors.—Advance on resales reported on certain older lines of equipment by one manufacturer, notably those suitable to the straight tungsten type of lamp. No general advance in reflectors anticipated at this time. Government orders feature this branch of industry, but progressive manufacturers are planning factory work to continue to meet regular industrial demands as far as possible without permitting former work seriously to interfere with non-military trade.

Iron Conduit.—Price advance of 5 per cent reported July 2. Market affected by heavy war demands on steel industry and railroad congestion.

Dry Batteries.—Advance to 40-cent standard announced July 2 by manufacturers.

Porcelain.—Present price level regarded as very high, and while another advance is rumored for the future, some skepticism is expressed regarding willingness of trade to meet further increases.

Insulating Tape (friction).—Price advance of about 15 per cent July 2, and with cotton at 25 cents per pound further increases are looked for as within possibilities.

Electric Ranges.—Slow but steady sale of these equipments in Boston district noted in spite of adverse circumstances, such as 40 to 60 per cent increase in price compared with year ago, and great reduction in number of new apartment houses erected this year. Ranges going mainly into single residences.

Wire and Cable.—Government orders are active, and commercial deliveries are correspondingly retarded. Prices show little if any variation compared with a week ago, though cotton is strong and may force slight changes in future.

Electric Fans.—More seasonable weather and knowledge of limited production facilities as to fans is stimulating the demand for this class of equipment. In jobbing circles some fear that the consumer might think fans in the luxury class has been dissipated by the evident buying power of the general public.

ATLANTA

Business in all lines of the electrical field is very brisk and with no apparent indications of any break in the healthy condition that has existed for some time, notwithstanding advancing prices for materials and labor and increasing lengths of deliveries in nearly all lines. Manufacturers, jobbers and contractors report collections as being very good. One manufacturer states that collections since Jan. 1 are 10 per cent better than the past four years.

Copper.—Prices firm, but stocks are badly depleted.

Wire.—Rubber-covered and weatherproof stocks are very low, with factory shipments improving.

Wiring Devices.—There is a very strong demand for sockets, receptacles, cut-outs, plugs, etc., and local stocks seem to be holding up well, covering immediate requirements.

Cable.—Demand for large cables exceeds supply, with no visible stock. Shipments getting longer, and all requirements should be anticipated.

Lamps.—Dull season of year and stocks are accumulating which will take care of expected normal fall demand.

Heating Appliances.—Business below normal, prices advancing sharply. Stocks in good shape.

Transformers.—Strong demand even in the face of advancing prices. Stocks depleted and deliveries getting longer with no betterment in sight.

Meters.—Very active market, stocks in fairly good shape.

Motors.—The recent price advance does not seem to curtail demands, especially in textile field. Practically no stocks, and no really definite shipment promises are being made.

Conduit.—There is a good demand for conduit, panelboards and outlets in spite of rising prices. Stocks are very low and no improvement in deliveries is expected soon.

Pole and Line Material.—Steady market with increasing prices. Stocks in good shape owing to anticipated orders covering future requirements.

Labor.—The labor situation is easy at present. Wages 10 to 15 per cent higher than a year ago.

SAN FRANCISCO

Pacific Coast jobbers now have an investment in stocks about 30 per cent higher than two years ago, partly on account of higher prices, and partly on account of delayed deliveries. Condition of stocks is generally good, and shipments are fair. Prices are dormant except for conduit, which shows slight increase. Deliveries on wire and conduit less certain than other lines. These two items are the most active just now, probably largely because of very heavy industrial demands and factory extensions, also much naval and oil company business. Large orders are expected for cantonment construction and similar government work, but sufficient notice is expected so that these can be handled as special business not affecting stocks. June credit and collections were below the good showing in previous months of this year. This is charged to Liberty bond and Red Cross campaigns. All San Francisco jobbing houses report fans practically sold out.

SEATTLE

The weeks following the declaration of war showed a marked increase in retail business in the Northwest. The panicky state which prevailed for a short time is now over and dealers have succeeded in establishing industrial business, which is good, and reported increasing. Government contracts from United States Navy Yard at Bremerton, Wash., American Lake (Wash.) cantonment and Alaska have done much to increase the volume of business. This is especially true as regards the American Lake cantonment, where an enormous amount of electrical equipment will be needed. Heavy demands from shipbuilding plants continue.

Sales of household appliances are picking up noticeably, especially during the last month. This fact is surprising, as conservative dealers believed prospective purchasers would hesitate on account of unsettled conditions. Dealers say that the increases along this line show electrical household devices are considered as economies and not luxuries. Small constructions, particularly residential, are at low ebb.

There is little speculative building, owing to the excessive cost of all material. Portland a year ago was issuing from fifty to seventy-five building permits daily. It now averages three daily. Seattle's proportion is about the same. Industrial building in Seattle and Portland is much below normal. Reticent buying characterizes this condition here. Dealers believe that the peak has been reached and are hesitating to order in large amounts. A conservative condition prevails. In small work stock is ordered as needed. Deliveries are better than for some time past. This is attributed to the action of the government and to the co-operation of the railroads. Prices along some lines have slightly increased. Money is plentiful and collections good.

Copper.—Copper is at a standstill and no change has been noted for several weeks.

Conduit.—Conduit is still advancing and output is decreasing. White pipe is much easier to obtain than black. Demand is heavy and stocks are low.

Heating Appliances.—Movement on heating appliances is expected shortly.

METAL MARKETS CONDITIONS

Strikes in Copper Mines Cause Reduction in Production

The metal markets were generally quiet during the past week. Copper, tin and spelter showed a slight falling off, while other metals held firm.

Strikes by miners in a number of copper mines have curtailed production, but it is not expected that the market will feel the effects thereof for some time. As these pages go to press, certain of the strikes have been settled, the men have returned to work, and the operators are expecting the men at the other mines to come to an agreement shortly.

No decision has been made by the government regarding the price it is willing to pay for copper. Various estimates run anywhere from 20 cents to 25 cents.

Nominal quotations were made for electrolytic as follows on Monday last: July, 31.62½ cents; August, 30.50 cents; third quarter, 30.50 cents; fourth quarter, 28.87½ cents.

NEW YORK METAL MARKET PRICES

	June 25			July 2		
	£	s	d	£	s	d
Copper:						
London, standard spot	130	0	0	130	0	0
Prime Lake	30.50	to	31.50*	30.50	to	31.50*
Electrolytic	32.25	to	32.50*	31.50	to	31.75*
Casting	30.00	to	30.50*	29.25	to	29.75*
Wire base	37.00	to	38.00*	37.00	to	38.00*
Lead, trust price			11.00			11.00
Nickel, ingot			50.00			50.00
Sheet zinc, f.o.b. smelter			19.00			19.00
Spelter, spot	9.30	to	9.42½			9.17½
Tin, Straits			62.87½*			62.00
Aluminum, 98 to 99 per cent	56.00	to	58.00*	55.00	to	57.00*

OLD METALS

Heavy copper and wire	27.75	to	28.00	27.50	to	27.75
Brass, heavy	17.50	to	18.00	17.00	to	17.50
Brass, light	14.50	to	14.75	14.00	to	14.50
Lead, heavy	10.25	to	10.50	10.00	to	10.25
Zinc, old scrap	7.00	to	7.25	6.75	to	7.00

*Nominal.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor		List, per 1000 Ft.
B. & S. Size		
No. 14 solid.....		\$61.00
No. 12 solid.....		71.00
No. 10 solid.....		90.00
No. 8 solid.....		106.00
No. 6 solid.....		145.00
No. 10 stranded.....		95.00
No. 8 stranded.....		115.00
No. 6 stranded.....		160.00
No. 4 stranded.....		205.00
No. 2 stranded.....		266.00
No. 1 stranded.....		315.00

Twin-Conductor		List, per 1000 Ft.
No. 14 solid.....		104.00
No. 12 solid.....		135.00
No. 10 solid.....		185.00
No. 8 stranded.....		235.00
No. 6 stranded.....		370.00
No. 4 stranded.....		575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor		
No. 14 solid:		
Less than coil.....	+10%	to \$54.90 Net
Coil to 1000 ft.....	3%	to 48.80 Net
No. 12 solid:		
Less than coil.....	+10%	to 63.90 Net
Coil to 1000 ft.....	3%	to 56.80 Net

Twin-Conductor		
No. 14 solid:		
Less than coil.....	+10%	to \$78.00 Net
Coil to 1000 ft.....	3%	to 75.00 Net
No. 12 solid:		
Less than coil.....	+10%	to 121.00 Net
Coil to 1000 ft.....	3%	to 108.00 Net

CHICAGO

Single-Conductor		Discount
No. 14 solid:		
Less than coil.....	Net to +10%	
Coil to 1000 ft.....	10% to 15%	
No. 12 solid:		
Less than coil.....	Net to +10%	
Coil to 1000 ft.....	10% to 15%	

Twin-Conductor		
No. 14 solid:		
Less than coil.....	Net to +10%	
Coil to 1000 ft.....	10% to 15%	
No. 12 solid:		
Less than coil.....	Net to +10%	
Coil to 1000 ft.....	10% to 15%	

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK		
Less than 1/5 std. pkg....	+20%	to 12%
1/5 to std. pkg.....	10%	to 20%
Std. pkg.....	24%	to 34%

DISCOUNT—CHICAGO		
Less than 1/5 std. pkg. . .	+12%	to +20%
1/5 to std. pkg.....	20%	to 10%
Std. pkg.....	30%	to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12....	\$0.35	\$0.35
12 to 50.....	.30	.30
50 to barrel....	.28	.28 to .29
Barrel lots.....	.24	.25

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12....	\$0.39	\$0.39
12 to 30.....	.34	.34
50 to barrel....	.26 1/4 to .295	.269 to .27 1/4
Barrel lots.....	.24 3/4 to .29	.25 3/4 to .29

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

DISCOUNT—NEW YORK

	Less than Coil	Coil to 1000 Ft.
3/4-in. single strip.....		
3/4-in. double strip.....	Net to 10%	7% to 20%
1/2-in. single strip.....	Net to 5%	4% to 15%
1/2-in. double strip.....		

NET PER 1000 FT.—CHICAGO....

	Less than Coil	Coil to 1000 Ft.
3/4-in. single strip....	\$71.25 to \$75.00	\$60.00 to \$63.75
3/4-in. double strip....		
1/2-in. single strip....	75.00 to 78.75	67.50 to 71.25
1/2-in. double strip....	95.00 to 100.00	80.00 to 85.00
1-in. double strip....	100.00 to 105.00	90.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, in.	List, per Foot	Size, in.	List, per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
5/8.....	.15	2.....	.55
3/4.....	.18	2 1/4.....	.65

DISCOUNT—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
Net to 33 1/3%	45% to 50%	53% to 55%

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.....	\$36.67	\$27.50
1/4-in.....	40.00	30.00
		27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Size, in.	Card No. 38	Conduit, List per Foot
1/4.....		\$0.08 1/2
3/8.....		.08 1/2
1/2.....		.08 1/2
3/4.....		.11 1/2
1.....		.17
1 1/4.....		.23
1 1/2.....		.27 1/2
2.....		.37
2 1/2.....		.58 1/2
3.....		.76 1/2

	Couplings, List	Elbows, List
1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.60
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

	1/4 In. to 1/2 In.	3/4 In. to 3 In.
Less than 2500 lb. 6% to 8%		8% to 10%
2500 to 5000 lb. 9% to 11%		11% to 13%
(For galvanized deduct six points from above discounts.)		

DISCOUNT—CHICAGO

	1/4 In. to 1/2 In.	3/4 In. to 3 In.
Less than 2500 lb.	3.8%	5.8%
2500 to 5000 lb.	6.8%	8.8%
(For galvanized deduct six points from above discounts.)		

FLAT IRONS

NEW YORK

Net	\$3.15 to \$3.50
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CHICAGO

Net	\$3.75 to \$3.85
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FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

Per 100 Net

Less than 1/5 std. pkg. \$5.75 to \$6.30
 1/5 to std. pkg. 4.50 to 5.25
 Standard package, 500. List, \$0.07.

CHICAGO

Per 100 Net

Less than 1/5 std. pkg. \$6.25
 1/5 to std. pkg. 5.25
 Standard package, 500. List, \$0.07.

LAMPS, MAZDA

105 to 125 Volts

List,

Each

Regular, clear: Std. Pkg.
 10 to 40-watt-B. 100
 60-watt-B. 100
 100-watt-B. 24
 75-watt-C. 50
 100-watt-C. 24
 200-watt-C. 24
 300-watt-C. 24
 Round bulbs, 3 1/4 in., frosted:
 15-watt-G 25. 50
 25-watt-G 25. 50
 40-watt-G 25. 50
 Round bulbs, 3 3/8 in., frosted:
 60-watt-G 30. 24
 Round bulbs, 4 1/8 in., frosted:
 100-watt-G 35. 24

DISCOUNT—NEW YORK

Less than std. pkg. Net
 Std. pkg. 10%

DISCOUNT—CHICAGO

Less than std. pkg. Net
 Std. pkg. 10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

Per 1000 Ft. Net

Less than coil (250 ft.) \$30.00 to \$35.17
 Coil to 1000 ft. 21.00 to 26.73

CHICAGO

Per 1000 Ft. Net

Less than coil (250 ft.) \$37.20 to \$37.84
 Coil to 1000 ft. 27.90 to 28.38

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100 \$18.00 to \$29.00

CHICAGO

Net per 100 \$12.50 to \$25.00

OUTLET BOXES

List,

per 100

Nos.
 101—A, A1 1/2, 4 S.C., 6200, 320. \$30.00
 102—B.A., 6200 S.E., 300, A.X. 1 1/2,
 4 S. 30.00
 103—C.A., 9, 4 R., B 1 1/2. 25.00
 106—F.A., 7, C.S. 1 1/2, 3 R. 20.00

DISCOUNT—NEW YORK

Black Galvanized

Less than \$10.00 list List to 33% List to 27%
 \$10.00 to \$50.00 list 42% 18% to 37%

DISCOUNT—CHICAGO

Black Galvanized

Less than \$10.00 list 40% to 43% 35% to 37%
 \$10.00 to \$50.00 list 53% 40% to 48%

PIPE FITTINGS**DISCOUNT—NEW YORK**

Less than 1/5 std. pkg. 10%
 1/5 to std. pkg. 20%
 Std. pkg. 30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg. 10%
 1/5 to std. pkg. 20%
 Std. pkg. 30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

Per 1000

Net

Less than 1/5 std. pkg. \$14.00 to \$20.00
 1/5 to std. pkg. 13.00 to 15.80
 Standard package, 2200. List per 1000,
 \$20.

CHICAGO

Per 1000

Net

Less than 1/5 std. pkg. \$14.00 to \$18.00
 1/5 to std. pkg. 13.00
 Standard package, 2200. List per 1000,
 \$20.

PORCELAIN KNOBS**NEW YORK**

5 1/2 N.C.—Nail-It—

Solid N.C.

Std. Pkg. Std. Pkg.

Per 1000 Net 3500 4000
 Less than 1/5 std. pkg. \$10.50 to \$24.30 \$21.10
 1/5 to std. pkg. 9.75 to 12.15 28.00

CHICAGO

5 1/2 N.C.—Solid Nail-It—N.C.

Std. Pkg. 3500 Std. Pkg. 4000

Per 1000 Net Std. Pkg. 3500 Std. Pkg. 4000
 Less than 1/5 std. pkg. \$10.50 to \$18.00 \$20.75 to \$28.00
 1/5 to std. pkg. 9.00 to 9.75 16.30 to 21.50

SOCKETS AND RECEPTACLES

Std. Pk. List

1/8-in. cap key and push sockets 500 \$0.33
 1/8-in. cap keyless socket. 500 .30
 1/8-in. cap pull socket. 250 .60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg. Net
 1/5 to std. pkg. 15%

DISCOUNT—CHICAGO

Less than 1/5 std. pg. Net list
 1/5 to std. pkg. 15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:

	List
30-amp. S. P. S. T.	\$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.83
60-amp. 3 P. S. T.	2.63
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00

Low Grade:

	List
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

Less than \$10 list
 \$10 to \$25 list 11% to 16%
 \$25 to \$50 list 14% to 24%

DISCOUNT—CHICAGO

Less than \$10 list +5% to 5%
 \$10 to \$25 list 11% to 16%
 \$25 to \$50 list 14% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp, 125-Volt Snap Switches

Std. Pkg. List

	List
5-amp. single pole.	\$0.28
5-amp. single-pole, ind. ....	.32
10-amp. single-pole. ....	.48
10-amp. single-pole, ind. ....	.54
5-amp., three-point. ....	.56
10-amp., three-point. ....	.76
10-amp., 250-volt, D. P. ....	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp., 250-Volt Push-Button Switches

Std. Pkg. List

	Std. Pkg.	List
10-amp. single-pole.	100	\$0.45
10-amp. three-way.	50	.70
10-amp. double-pole.	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg. 10%
 1/5 to std. pkg. 15%
 Std. pkg. 28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg. Net list to +20%
 1/5 to std. pkg. Net list to 15%
 Std. pkg. 30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar

	List,
No. 155.	\$0.34
No. 160. ....	.60

DISCOUNT—NEW YORK

Black Galvanized

Less than \$2.00 list Net to 23% Net to 18%
 \$2.00 to \$10.00 list 23% to 50% 18% to 40%
 \$10.00 to \$50.00 list 23% to 60% 18% to 52%

DISCOUNT—CHICAGO

Black Galvanized

Less than \$2.00 list 25% to 50% 20% to 40%
 \$2.00 to \$10.00 list 25% to 50% 20% to 40%
 \$10.00 to \$50.00 list 25% to 64% 20% to 52%

TOASTERS, UPRIGHT**NEW YORK**

Net price \$2.10 to \$3.50

CHICAGO

Net price \$2.80 to \$3.50

WIRE, ANNUNCIATOR**NEW YORK**

Per Lb. Net

No. 18, less than full spools. \$0.65
 No. 18, full spools. 0.55

CHICAGO

Per Lb. Net

No. 18, less than full spools \$0.565 to \$0.6885
 No. 18, full spools 0.495 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

Price per 1000 Ft. Net—

	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No. 14.	\$15.00-18.00	\$12.00-14.50	\$11.50-12.50
12.	21.06-27.05	18.96-22.85	18.01-20.95
10.	29.60-39.27	26.64-33.66	24.68-25.31
8.	42.40-51.44	38.16-48.42	33.51-36.25
6.	72.19-89.57	64.98-76.80	56.63-61.73

CHICAGO

Price per 1000 Ft. Net—

	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No. 14.	\$18.00	\$16.00	\$14.00
12.	25.99-29.89	21.96-25.62	20.13-21.35
10.	36.48-41.51	30.84-35.58	28.27-29.65
8.	43.80-60.13	40.15-51.54	35.77-42.95
6.	69.24-82.20	63.47-75.35	56.55-68.50

WIRE, WEATHER-PROOF

Solid-Conductor, Triple-Braid, Sizes 4/0 to 8 Inc.

NEW YORK

Per 100 Lb. Net

Less than 25 lb. \$40.25 to \$45.00
 25 to 50 lb. 39.25 to 42.00
 50 to 100 lb. 38.00 to 38.25

CHICAGO

Per 100 Lb. Net

Less than 25 lb. \$42.85 to \$45.00
 25 to 50 lb. 41.85 to 44.00
 50 to 100 lb. 40.85 to 43.00

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Electric Table Stove

The Hughes Electric Heating Company, Chicago, has brought out a new heavy-duty table stove. The heating element is rated at 660 watts and is the standard used in all Hughes hot plates and electric ranges. On account

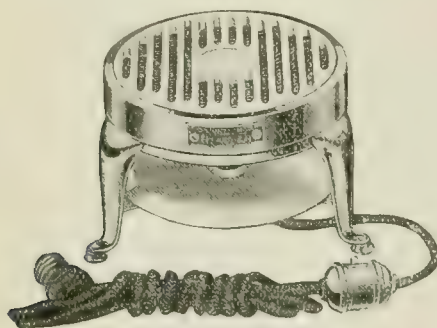
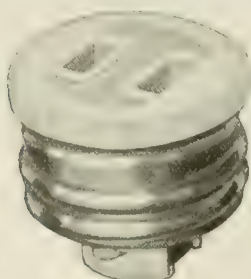


TABLE STOVE WITH ONE-HEAT SWITCH

of the fact that heavy resistance wire recessed in composition plate is used, this table stove operates somewhat on the principle of stored heat, it being possible to utilize the burner for some light cooking even after the energy has been turned off. The table stove is 5 in. (12.7 cm.) in height, and its burner is 6.5 in. (16.5 cm.) in diameter. It is finished in nickel throughout and is furnished with an attachment plug, 7 ft. (2.1 m.) of flexible cord and a single-heat or three-heat switch conveniently located for use at the table. Its shipping weight is 5 lb. (2.3 kg.).

Separable Plug Adapter for Screw-Base Receptacles

In order to make possible the use of devices fitted with separable attachment plugs in baseboard receptacles of the screw type, a screw-base adapter



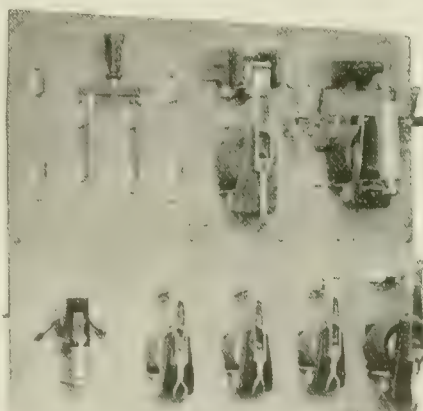
DEVICE FOR CONVERTING SCREW-PLUG RECEPTACLE INTO ATTACHMENT PLUG

has been designed by the Bryant Electric Company, Bridgeport, Conn. The device is made to be fastened into the standard Edison receptacle by means of a threaded portion and will serve to

permanently convert the old-type receptacle for use with the tongue-type plug. With this addition it will then be possible to use a variety of attachment caps of either reversible or non-reversible polarity type.

Automatic Motor Starter

While manual control can be used for motors in a number of factories, it may be desirable to use an automatic starter because of the safety afforded to the motor, the machine and the operator, and because of the readiness with which motors may be started by simply pushing a button. Apparatus intended for this service is shown in the accompanying illustration. In the upper left-hand corner is a service knife switch with fuse clips. Just to the right of the knife switch panel is the main line



INDUSTRIAL-PLANT MOTOR STARTER OPERATED BY PUSH-BUTTON

magnetic switch, which is operated by a push-button at some remote point. This switch makes and breaks the main motor circuit. The magnetic switches on the lower panel are controlled by an accelerating mechanism, which is the principal feature of this starter.

Instead of starting the motor in a definite length of time, as is done by time-element starters, or in a period directly dependent on the load of the motor, as in current-control types, a combination of these two general methods has been employed. If the motor being started is overloaded, the resistance will be cut out automatically if the motor fails to accelerate properly, thus protecting the resistance against burning out. This operation is performed by an overload relay which opens the main line switch and stops the motor. The apparatus is made by the Rowan Controller Company, Baltimore, Md.

Table Stove

The portable table stove shown herewith has been brought out by the Allmur Manufacturing Company of Marion, Ind. The stove is 8 in. (20.32 cm.) in diameter and 5 in. (12.7 cm.) high. The heating unit is removable

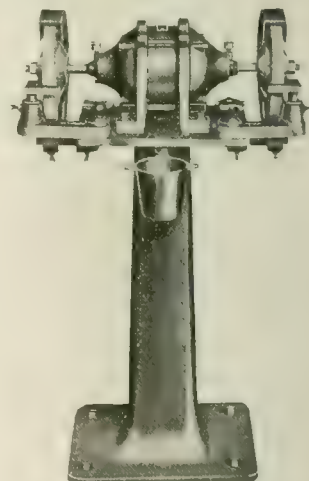


PORTABLE TABLE STOVE

without the use of tools, the element being held in place or contact with wing nuts. This construction, as is pointed out, makes it convenient for the user to remove the element when cleaning other portions of the stove.

Grinding Motor

In the accompanying illustration is shown a self-contained motor-driven tool for machine shops that has been brought out by the U. S. Electrical Manufacturing Company of Los Angeles, Cal. The ball bearings are mounted in a special housing with sealing rings that keep out dirt and grit. The motor is totally inclosed. Convenient tool-grinding rests are adjustable in any direction. The flanges are ample and are turned to insure perfect bal-

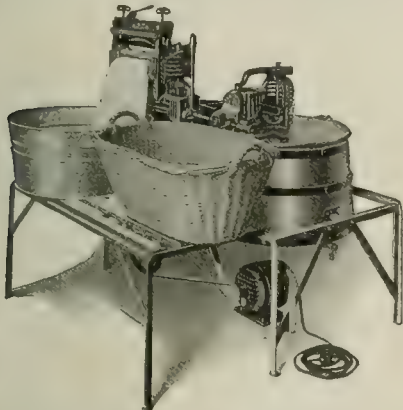


SELF-CONTAINED MOTOR-DRIVEN GRINDER

ance, it is claimed. These outfits are sold motor only for bench mounting, motor with pedestal or motor with pedestal guards, tool rests, water bucket, etc.

Washing Machine with a Vacuum Cup

The new electric washing machine recently brought out by the Wayne Manufacturing Company, 100 Sidney Street, St. Louis, Mo., operates on the vacuum-cup principle. The process of



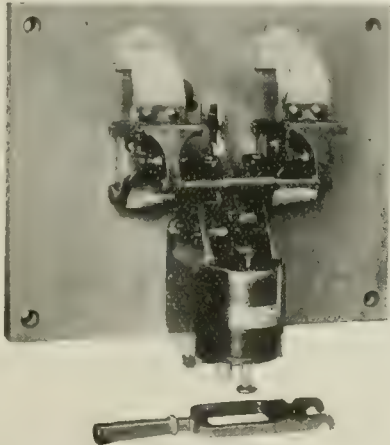
WASHING AND WRINGING MACHINE CONTROLLED BY ONE LEVER

alternately sucking and forcing soapy water and air through the fabric is claimed to do a very thorough job of cleaning. The galvanized vacuum cup consists of a one-piece steel stamping with corrugated sides to give a rubbing action on the clothes. The driving mechanism which is mounted on the lid of the tub causes the vacuum cup to oscillate as it moves up and down, changing the position of the clothes with each stroke. The lifting of the lid of the machine automatically shuts off its operation. The wringer is so arranged that wringing and washing operations may be carried on at the same time or separately. The wringer is reversible and provided with a quick-releasing device. A Robbins & Myers motor is used for driving the outfit.

etc. This section revolves at a speed of 60 r.p.m. The smaller section of the combination is driven through reduction gears and revolves at a speed of 6 r.p.m. Switches on this section are used to control reading matter and also to act as master or control switches for the high-speed section.

Field Switches for Remote Control

Double-pole solenoid-operated field switches which may be mounted on or near the field rheostats or located on the exciter board remote from the main control board have been developed by the General Electric Company, Schenectady, N. Y. All of the switches in this line are operated by means of small control units of the push-and-pull button type, which may be located on benchboards or vertical panels. The field switches are similar in construction to non-automatic solenoid-operated air circuit breakers, the principal points of difference being the omission of carbon secondary contacts and the addi-



DOUBLE-POLE, SINGLE-THROW, SOLENOID-OPERATED FIELD SWITCH

tion of a field discharge switch. The field discharge switch is so arranged that the opening of the solenoid-operated field switch introduces a resistance across the field of sufficient value to prevent any injury to the field coil windings by the inductive "kick" produced by suddenly opening the switch. One set of operating coils is provided, which opens and closes the switch, the magnet frame being centrally spaced between the two poles.

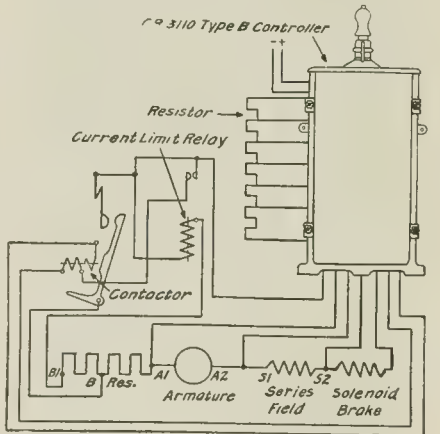
For use with synchronous motors the field switches are designed so that both poles are closed simultaneously, but one pole precedes the other in opening, connecting the discharge resistance across the field. The interval between the opening of the first and second poles of the field switch is obtained by means of a time-limit relay connected in the control circuit. The discharge resistance circuit is opened when this second pole is actuated. Removable handles are provided so that any of these switches may be closed by hand. Insulated buttons, attached to the tripping coil plunger, are provided for hand tripping.

Braking Control for Crane Hoist Service

The General Electric Company of Schenectady, N. Y., has recently brought out an automatic device which can be attached to its standard type B drum controller, and thus make a serviceable semi-magnetic dynamic braking control for crane hoist service. The equipment consists of a panel for wall mounting which contains a direct-current contactor and current-limiting relay, and an extra resistance which is inserted in the circuit during the acceleration and deceleration period.

A dynamic braking, manually operated, drum-type controller is more severe on the commutator of a direct-current series motor than is a plain reversing manual controller, because when lowering the speed the motor is connected in the same way as a shunt-wound motor, and does not have the inherent protection of the series field. In many installations where the service is severe a semi-magnetic equipment will materially assist commutation. This equipment is useful also where the service is not quite severe enough to justify the expense of a full magnetic equipment.

The connections, when used with the dynamic braking controller, are shown in the accompanying illustration. The extra resistance *B-B1* is to be added to the block *A-B* regularly furnished with this controller. With the new arrangement this block of resistance would be so high that it would be impossible to damage the motor, it is claimed, no matter how quickly the controller is thrown on and off. The contactor and relay simply insert and cut out this resistance when accelerating and decelerating in such a manner as to give practically the same speed characteristics on the motor as would be obtained with a standard controller and at the same time prevent abusive currents. This device, it is pointed out, protects the commutator, controller fingers and segments from severe arcing. It also



CONNECTIONS FOR DYNAMIC BRAKE CONTROLLER

enables the motor to run at a higher lowering speed for a given severity and condition of service, provided extra registers are used to weaken the motor field.

Sign Flasher with Variety of Uses

Electric flashers which, besides being used for electric signs, are employed as automatic controllers for controlling solenoids and as contact makers for alarm apparatus, including gongs and sirens, are being manufactured by the Reynolds Electric Company of 422 South Talman Avenue, Chicago, Ill. The flashers are equipped with a number of patented features such as adjustable contacts, detachable brushes and reinforced contact points, besides a number of interchangeable devices which make it convenient to vary the



COMBINATION FLASHER WITH HIGH AND LOW-SPEED DRUMS

effects produced by the outfit. The large flashers consist of two sections, one of which is used for a variety of effects, such as waving flags, revolving wheels or globes, flames, waterfalls,

Trade Notes

THE ILAW STEEL CONSTRUCTION COMPANY, Barbers Bank Building, Pittsburgh, Pa., has changed its name to the Blaw-Knox Company.

THE LINCOLN ELECTRIC COMPANY of Cleveland, Ohio, announces the opening of an office at 10 High Street, Boston, Mass., under the direction of W. A. Blachford.

THE STANDARD VARNISH WORKS, Chicago, Ill., announce that they have established their advertising department at the head office, 90 West Street, New York City.

THE PITTSBURGH ELECTRIC MANUFACTURING COMPANY will build a new one-story building, about 200 ft. by 220 ft., at Penn and Lexington Avenues, Pittsburgh, to cost \$50,000.

THE GENERAL ELECTRIC COMPANY will build two additions to its lamp works at Harrison, N. J., comprising a two-story brick and concrete structure, 130 ft. by 250 ft., and a one-story building on Cross Street, about 50 ft. by 90 ft.

D. B. MUGAN, formerly associated with the Illinois Central Railroad Company, in charge of its electrical department at New Orleans, La., has been appointed resident manager of the Edison Storage Battery Supply Company, with headquarters at 201 Baronne Street, New Orleans.

THE BOOTH HALL COMPANY, 565 West Washington Boulevard, Chicago, announces that its services are available as electric furnace builder and engineer. The officers of the company are: Carl H. Booth, president and general manager (formerly president Snyder Electric Furnace Company); William K. Booth, metallurgical engineer (formerly metallurgist Snyder Electric Furnace Company); Julius R. Hall, vice-president and mechanical engineer (formerly production manager Snyder Electric Furnace Company); Douglas Walker, sales manager (formerly sales manager Snyder Electric Furnace Company); Frank J. Sheldon, secretary and treasurer (formerly auditor Snyder Electric Furnace Company).

New Incorporations

THE THOMASVILLE (Ala.) LIGHT & POWER COMPANY has filed articles of incorporation with a capital stock of \$3,000.

THE BROOK ELECTRIC COMPANY of Trenton, N. C., has been chartered with a capital stock of \$25,000 by Frenifold, M. Brock and others.

THE POCOPSON TOWNSHIP ELECTRIC COMPANY of Philadelphia, Pa., has been chartered with a capital stock of \$5,000. J. C. Murtagh is treasurer.

THE DILWORTH TOWNSHIP ELECTRIC COMPANY of Philadelphia, Pa., has been incorporated with a capital stock of \$5,000. J. C. Murtagh is treasurer.

THE WUCHLAN LIGHT, HEAT & POWER COMPANY of Coatesville, Pa., has been chartered with a capital stock of \$5,000. John E. Zimmerman is treasurer.

THE NEW ELECTRIC LIGHT, HEAT & POWER COMPANY of Coatesville, Pa., has been chartered with a capital stock of \$5,000. John E. Zimmerman is treasurer.

THE POCOPSON LIGHT, HEAT & POWER COMPANY of Coatesville, Pa., has been incorporated with a capital stock of \$5,000. John E. Zimmerman is treasurer.

THE WEST BRADFORD TOWNSHIP ELECTRIC COMPANY of Philadelphia, Pa., has been granted a charter with a capital stock of \$5,000. J. C. Murtagh is treasurer.

THE EAST CALIFORNIA LIGHT, HEAT & POWER COMPANY of Coatesville, Pa., has been granted a charter with a capital stock of \$5,000. John E. Zimmerman is treasurer.

THE GOSHEN ELECTRIC LIGHT, HEAT & POWER COMPANY of Coatesville, Pa., has been granted a charter with a capital stock of \$5,000. John E. Zimmerman is treasurer.

THE WITHERBEE STORAGE BATTERY COMPANY of New York, N. Y., has been incorporated by Charles Meder, Philip Meder and Charles Staudt. The company is capitalized at \$10,000 and proposes to manufacture engines, motors, appliances, etc.

THE A. B. C. ARC LAMP COMPANY of New York, N. Y., has been chartered with a capital stock of \$20,000 by William Bach, William A. Cunningham and M. Beach. The company proposes to manufacture arc lamps.

THE ARKANSAS PREPAY FAN COMPANY of Little Rock, Ark., has been incorporated by E. T. Reeves, Hugh D. Hart, G. Berther and others. The company is capitalized at \$30,000 and proposes to manufacture electric fans.

THE UNITED MANUFACTURING COMPANY of St. Louis, Mo., has been incorporated with a capital stock of \$15,000 to manufacture electrical equipment. The incorporators are: W. F. Byrnes, W. L. Cummiskey and C. R. Baldwin.

THE COSTELLO-HORNER COMPANY of Lakewood, N. J., has been incorporated by Charles W. Costello, Albert Horner and Isaphene B. Peters all of Lakewood. The company is capitalized at \$20,000 and proposes to deal in electrical apparatus, etc.

THE ELECTRIC APPLIANCES, LTD., of Hamilton, Ont., Can., has been incorporated by John F. Radigan, George G. Sutherland, Thomas D. Fallon and others. The company is capitalized at \$50,000 and proposes to manufacture electric stoves, heaters, furnaces, etc.

THE EASTERN MOUNTAIN LIGHT & POWER COMPANY of Chicago, Ill., has filed articles of incorporation with a capital stock of \$425,000. The incorporators are: Miles J. Hall, Harry H. Phillips, Charles J. Horn, Burrell J. Cramer, Frank Conrad and Clarence A. Flinn.

THE PERFECTION STORAGE BATTERY COMPANY of Brooklyn, N. Y., has been chartered with a capital stock of \$3,500 to manufacture batteries for autos, bicycles and vehicles. The incorporators are: Robert M. Stevenson, Clarence E. Mundy and Frank E. Stouvenel.

THE NEW HOME GAS & ELECTRIC SUPPLY COMPANY of New York, N. Y., has been incorporated with a capital stock of \$50,000 by E. London, H. Kupferberg, and L. Ruderfer, 598 Van Siclen Avenue, Brooklyn, N. Y. The company proposes to deal in gas and electric fixtures, etc.

WARREN G. GREEN of Watertown, N. Y., has filed articles of incorporation with a capital stock of \$20,000 for the purpose of dealing in auto and motor boat accessories and electrical supplies. The incorporators are: W. J. Green, L. M. Moore and G. W. Bailey of Watertown, N. Y.

THE WISE-McCLUNG MANUFACTURING COMPANY of New Philadelphia, Ohio, has been chartered with a capital stock of \$200,000 to manufacture electric vacuum sweepers. W. A. Wise is president and general manager; W. A. McClung, vice-president and Ivor Harris, secretary and treasurer.

THE NOVELTY ELECTRIC COMPANY of Litchfield, Conn., has been incorporated with a capital stock of \$2,000 by Raymond G. Stewart of Watertown, George R. Trumbull of Bantam, and Fred L. Garrigues of Waterbury. The company proposes to manufacture metal goods and electrical novelties.

THE HARTFORD ELECTRIC STEEL CORPORATION of Rocky Hill, Conn., has been chartered with a capital stock of \$150,000 by William R. Palmer of Bridgeport, Conn.; Harry S. Blumenthal and Michael Suisman of Hartford. The dividend plant at Rocky Hill was recently purchased by Messrs. Suisman and Blumenthal.

THE WORLD HARVESTER CORPORATION has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$15,000,000 for the purpose of manufacturing apparatus and mechanical devices operated by electricity or other motive power. The incorporators are: D. Halley Barber, Herbert E. Monahan and Ruth Frackman, all of New York, N. Y.

THE KEYSTONE IRON & STEEL WORKS of Los Angeles, Cal., has been incorporated by J. E. Geyer, A. A. Barton, W. F. Allen, W. S. McGiffert and J. P. Loftus, all of Los Angeles. The company, it is understood, is affiliated with the Keystone Iron Works, 973 North Main Street, which manufacture iron lamp standards, fire hydrants, pumps, etc., and will take over and operate the plant.

THE RUMSEY ELECTRIC COMPANY of Philadelphia, Pa., has been incorporated by Eugene A. Rumsey, Fox Chase, Philadelphia, Pa.; George A. Rumsey, Jr., Stenton, Mount Airy, Philadelphia, Pa.; George A. Rumsey, Sr., Salem, N. J.; Charles H. Kelley, Haddonfield, N. J.; B. F. Hare, Germantown, Philadelphia, and George S. Trimble, 5903 Christian Street, Philadelphia. The company is capitalized at \$325,000 and proposes to manufacture electrical appliances, machinery, etc.

Trade Publications

METERS.—Bulletin No. 45 of the Sangamo Electric Company, Springfield, Ill., describes and gives uses of ampere-hour meters.

LUMBER MILLS.—The Wagner Electric Manufacturing Company, St. Louis, Mo., is distributing a booklet on the uses of Wagner motors in lumber mills.

GASOLINE-ELECTRIC AUTOMOBILES.—The Wood Motor Vehicle Company, Chicago, has briefly described its model 54 car with special reference to simplicity of control.

AUTOMOBILE HEADLIGHTING.—The Corning Glass Works of Corning, N. Y., have issued a booklet on the principles of and the results obtained with the Corning "Conaphore" headlight glass.

INSULATORS.—The R. Thomas & Sons Company of East Liverpool, Ohio, has issued catalog No. 16. This describes various types of insulators for all voltages, with tables and illustrations.

DIES AND HOLDERS.—The Greenfield Tap & Die Corporation of Greenfield, Mass., has prepared a booklet describing the "Acorn" die. Tables of sizes and prices of dies and holders are given.

TABLEWARE.—Features of percolators, grills, toasters, etc., manufactured by the Hotpoint Electric Heating Company, Ontario, Cal., are pointed out in a booklet recently issued by that company.

GRAIN STORAGE FIRE ALARM.—The Western Fire Appliance Works, Chicago, are sending out folders of their Zeleny thermometer system for indicating changes in temperature in grain in storage.

MOTORS.—"Motor Installations" is the subject of a book issued by the Wagner Electric Manufacturing Company, St. Louis, illustrating the use of Wagner motors in various lines of industries.

ELECTRIC SIGN EQUIPMENT.—The Reynolds Electric Company, Chicago, describes and gives tables of sizes and prices of its color hoods and flashers. Illustrations of electrical displays are given.

REFLECTORS.—The Holophane Glass Company of New York has published a booklet showing the use of Holophane units with type C lamps. Charts and data for designing installations are given.

OXY-ACETYLENE WELDING AND CUTTING.—Apparatus for oxy-acetylene welding and cutting is referred to in a bulletin recently distributed by the Prest-O-Lite Company, Inc., Indianapolis, Ind.

STEEL HARDENING.—The advantages of some of its steel products hardened by the Stroh process are outlined in a bulletin recently prepared by the Stroh Steel Hardening Process Company, Pittsburgh, Pa.

LIGHTING.—The National X-Ray Reflector Company of Chicago and New York has issued catalog 20 on the use of X-ray reflectors for show windows, showcases, floodlighting, industrial and other direct lighting.

MOTORS.—Bulletin 2014 of the Reliance Electric & Engineering Company of Cleveland, Ohio, describes and illustrates the various mechanical and electrical details of type T heavy-duty "Reliance" motors for direct current.

LIGHTING FIXTURES.—The National X-Ray Reflector Company, 21 West Forty-sixth Street, New York City, has sent out a number of leaflets illustrating lighting fixtures for offices, hospitals, showcases and floodlighting purposes.

CHAIN DRIVE.—"The Ideal Drive for Textile Machinery" has recently been issued by the Link Belt Company of Chicago. This book describes and illustrates the Link Belt silent chain drive, which is being used in the textile industry.

HIGH-TENSION BUSBARS.—The Delta-Star Electric Company, Chicago, is distributing bulletin No. 31, describing its "unit type" high-tension busbar wiring supports. Detailed dimension tables are given, and there are 198 illustrations.

AUTOMATIC WEIGHING.—The Richardson Scale Company, Passaic, N. J., has issued bulletin No. 101, which shows the construction, operation and advantages of the Richardson automatic coal scale and the Richardson automatic liquid scale.

CIRCULATING-TYPE WATER HEATER.—The Automatic Electric Faucet Company, San Francisco, Cal., has distributed a folder illustrating the construction of a recently developed circulating-water heater which may be attached to any kitchen boiler.

New England States

TAUNTON, MASS.—The Gas and Electric Light Commissioners have handed down a decision approving the petition of the Fall River Electric Light Company asking for permission to erect wires across the Taunton River for the purpose of transmitting electricity. The company proposes to connect with the transmission system of the Rhode Island Power Company.

TURNERS FALLS, MASS.—The Turners Falls Power & Electric Company has petitioned the Gas and Electric Light Commission for authority to issue \$1,030,000 in capital stock. The company has recently entered into a contract with the Springfield Street Railway Company to furnish energy for a long term of years.

NEWPORT, R. I.—A substantial increase in the appropriation for the expansion of the naval torpedo station in Newport has been granted by the Navy Department. The \$400,000 originally set aside for the new power plant, it is stated, has been increased to \$1,100,000.

SEYMOUR, CONN.—A new electric transmission line, capable of transmitting 2500 kw., is being erected by the Seymour Electric Company from Seymour to Derby. A large substation is being erected at Derby and extensive alterations will be made at the Seymour substation, near George Street.

Middle Atlantic States

ATTICA, N. Y.—The Village Council has authorized Willis E. Hopkins, village clerk, to apply to the Public Service Commission for authority to acquire and conduct the electric plant and water-works system of the Attica Water, Gas & Electric Company, which the village has voted to take over.

BEACON, N. Y.—The power house of the Southern Dutchess Gas & Electric Company was destroyed by fire on June 26, causing a loss of about \$100,000. The plant, it is understood, will be rebuilt.

COHOES, N. Y.—Bids will be received by the Board of Contract and Supply, Cohoes, until July 13, for two motor-generators and other electrical equipment for pumping station.

NEWBURGH, N. Y.—Extensive improvements are contemplated to the plant of the Newburgh Shipyards, Inc., which include the erection of a large power house, new office building, etc.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 9, for furnishing electric traveling cranes in the structural shop at the navy yard, New York, N. Y. For further information relating to this specification (No. 2444) address the chief of Bureau of Yards and Docks, Navy Department, Washington, D. C.

NEW YORK, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until July 12, for construction, heating, plumbing and drainage, and electric work for building and kitchen for disturbed patients (additional accommodations for disturbed patients) at the Manhattan State Hospital, Ward's Island. Plans may be seen at the hospital, Ward's Island; at the New York office of the Department of Architecture, Room 1224 Woolworth Building, and the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

OSWEGO, N. Y.—Upon the application of local taxpayers to restrain the city from building the proposed hydroelectric plant at Dam No. 6, Oswego River, public hearings are now being held at the local court. The proposed plant will have a capacity of about 1500 hp. and will cost about \$139,000, and will be supplemented by a steam power plant, to cost about \$300,000, for use during low-water periods.

OYSTER BAY, N. Y.—The New Telephone Company is planning to erect a two-story telephone exchange building on Tooker Avenue, to cost about \$40,000.

POTSDAM, N. Y.—Plans have been completed by the Hannawa Falls Water Power Company for the construction of a hydroelectric power plant, to develop a minimum of 10,000 hp. F. A. Stoughton is president.

UTICA, N. Y.—The Utica Gas & Electric Company is now building a large hydroelectric development at Trenton Falls, where it is estimated that 30,000 hp. can be developed. Water power to operate the plant will be secured from West Canada Creek.

COLLINSWOOD, N. J.—The residents of West Collinswood are negotiating with the Public Service Electric Company for the installation of a local lighting system.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

FLEMINGTON, N. J.—The Dural Rubber Incorporation, 711 Broad Street, Trenton, recently incorporated with a capital stock of \$200,000, has acquired property in Flemington, consisting of five acres of land and buildings for its proposed new plant for the manufacture of automobile tires, rubber goods for aeroplanes and aeroplane parts and specialties. The main building is 40 ft. by 200 ft.; the smaller buildings will be utilized for electric plant, boiler room and offices. Edgar H. Wilson is president.

GLOUCESTER, N. J.—Bids will be received by Harry P. Johnson, city clerk, until July 19 for lighting the streets of the city for a period of five years from Jan. 1, 1918. The installation of incandescent street lamps is under consideration.

NEWARK, N. J.—The Board of Education has approved an appropriation of \$206,700 for the construction of a new vocational school for boys, on Sussex Avenue, near First Street. The proposed building will be of factory type, about 170 ft. by 225 ft., three stories, and will be equipped for instruction in toolmaking, foundry work, machine-shop operations, pattern making, woodworking, cabinet-making, machine construction, heat treatment of metals, gas and electric welding. There will also be departments for work in power-plant operation, automobile construction and repair, gas and gasoline-engine work. Plans have been prepared by Louis Sonntag, acting supervisory architect of the board. Wesley O'Leary, 31 Clinton Street, is one of the directors.

SOUTH AMBOY, N. J.—The City Council has granted the Jersey Central Traction Company of Keyport a franchise to construct and operate an electric railway in South Amboy. T. W. Wilson, 603 Market Street, Wilmington, Del., is general manager.

HARRISBURG, PA.—Preparations are being made by the Harrisburg Light & Power Company to begin work at once on the installation of the new street-lighting system. The present arc lamps will be replaced with lamps mounted on ornamental standards, maintained by underground wires.

PHILADELPHIA, PA.—The DeLong Hook & Eye Company is planning to build a power plant at its new factory to be erected at Twenty-first and Clearfield Streets. Plans are being prepared by William Steele & Son, architects, 1600 Arch Street, Philadelphia.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 16, under specification 2451, for installing coal-handling plant at the navy yard, Philadelphia, Pa. For further information address the chief of bureau.

TAMAUQUA, PA.—The East Lehigh Colliery, recently rebuilt, it is reported, will be equipped for electrical operation throughout, at a cost of about \$40,000.

WILMINGTON, DEL.—The contract for furnishing electricity for lighting the hundred bridges in Wilmington has been awarded to the Wilmington & Philadelphia Traction Company for a period of one year.

WILMINGTON, DEL.—The Delaware & Maryland Traction, Light & Power Securities Company has acquired the franchises of the Fox Creek Railroad Company of Dorchester County and the Peninsula Traction Company of Talbot County and proposes to build an electric railway to connect Cambridge with Bishop's Head on the Chesapeake Bay and a railway connecting the principal points on the Eastern Shore with Elkton. The company, it is said, also proposes to construct a road from Wilmington to Salisbury, with a branch from Bridgeville to Williamsburg and thence to Easton. Lindes & Company of Philadelphia, Pa., are interested.

BALTIMORE, MD.—Bids have been asked by the United Railways & Electric Company for stokers for the Pratt Street power house.

HUNTINGTON, W. VA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 23, for installing an elevator in the United States post office at Huntington, W. Va.

MORGANTOWN, W. VA.—The Morgantown & Wheeling Railway Company, it is

reported, is contemplating the construction of 8 miles of new track.

WASHINGTON, D. C.—Bids will be received at the office of the secretary of Board of Commissioners of District of Columbia, Room 509, District Building, Washington, D. C., until July 9, for furnishing one 30-kw. motor-generator for the new Central High School Building at Thirteenth and Clifton Streets. Specifications, etc., may be obtained from the chief clerk of the Engineering Department, Room 427 District Building, upon deposit of \$5.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 9, for 12 electric freight elevators as follows: Two in the new foundry at the navy yard, Norfolk, Va.; one in the new foundry at the navy yard, Philadelphia, Pa.; two in the new machine shop at the navy yard, Norfolk, Va.; one in the new structural shop at the navy yard, New York, N. Y.; two in the shipbuilding ways, navy yard, Norfolk, Va.; two in the shipbuilding ways, navy yard, Philadelphia, Pa.; two in the shipbuilding ways, navy yard, New York, N. Y., and one hydro-pneumatic elevator in the woodworking shop, navy yard, Pearl Harbor, Hawaii.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations as follows: Various, Schedule 1296, 86 dynamo and fire room clocks; Schedule 1303, miscellaneous brushes, boiler tube, spiral, bristle type; coil type; sectional; Schedule 1283, 48,800 steel wire casting brushes. Norfolk, Va., Schedule 1282, 500,000 4-amp. glass tube fuses; Schedule 1294, 7500 steel galvanized wire rope sockets; Schedule 1281, miscellaneous seamless steel tubing. Washington, D. C., Schedule 1300, 800,000 ft. Litendracht wire; Schedule 1291, furnishing and installing three motor-generator sets. Puget Sound, Wash., Schedule 1301, one refrigerating plant; Schedule 1279, 10 water-tight, vibrating bells, 175 push buttons, 200 20-volt, salvo firing buzzers, 60 20-volt, non-water-tight buzzers, 1000 interior fittings, 1800 non-water-tight, portable guards, 2500 shade holders, 100 lb. grade "A-1," uncut clear mica, 4250 brass and bronze key sockets, 3000 screws for 5-amp. switch handles, 850 snap switches; Schedule 1302, one 3000-gal. fire and flushing pump. Newport, R. I., Schedule 1290, 7000 lb. seamless steel tubing. South Charleston, W. Va., Schedule 1288, one motor-driven trimming press. Boston and Brooklyn, Schedule 1303, 28 hydraulic turbine tube cleaners. Boston, Norfolk, Schedule 1303, miscellaneous single end boiler tube scrapers. Applications for proposal blanks should designate the schedule desired by number.

North Central States

NEW BALTIMORE, MICH.—The village of New Baltimore has voted to close down the municipal electric-light plant and to grant the Detroit (Mich.) Edison Company a franchise to furnish electrical service here. The municipal plant has been operated at a loss for several years.

CINCINNATI, OHIO.—The Union Gas & Electric Company has taken a five-year lease on property on Dana Avenue, Evans-ton, on which its proposes to erect a substation.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioners of purchases and supplies, City Hall, Cleveland, until July 10, for series multiple transformers. Specifications may be obtained on application to the office of the division of light and heat, Room 204, City Hall.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioners of purchases and supplies, City Hall, Cleveland, until July 17, for constant-current regulators for the division of light and heat. Specifications may be obtained at the office of the division of light and heat, Room 204, City Hall.

SALEM, OHIO.—The Salem Lighting Company is installing a 3000-kw. steam turbo-generator to replace the old 600-kw., gas-engine-driven plant. H. E. Drevenstedt is general superintendent.

SEBRING, OHIO.—The Alliance (Ohio) Gas & Electric Company, it is reported, is negotiating for the purchase of the property of the McKee Light & Power Company of Sebring.

YOUNGSTOWN, OHIO.—The Youngstown & Niles Railroad Company has petitioned the Public Utilities Commission for permission to issue \$37,500 in bonds. The company proposes to build a new electric railway between Youngstown and Niles, passing through the new town of McDonald.

BARBOURVILLE, KY.—The Barbourville Electric Light & Power Company is planning to acquire and operate its own coal mine to make sure of a continuous supply.

SELIERSBURG, IND.—The Silver Creek Telephone Company, recently organized with a capital stock of \$60,000, is planning to erect telephone lines and exchanges. Walter B. McCannon is one of the directors.

EAST ST. LOUIS, ILL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 23, for installing elevator in the United States post office at East St. Louis.

WENONA, ILL.—The contract for the new telephone exchange building in Wenona has been awarded to A. B. Kip & Company of Minonk. A new switchboard and other equipment will be installed.

CUBA CITY, WIS.—Bids will be received at the office of the village clerk, Cuba City, until July 12, for drilling a deep well and installing a new pump and motor. J. G. Thorne & Company, 317 Howes Block, Clinton, Iowa, are engineers.

MADISON, WIS.—The Peninsular Power Company has applied for an amendment of its charter increasing its capital stock from \$1,750,000 to \$3,000,000. The company has acquired a site on the Brule River, about 3 miles from Florence, where it proposes to build a hydroelectric power plant and furnish electricity over a large area in the northern part of the State. F. E. Tureaure of Madison is secretary.

RACINE, WIS.—Plans are being prepared for the construction of a tire and rubber factory, 260 ft. by 320 ft., five stories and basement, for the Racine Auto Tire Company, to cost, complete with equipment, about \$300,000. The plans provide for a steam-driven generating plant.

ALBERT LEA, MINN.—The City Council has appointed a committee to investigate the proposal to establish a municipal electric-light plant in the city.

RANDOLPH, MINN.—Bids will be received by C. L. Morrill, clerk, addressed to the Consolidated School District No. 59 (Joint), Dakota County, Randolph, Minn., until July 18, for construction of consolidated school building, to be erected by the Consolidated School District No. 59, Dakota County, separate bids to be submitted as follows: (a) General contract; (b) plumbing; (c) electrical construction; (d) heating and ventilation; (e) temperature regulation; (f) fans, motor drives and heater. Plans and specifications may be obtained upon application to Tyrie & Chapman, architects, Auditorium Building Minneapolis.

RED WING, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, until July 17, for alterations and additions to power plant, and alterations to heating systems for the State Training School, Red Wing, in accordance with plans and specifications prepared by Charles L. Pillsbury & Co., engineers, St. Paul and Minneapolis.

COLLINS, IOWA.—The City Council has granted C. E. Lookingbill a franchise to install and operate an electric-light plant in Collins.

FREDERICKSBURG, IOWA.—At an election held recently the proposal to sell the local electric distributing system to C. Miller & Sons of Clermont, and grant them a 20-year franchise to furnish electric service in Fredericksburg was carried.

LYTTON, IOWA.—The Electric Light Company is contemplating extending its electric transmission lines on Walnut Street.

OTTUMWA, IOWA.—The Ottumwa Railway & Light Company is installing a new 1250-kw. turbo-generator set, a water softener, a settling basin and pumps will also be installed. The company will also erect a high-tension transmission line to Batavia.

PLYMOUTH, IOWA.—The Iowa Heat, Light & Power Company of Grinnell, it is reported, has purchased a site and will erect a power station to supply electricity in Plymouth.

SHENANDOAH, IOWA.—Bids will be received by the board of education of Shenandoah until July 19 for construction of Junior High School building, separate bids to be submitted on heating, plumbing, vacuum cleaning system, program clock, electric wiring, etc. The cost of the building is estimated at \$100,000. Trunk & Gordon, 5 Donnell Court, St. Joseph, Mo., are architects.

SIOUX CITY, IOWA.—Plans are being prepared for the erection of an addition to the power station of the Sioux City Gas & Electric Company. The cost of the work is estimated at \$200,000 and will include a building 75 ft. by 50 ft., and equipment.

TREYNOR, IOWA.—The construction of an electric railway from Noega to Treynor, using the old right of way of the Iowa & Omaha Short Line, is under consideration. Owing to the unsettled condition of the market for material no work will be done this year. E. A. Wickham of Council Bluffs is interested.

WAUCOMA, IOWA.—A special election will be held to submit the proposal of selling the property of the Waucoma Electric Light & Power Company to C. Miller & Sons, for \$17,000.

CANTON, MO.—A special election will soon be held to vote on the proposal to issue \$15,000 in bonds for extensions to water mains, building a seawall to protect power house, and to install an ornamental lighting system in Canton.

JOPLIN, MO.—At a special election held June 12 the proposals to build a new municipal electric-light plant, at a cost of \$225,000, and to award the Empire District Electric Company a contract for lighting the city were defeated.

SEDALIA, MO.—Improvements are contemplated by the City Light & Traction Company to its electric plant on East Broadway. The work will cost about \$60,000 and will include the erection of a 150-ft. smokestack, the installation of a new electric generating unit and a switchboard.

WASHBURN, N. D.—Bids will be received at the office of R. W. Brownson, city auditor, Washburn, until July 12, for furnishing and installing pumping equipment, piping and wiring connections for the city of Washburn. Plans and specifications may be seen at the above office, and at the Builders' Exchange in Minneapolis and St. Paul, Minn., and Fargo, N. D.

ALTOONA, KAN.—At an election held recently the proposal to issue \$30,000 in bonds to enlarge the electric-light and water systems was carried.

ARMA, KAN.—The municipal electric plant, it is understood, will be closed down. Energy for operating the local system will be supplied by the Kansas Gas & Electric Company of Wichita.

GARDEN CITY, KAN.—Contracts have been awarded for extension to the waterworks system of Garden City, including electric transmission line and pumping plant. The Ruckel Engineering Company has charge of the engineering work.

Southern States

AMERICUS, GA.—Bonds to the amount of \$250,000 and \$100,000 in capital stock will be issued by the Americus Lighting Company, the proceeds to be used for the purchase of the property of the Americus Public Service Company and for extensions and improvements to the combined system.

ATLANTA, GA.—Bids will be received by the office of the superintendent of prisons, Department of Justice, Washington, D. C., until July 19, for furnishing at the United States penitentiary, Atlanta, Ga., material required for electric light, telephone and clock installations for the east and main cell wings of the above institution. Copies of specifications together with further information may be obtained upon application to the above office. F. H. Duchay is superintendent.

NASHVILLE, TENN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 23, for installing an elevator in the United States post office at Nashville, Tenn.

ALBANY, ALA.—The Alabama Power Company of Birmingham, it is reported, contemplates improvements to its plants and transmission system, involving an expenditure of from \$5,000 to \$10,000.

OKLAHOMA CITY, OKLA.—The capital stock of the Oklahoma Gas & Electric Company has been increased from \$5,000,000 to \$50,000,000. The proceeds to be used for the construction of a large electric power plant and the erection of an extensive system of transmission lines. The company owns and operates light and power plants in Oklahoma City, Shawnee, Muskogee and several other towns in the State. H. M. Byllesby & Company of Chicago, Ill., are managers.

TEMPLE, OKLA.—At an election to be held July 13 the proposal to grant a franchise to John C. Keys of Lawton to construct and operate an electric light and natural gas plant will be submitted to the voters. Electricity is to be transmitted from the plant in Lawton.

WILSON, OKLA.—Bonds to the amount of \$35,000 have been voted of which the proceeds of \$10,000 will be used for the electric-lighting system and the remainder for waterworks. The Benham Engineering Company of Oklahoma City has charge of the engineering work.

Pacific and Mountain States

BREMERTON, WASH.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 17 for furnishing non-water-tight buzzers, salvo firing buzzers, push buttons, vibrating bells, electric fittings, interior fittings, snap switches, clear mica, non-water-tight guards, shade holders, screws for switch handles and key sockets. For further information address the Bureau of Supplies and Accounts, Navy Department.

LA CONNER, WASH.—The La Conner Commercial Club has petitioned the Stone & Webster interests to extend its electric transmission lines into La Conner. The local power plant, owned by S. J. Eyerax, will be closed down permanently July 1.

TACOMA, WASH.—Preparations are being made for the construction of the large substation to be erected in Tacoma in connection with equipping the Cascade division of the Chicago, Milwaukee & St. Paul Railway for electrical operation. The Tacoma station will furnish energy for the Tacoma yards and for the division between this city and Seattle.

PORTLAND, ORE.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 30, for the installation of an elevator plant in the United States post office at Portland, Ore. For details see Searchlight Department.

ALAMEDA, CAL.—Work will soon begin on the installation of electrolite lighting system on Webster Avenue. The standards will carry three-lamp clusters, and will be maintained by underground wires.

BLYTHER, CAL.—The State Railroad Commission has issued an order authorizing the Southern Sierras Power Company of Denver, Col., to construct and operate an electric generating plant and distribution system in the city of Blythe. The company proposes to erect a steam generating station and an electric transmission line to connect with its hydroelectric plant. The cost of the steam plant is estimated at \$20,000, of which \$10,200 has been expended.

PITTSBURG, CAL.—The Board of Trustees is negotiating with the Pacific Gas & Electric Company of San Francisco for the installation of street lamps in the new residence district south of Eighth Street.

RICHFIELD, UTAH.—The State Public Utilities Commission has granted the Southern Utah Power Company permission for extensions to its plant and system, including the installation of a 100-hp. generator on Panguitch Creek and a distributing system for the town of Panguitch; a transmission line from Beaver Station to Marysville and a line from Sevier to the latter town with a distribution system in Marysville, and also a transmission line to the Dear Trail Mine to transmit 300 hp. Later the company will ask for a certificate of convenience and necessity to construct a 2500-hp. plant just below its present station near Beaver.

TUCSON, ARIZ.—The City Council has authorized the city clerk to advertise for bids for the installation of electric conduits on Sixth Avenue.

GREAT FALLS, MONT.—The City Council has adopted a resolution to create a special improvement district for the purpose of installing electric street lamps.

ALBUQUERQUE, N. M.—The Albuquerque Gas & Electric Company, recently incorporated, has acquired all the properties and holdings of the Albuquerque Gas, Electric Light & Power Company and the Albuquerque Electric Power Company and will continue the business carried on by the two companies in the city of Albuquerque.

Canada

ST. THOMAS, ONT.—The purchase of electrical equipment for the municipal electric-light plant is under consideration. E. H. Coughell is manager.

QUEBEC, QUE.—The construction of an electric and machine shop, to cost about \$10,000, is contemplated by Louis Lavoie, 134 Queen Street, Quebec.

Miscellaneous

PEARL HARBOR, HAWAII.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 9, for furnishing, under specification 2449, elevators at the naval station at Pearl Harbor. For further information address the above bureau.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

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Printed in the First Issue of Each Month

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Record of Electrical Patents

Notes on United States Patents
issued on June 26, 1917

1,230,835. TELEPHONE-EXCHANGE SYSTEM. Garrison Babcock, Chicago, Ill. App. filed Aug. 8, 1913. Relates to service meters for telephone-exchange systems, particularly those where the metering mechanism is installed at the substations.

1,230,840. MEANS FOR FACILITATING STARTING OF GAS ENGINES; Charles H. Belknap, Brooklyn, N. Y. App. filed March 10, 1916. Facilitates starting of gas engines and particularly the explosion motors used on automobiles, especially in cold weather.

1,230,848. ELECTRIC LIGHT SOCKET; Tonjes A. C. Both, Stratford, Conn. App. filed Feb. 20, 1915. Provides a quick make and a quick break of the electric current without arcing.

1,230,857. ELECTROMAGNETIC VIBRATOR; Frank E. Brixius, Manitowoc, Wis. App. filed Oct. 21, 1916. Means for vibrating pattern plates disposed in molds.

1,230,869. METHOD OF MAKING INCANDESCENT LAMPS; William D. Collidge, Schenectady, N. Y. App. filed Nov. 7, 1910. Consists in winding the tungsten filament on a spider while it is in a heated and pliant condition.

1,230,874. METALLIC AUDION; Lee de Forest, New York, N. Y. App. filed Feb. 21, 1917. Provides an audion with a metal shell which forms one electrode of the device.

1,230,884. TELEPHONIC APPARATUS; Charles Forgues, Paris, France. App. filed Aug. 3, 1914. Relates to an intensive and hygienic telephonic apparatus of the "net" type.

1,230,934. ALTERNATING-CURRENT ELECTROMAGNETIC CONTROL SWITCH; John T. Skinner, Lawrence, Kan. App. filed Jan. 28, 1915. Relates to electromagnet switches, particularly to those used in conjunction with an alternating current.

1,230,935. ELECTRIC BRAKING SYSTEM; John T. Skinner, Lawrence, Kan. App. filed May 17, 1915. Relates to a system of electro-dynamic control for motor-propelled vehicles.

1,230,946. PORTABLE SWITCHBOARD; George Thompson, Shelby, Ohio. App. filed Dec. 6, 1915. Produces a simple and compact switchboard whereby, by plugging in at different points a wide range of circuit connections may be obtained.

1,230,955. MAXIMUM CUT-OUT; Gerardus J. van Sway, Delet, and Henri I. Keus, Hengelo, Netherlands. App. filed March 8, 1915. Relates to switches which may be switched in and out by hand and which are further thrown out automatically on the current exceeding a predetermined value.

1,230,956. MICROPHONE; Alexandre Vaugéan, Anthony de Lavandeyra and William Garthwaite, Paris, France. App. filed Oct. 15, 1915. Relates to microphones for use in telephony.

1,230,957. ELECTRIC SIGNALING DEVICE FOR AUTOMOBILES; George F. Voight, San Francisco, Cal. App. filed June 21, 1916. Provides means whereby the driver of an automobile can operate an electrically actuable horn or signaling device by manipulating a switch element within the steering-wheel assembly.

1,230,983. ELECTRIC PULL SOCKET; Frederic Barr, New York, N. Y. App. filed Oct. 31, 1911. Relates particularly to the construction by means of which the parts of a switch are supported in the casing and the operating chain or cord is guided.

1,230,996. TELEPHONE SYSTEM; Edward E. Clement, Washington, D. C. App. filed March 2, 1911. Relates particularly to semi-automatic systems.

1,231,008. ELECTRICAL INSTALLATION; Frank W. Funk, Youngstown, Ohio. App. filed Aug. 24, 1916. Provides a telltale which shall give visible or audible signal in the event of an excess of potential.

1,231,013. AUTOMATIC TELEPHONE-EXCHANGE SYSTEM; Charles L. Goodrum, New York, N. Y. App. filed Nov. 18, 1914. Relates to systems employing machine switching.

1,231,024. TELEPHONE-EXCHANGE SYSTEM; Edward E. Hinrichsen, New York, N. Y. App. filed May 19, 1915. Provides a simple equipment for obtaining a flashing signal.

1,231,033. ELEVATOR SIGNALING SYSTEM; Walter A. Loomis, Los Angeles, Cal. App. filed Feb. 7, 1916. Provides a signaling means which will indicate to operators of elevator cars their relative running positions at all times.

1,231,036. REFILLABLE CARTRIDGE FUSE; Clarence T. McDonald, Chicago, Ill. App. filed Dec. 31, 1913. Relates to inclosed or cartridge fuses of the refillable type.

1,231,043. IGNITION SYSTEM; Charles T. Mason, Sumter, S. C. App. filed Oct. 21, 1916. Relates to an ignition system for a high-tension, high-speed magneto.

1,231,048. ELECTRICAL RELAY; Eggon O. Moller, Brooklands, England. App. filed March 20, 1913. Relates to automatic circuit breakers.

1,231,056. ELECTRIC IRON; Charles S. Palmer and Dean Palmer, Saranac Lake, N. Y. App. filed Dec. 18, 1916. Provides improved automatic means for controlling the supply of current.

1,231,057. DRY-CELL BATTERY; Herbert R. Palmer, Cleveland, Ohio. App. filed March 2, 1917. Relates to the construction of dry-cell batteries or batteries of the Leclanché type.

1,231,063. ELECTRICAL RECEPTACLE; Clarence D. Platt, Bridgeport, Conn. App. filed Feb. 15, 1917. Provides a receptacle in which it is impossible to accidentally short-circuit the screw socket and the center contact.

1,231,085. TELEPHONE-EXCHANGE SYSTEM; Arthur B. Sperry, New York, N. Y. App. filed Sept. 22, 1916. Relates to systems employing machine switching.

1,231,086. TELEPHONE-EXCHANGE SYSTEM; Arthur B. Sperry, New York, N. Y. App. filed Nov. 6, 1916. Relates to systems employing machine switching.

1,231,095. TELEPHONE TRANSMITTER; Naho Tannaka, New York, N. Y. App. filed Nov. 11, 1915. Relates to improvements in variable resistance devices, particularly to telephone transmitting apparatus.

1,231,109. AUTOMATIC SYNCHRONIZER; James G. Zimmermann, Milwaukee, Wis. App. filed Nov. 23, 1913. Relates generally to systems of electrical distribution wherein alternating, intermittent or pulsating currents are utilized.

1,231,126. GENERATOR FOR INTERMITTENT ELECTRIC CURRENTS; Jonas Carter, Waukegan, Ill. App. filed March 1, 1916. Produces a device for use particularly with internal-combustion engines.

1,231,140. TELEGRAPH SYSTEM; Amos F. Dixon, Newark, N. J. App. filed April 15, 1915. Provides for automatically signaling the receipt of operative current impulses at any printer.

1,231,149. IGNITION MECHANISM FOR INTERNAL-COMBUSTION ENGINES; Harry F. Geist, Racine, Wis. App. filed Sept. 20, 1915. Capable of being economically manufactured.

1,231,179. SIGNALING DEVICE; James I. McBride, Seattle, Wash. App. filed Feb. 24, 1914. Relates to signaling devices which are especially adapted for use in the logging industry.

1,231,193. ELECTROMAGNET; Charles C. Powers, Williams, Ariz. App. filed Sept. 8, 1916. Provides means whereby a rotatable movable core (either in one piece or in a number of separate sections) may be employed in place of the conventional rectilinearly movable core.

1,231,196. RADIANT-TYPE STOVE; William A. Rankin and Henry D. Laraway, Ontario, Cal. App. filed Feb. 2, 1916. Provides a water-cooling means for preventing the oxidation and dulling of the reflector and the surrounding case.

1,231,200. ELECTRICAL TIMING DEVICE; Earl H. Rollinson, Lyons Farms, N. J. App. filed Nov. 27, 1915. Provides a means so that none of the operating current passes through the hot wire; it depends entirely for its operation upon heat generated in a heating coil which is placed either in a main circuit or a shunted circuit through the device.

1,231,202. INSULATING JOINT; Frank D. Saylor, Pittsburgh, Pa. App. filed Sept. 9, 1914. Provides a fixture for supporting either electric or gas lamps or both.

1,231,221. ELECTRIC-CURRENT INTERRUPTER; Knut Trosdahl, Christiania, Norway. App. filed May 9, 1917. Has for its object an electric current limiter of the periodical interruption type.

1,231,229. MOTOR-STARTING SWITCH; Carl A. Ahlstrom, New Britain, Conn. App. filed April 20, 1916. Prevents the operator from starting the motor with the fuses in circuit.

1,231,264. IGNITION DEVICE; Charles F. Kettering, Dayton, Ohio. App. filed March 12, 1916. Relates to an ignition system or combination of apparatus for internal-combustion engines of automobiles and other vehicles.

1,231,265. CONTROL FOR ELECTRICAL SYSTEM; Charles F. Kettering, Dayton, Ohio. App. filed Aug. 9, 1912. Improves electric voltage regulators.

1,231,266. ENGINE-STARTING DEVICE; Charles F. Kettering, Dayton, Ohio. App. filed March 5, 1915. Facilitates the starting of engines of the non-self-starting type, etc.

1,231,268. CIRCUIT CONTROLLER; George C. Knapp, Chicago, Ill. App. filed Oct. 29, 1914. Relates to sockets or connectors for controlling the light of one or more incandescent lamps.

1,231,271. ELECTROMAGNETIC SWITCH; Franz Krantz, Stuttgart, Germany. App. filed Dec. 17, 1914. Provides an intimate engagement of low electrical resistance between the contacts upon establishing the circuit and exerts uniform pressure on the two poles.

1,231,273. INSULATING CAP FOR CONDUITS; Charles M. Lefkowitz, New York, N. Y. App. filed June 24, 1916. Comprises a perforated insulating cap having a recess to receive an end of the conduit, armored conductor or the like.

1,231,319. AUTOMATIC TELEPHONE SYSTEM; Charles S. Winston, Chicago, Ill. App. filed Sept. 17, 1913. Relates to improved means for reversing the battery flow over a calling telephone line upon response being received from a called substation.

1,231,335. ELECTRIC INCANDESCENT LAMP; John H. Dale, New York, N. Y. App. filed March 5, 1915. Relates to electric incandescent lamps and especially to the "nitrogen" lamp.

1,231,364. INCLOSED SAFETY FUSE; Henry M. Huxley, Evanston, Ill. App. filed May 3, 1915. Relates to cartridge fuses for the protection of electrical circuits, and particularly the "knife-blade" type.

1,231,367. ELECTRIC SWITCH; Ernest H. Jacobs, Schenectady, N. Y. App. filed May 23, 1914. Relates to the mechanism for actuating electric switches.

1,231,379. SWIVEL ATTACHMENT PLUG; Otto Kessler, Passaic, N. J. App. filed July 27, 1916. Permits freedom of swiveling movement with maintenance of perfect electric contact between the elements.

1,231,412. ELECTROMAGNETIC SWITCH; Edwin J. Murphy, Schenectady, N. Y. App. filed July 13, 1914. Provides a device in which the contacts cannot stick or freeze together and at the same time are spring-pressed apart.

1,231,416. MANUFACTURE OF INCANDESCENT LAMPS; Harry H. Needham, East Orange, N. J. App. filed Jan. 19, 1916. Provides a method by which a substance in the bulb can be protected from the effects of variations of pressure and temperature of the bulb contents.

1,231,417. ATTACHMENT-PLUG RECEPTACLE; Arvid H. Nero, New Britain, Conn. App. filed March 22, 1917. Relates particularly to the contacts.

1,231,456. ELECTRIC-LAMP SOCKET; George B. Thomas, Bridgeport, Conn. App. filed Jan. 20, 1916. Provides an improved holding device and receiving contacts for lamps of the Edi-Swan type.

1,231,489. SPARK GAP; Charles E. Campbell, Lynn, Mass. App. filed April 24, 1916. Improvements.

1,231,494. NEON TUBE; Georges Claude, Boulogne-sur-Seine, France. App. filed June 16, 1915. Overcomes a defect in neon tubes, owing to the excessive amount of red contained therein when employed for lighting purposes.

1,231,516. PHANTOM LOADING COIL; William Fondiller, New York, N. Y. App. filed May 1, 1916. Relates to phantom circuit loading in telephony.

1,231,528. GENERATOR FOR HIGH-FREQUENCY CURRENTS; Peder O. Pedersen, Frederiksburg, Denmark. App. filed March 24, 1913. Provides a generator with which frequencies higher than those previously obtained can be procured.

1,231,537. CALL SYSTEM; Thomas J. Murphy and Edward Miller, Rochester, N. Y. App. filed July 17, 1916. Indicates upon calling whether the party called is in position to receive the call.

Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN

Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, JULY 14, 1917

No. 2

Co-ordination in Power

CONSERVATION of invested capital receives new significance because of the necessary enormous outlay for war. Studied economy in the use of existing property and in additional investment is the demand of war. It does not meet the problem to cut off all expenditure ruthlessly; a higher, more effective quality of policy is needed. The question is: "How shall growing demand for energy be met by broad methods and far-reaching plans? How shall we assure the most efficient employment of every existing resource?" In California both State commission and private operators are co-operating in a plan for co-ordinating power facilities to give maximum service at minimum waste. The Massachusetts commission, deeply impressed by the same sound principle, authorizes transmission-line connection between the Fall River company and the New England Power Company. There is clear prophecy in its words: "High-tension transmission . . . has made possible and desirable that the developed sources of power, both steam and hydroelectric . . . shall be so co-ordinated by connecting lines as to result in utilizing all plants more uniformly and in the end in substantial economies in investment and operation." A local issue was involved, but the commission sees in it an opportunity to form precedents which are of highly important economic influence. Co-ordination of power-generating forces is true efficiency.

Determination of Alternator Regulation

THE problem of the determination of alternator regulation, at any assigned load and power factor, from data secured by preliminary tests, is a very difficult one, when a fairly high degree of precision is aimed at. The conditions are complicated. There is a certain amount of reactance in the armature windings, which depends to some extent upon the strength of the armature current. There is also a certain amount of armature reaction, which tends to affect the magnetomotive force developed by the field excitation. This varies with the phase and also to some extent with the strength of the armature current. Finally, there is also the resistance drop in the armature, which is ordinarily small by comparison with the effects just mentioned.

There are several methods of computation in regular use for arriving at the regulation, based upon characteristics of the alternator obtained from regular tests. One of the best is the Potier method, which takes each of the three component effects into separate account. The full development of the method leads to a somewhat

lengthy formula. We print this week a graphical method, by A. S. Blatterman, which is swift in application, and which virtually follows the Potier method of computation with some simplification permitted in a graphical solution. The alternator is tested for short-circuit and open-circuit characteristics. From the known load and power factor, lines are drawn on the diagram of characteristics, whereby the excitation required may be immediately read off. The method has the limitations in precision to which all graphical processes are exposed, but the problem, at best, does not at present permit of a high degree of precision being reached.

Characteristics of Iron Wire for Transmission

WAR is a condition which necessarily interferes with normal conditions of supply in commodities. It is useless to cavil or repine at war prices. There would be no credit in being optimistic if the turning of a nation to warfare left all industry and prices in the ordinary status quo ante bellum. The demands for the electrically conducting metals tend to raise their prices to economically unattainable values. If copper and aluminum are not at present available for conductors, the question arises of what can be found during the interim to meet immediate needs in electric transmission.

In his article appearing in this week's Digest Prof. L. W. W. Morrow describes some comparative alternating-current tests of steel conductors arranged in pairs on a pole line. The losses in copper or in aluminum wires, if all the joints are good, depend only on the cross-section at a given temperature, and can be predicted with all desirable precision from the known resistivity of the material. In the case of iron or steel, however, the skin effect is very appreciable at ordinary frequencies, and depends to some extent upon the strength of alternating current carried. This is for the reason that the skin effect depends upon the permeability of the wire, as well as upon its size and conductivity, at the frequency employed. The permeability, in its turn, depends upon the magnetic force in and at the surface of the wire, which force is in proportion to the current carried.

The amount of power wasted in such steel wires, when carrying the strengths of alternating current ordinarily used in transmission, is very considerable. The only physical compensation lies in the greater tensile strength of steel in comparison with copper. This permits of placing the points of support further apart. In cases where steel conductors are decided upon there is a

strong temptation to take the benefit of this mechanical advantage. On the other hand, it would prevent the replacement of the steel by copper wires at more normal prices in years to come.

Magnetic-Mechanical Testing

UNDER existing conditions, iron and steel material which is chemically correct but deficient physically must be accepted for lack of a proper test which is applicable to the material as a whole. Mechanical testing, in tension, for example, hardness measurements, and microscopic examination, while of very great utility in many cases, frequently fail to define satisfactorily the state of a given material, even where it is commercially practicable to apply them in extenso. Every operation, whether thermal or mechanical, which induces a change in the working performance of a given iron or steel product appears to bring about a change in the magnetic characteristics, which is invariably repeated under similar circumstances. This is strikingly so when such operations produce changes in crystalline structure.

The presence of inhomogeneities or flaws, as in steel rails, for example—in which field considerable work has been done—results in changes in magnetic characteristics either because there is an actual reduction of the quantity of metal in certain portions of the section or because the physical properties are modified owing to strains or foreign inclusions. A future application of the homogeneity test which appears to be most promising is in the examination of the component parts of the large guns used in army and naval operations, as well as in car and locomotive axles, automobile axles, crank shafts, bridge members and aeroplane stay wires. In this latter connection it is important to point out that the local straining of steel wire beyond the elastic limit, in accidental bending, produces unfavorable changes in the mechanical properties which are accompanied by pronounced magnetic changes. Such magnetic changes are readily located. Excessive cold working of material, as well as the presence of gases, as in oxidized steel, effects changes of the magnetic characteristics, as has been pointed out by workers in these lines. Iron or steel which is to be enameled must be free from deleterious gases to be successfully coated.

One of the principal applications of magnetic-mechanical testing lies in the realm of steel, and especially high-speed steel, which is subjected to thermal treatment previous to use. It is essential here to know, before expensive processes are carried out, if the raw material is in a favorable condition, as the result of proper handling in the mill or forging plant, to respond to an established routine heat treatment. It is equally important to be able to determine, subsequent to heat treatment, if the definite thermal procedure has been faithfully carried out. Variations in thermal handling will unfailingly result in variations in magnetic characteristics. The Bureau of Standards has demonstrated the applicability and the precision of the Fahy permeameter for all such work.

Office Lighting

LIGHTING a space used for clerical work is one of the most troublesome problems with which the illuminating engineer comes in contact. We believe our readers will profit from Professor Clewell's discussion of the matter in our current issue. Office buildings involve some very curious differences of condition on account of the wide variety of work carried on, the great differences in the natural lighting attainable and the wide variations in height of rooms and interior finish. Again, the subdivision into various working spaces often involves serious difficulties even in large areas subdivided only by glass partitions and with ample window space. Good lighting looks easy, but is sometimes extremely difficult. On the other hand, one finds big office rooms in which there are no partitions properly so called, but which are cut up so badly by barricades of file cases and the like that ordinary arrangements of lighting are peculiarly inefficient. In no branch of illumination is the need of studying the detail of the actual arrangement of things greater. The typical small office in an office building is relatively easy. It is in the larger areas that such great diversity exists.

Professor Clewell points out in some detail the nature of the lighting systems used for these office spaces. We do not fully agree with him that semi-indirect lighting is inferior to straight indirect lighting for general office work. His contention, however, that many semi-indirect fixtures when used with gas-filled lamps present too great intrinsic brilliancy is absolutely sound, and in it we heartily concur. Certain types of so-called semi-indirect fixtures are on the market in which the intrinsic brilliancy of the glassware is pushed so high that from the standpoint of ocular hygiene the system is quite inadmissible. The trouble comes from a somewhat natural tendency to decrease the area of the diffusing surfaces in order to make a smaller fixture and save expense, using, for example, a 200-watt lamp in a fixture which really is suitable for nothing above 100 watts, and so on. In a few cases direct fixtures are entirely adequate and give admirable results. Such instances are those in which the diffusing glassware of the shade is big enough and deeply skirted enough to protect the eye fully from the light of the filament itself. With this provision met, direct units often serve well for providing a groundwork of general illumination in the instances where local conditions compel the somewhat free use of desk lamps.

In principle the illuminating engineer eschews desk lamps. A general illumination by one of the three common systems seems to be more logical and to give a far closer approximation to the fine diffusion of light one would naturally wish to see. Nevertheless it is a fact which is driven home to every man of large experience that there are many cases in which the conditions are best met by considerable use of desk lamps of a suitable character, for the simple reason that from those only can adequate light be given at certain points without an enormous waste of energy. Any one who has dealt extensively with those in charge of clerical rooms

realizes that as a rule they feel that the heavens had better fall at once and engulf the whole establishment than that any desk should be changed from the position that it now occupies. They say with some flavor of superciliousness that the illuminating engineer is supposed to be able to furnish general illumination for that room, and they do not see why they should shift the furniture to please him.

An analogous problem is the room used for book-keeping, often a large, clear space with comparatively light finish, in which one would suppose that indirect or semi-indirect fixtures would do admirable work. So they would if it were not the habit in many establishments to have the clerks working over their finely ruled columns with a crow-quill pen dipped in ink which at the start flows sickly blue. Here again the desk lamp sometimes has to come into play. When used it should never be of high power, and it should always be thoroughly screened either by frosting the bulb in a diffusing reflector or by covering the mouth of the reflector itself with a diffusing medium. With either the semi-indirect or indirect systems very admirable results can be obtained where special problems do not confront one; but they turn up oftener than one would think, and it is not putting the case too strongly to say that the successful lighting of an office space requires more patient and careful study of local conditions than almost any other branch of the art.

Combining Gas and Coal

THOSE of our readers who deal with steam plants will find profitable food for thought in Alex W. Morgan's paper descriptive of recent experiments in firing boilers with a combination of coal and fuel gas. The work was done in the plant of the Toledo Railways & Light Company, and its immediate cause was the necessity of greater boiler output at once to meet the growing demands for energy. In this case the gas was not used as a substitute for coal except at certain times, but employed to force the output of the boilers by actually adding the gas combustion to that of the coal in the furnace. A cheap supply of good fuel gas was available from a large by-product coke oven.

Somewhat extensive experiments were made to find the best way of utilizing the new fuel, resulting in the

combination burning which Mr. Morgan describes. In the earlier work gas alone was burned under the boilers with only moderate changes in the furnace arrangement other than the addition of broken firebrick over the grate. It was found that the arrangement worked well but would not permit the boilers to be forced as much as was desirable. A Dutch oven was then tried on a boiler, and it increased the rating considerably, without, however, reaching the results which were thought desirable. Finally a boiler was equipped as described in Mr. Morgan's paper with gas burners shooting the gas directly down upon the burning coal, itself fed forward by a chain grate. This made it possible to push the boiler output more than 30 per cent above the figure attainable by coal alone, and with a good degree of economy. The flue gas was slightly hotter than with coal alone; the unburned residuum in the ash was slightly greater, both results being probably due to a somewhat inadequate supply of air for the needs of the combined fuel; for all the air supplied was that passing up through the fire. The efficiency of the boiler and furnace using the combination was only a shade higher than with coal alone. All this probably merely shows that there was a slight loss of relative efficiency in forcing the output to the extent desired. With gas alone, at such output as was feasible with gas, the efficiency was better than with either coal or the combination.

Of course, the actual economics of the situation were controlled by the relative cost of gas and coal, but since the price of the latter is very much on the up grade it seems reasonably certain that in many instances it would prove more economical to use gas or gas and coal together than the latter exclusively. The particular point in the paper is, however, the great benefit of the expedient of pushing the output of boilers already installed to the point demanded by a growing peak load. In these days of extraordinary industrial growth central stations are likely to have large calls for increased output. Deliveries on boilers are slow, and if a supply of cheap gas is available, its addition to the coal fires already burning gives added output enough to tide over many a serious emergency. The regions in which the device can be successfully used are, of course, comparatively limited, but they are mostly regions in which manufacturing plants are daily springing up and requiring power.

THE time is not far distant when the type of high-tension apparatus requiring protection against the weather will have disappeared entirely. Meanwhile existing arrangements in outdoor stations should be improved and equipment should be modified so that the expense of constructing, operating and maintaining stations in serviceable condition will be minimized. Particular attention should be given to avoiding awkward wiring, providing for extensions and eliminating operating hazards. In the next issue of the ELECTRICAL WORLD an article will be presented in which these points as well as others will be discussed. The eighth installment of Professor Clewell's

The Coming Issues

series on lighting will also appear, the subject being lighting in iron and steel mills. Among other things, attention will be called to methods of overcoming such obstacles to effective illumination as high roofs and dust-pervaded atmosphere. In the fourth issue of July there will be discussed in a symposium the advisability of furnishing sales and other employees with appliances free of cost. It has been generally felt that those selling appliances should be familiar with their working through a personal knowledge gained from experience. Reports which have been received from a number of companies show very definite tendencies.

Combination Coal and Gas Firing

Methods Used to Burn Coal and Coke-Oven Gas Simultaneously Under Same Boilers—Results of Tests to Determine Efficiency and Adaptability of Confined Fuel

BY ALEX W. MORGAN

BECAUSE the addition of more boilers in its Water Street station was inadvisable with a new station on another site in prospect, and because the increasing load demanded immediate additional plant output, the Toledo Railways & Light Company equipped some of the boilers already in its Water

the same furnace proves most economical. The company has therefore equipped a large number of its boilers for the combination operation.

ARRANGEMENTS FOR BURNING GAS ALONE

At first gas alone was burned under six type S 475-hp. Stirling boilers equipped with McKinzie grates, which, owing to limited area, could not be operated much above rating. In these furnaces the grates were partly covered with asbestos. A space 12 in. (30.4 cm.) wide was left uncovered for a secondary air port. The front of this air port was 40 in. (101.6 cm.) from the burner tips and flush with the nose block of the ignition arch. Over the entire grate surface was spread firebrick crushed to the size of an egg, the layer varying in thickness from about 2½ in. (6.4 cm.) at the burner tips to 7 in. (17.8 cm.) at the bridge wall. This covering deflected the flame and prevented it from striking the tubes directly.

The burner consisted of a 6-in. (15.2-cm.) air mixer, 14 in. (35.4 cm.) long, swedged down to 5 in. (12.7 cm.) at the outlet. This arrangement was successful for operating up to 175 per cent of rating, but would not do for higher boiler output. It was not so flexible as was desired. To increase the overload that might be carried the grates were removed and one boiler was equipped with a Dutch oven. It was possible to get 263 per cent rating from this unit. The installation, however, was inflexible.

To burn the gas directly above the coal and in combination with it, a special tile with a 2.5-in. (6.4-cm.) hole was developed and set so that the gas when introduced into the firebox was directed down against the

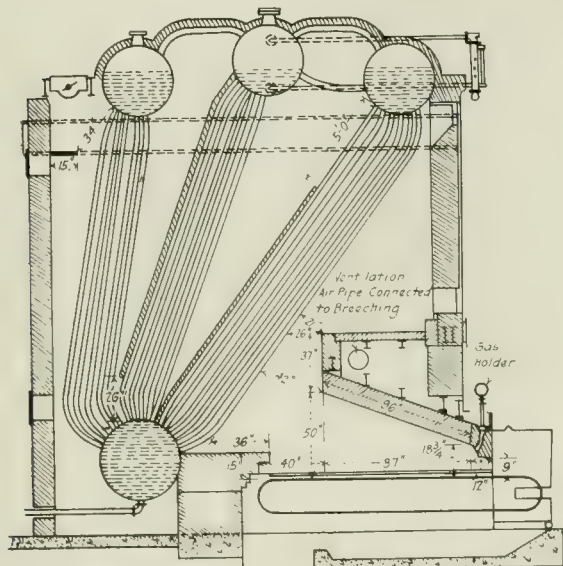


FIG. 1—THE TYPE OF ARCH AND BAFFLE CONSTRUCTION MADE USE OF IN TEST BOILER

Street station with apparatus for burning coal and coke-oven gas at the same time. By this expedient it was possible with the existing equipment to increase the boiler output economically and thus to care for the growing load. Particular interest attaches itself to the results of this venture, because of the present high price of coal and because of the applicability of the plan to other plants which have producer gas or other suitable gas available.

CONDITIONS INFLUENCING OPERATION

The conditions which made this solution of the problem possible were as follows: The Toledo Furnace Company installed a by-product coke oven and contracted to sell the entire gas output to the Atlas Chemical Company. The latter concern under its contract is receiving about 9,000,000 cu. ft. (247,208 cu. m.) of rich gas each twenty-four hours in excess of its needs. The chemical company needs only the lean gas for its operations. Therefore the rich gas, which has an average heating value of about 600 B.t.u. per cubic foot (21,429 B.t.u. per cu. m.) and which is the "first-run gas" from the ovens, is being delivered to the Toledo Railways & Light Company through a 20-in. (50.8-cm.) main which was approximately 4 miles (6.4 km.) long.

Experiments were tried with several different methods of combining gas and coal firing, but it is now thought that burning coal and gas at the same time in

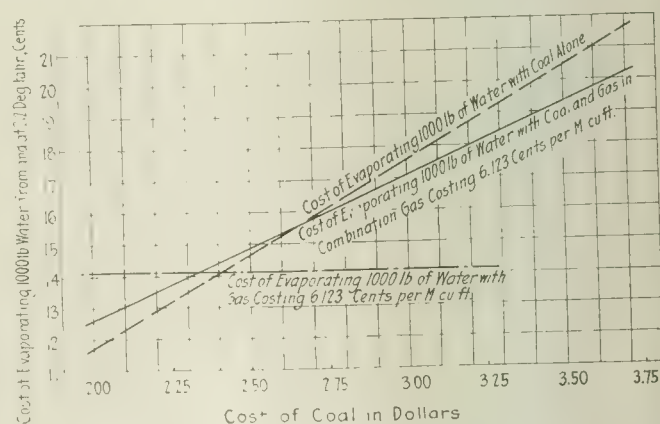
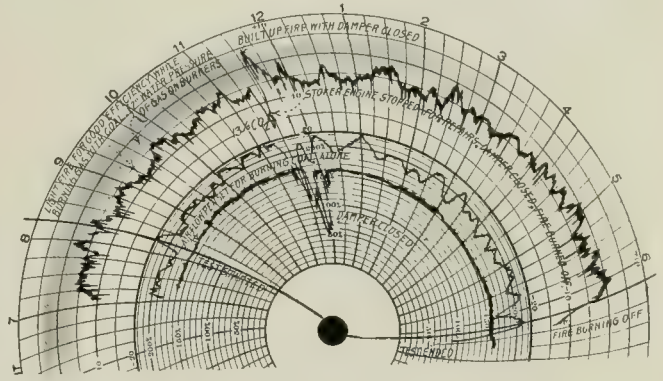


FIG. 2—CURVES SHOWING POINTS AT WHICH COMBINATION COAL AND GAS FIRING IS ECONOMICAL

coal. This tile was placed in the ignition arch next to the grate. All primary air was shut off and the gas in the firebox had to depend upon secondary air coming through the fuel bed for its combustion.

After these preliminary experiments had been carried out arrangements were made for conducting tests to determine accurately the performance of the newly

An analysis of the results obtained shows that the



amount of coal burned per hour with the combination firing was practically the same as the amount burned when coal alone was fired. Therefore the additional rating developed was the result of the introduction of gas in the furnace. The rating developed by the gas and coal in combination was 337 boiler-hp., or an additional rating of 31 per cent over that obtained with coal alone.

The temperature of flue gas leaving the boiler was 43.4 deg. Fahr. (6.3 deg. C.) higher with the combination than with coal alone. The stack temperature was considered to be too high on all tests, and it is thought that it could be reduced by changing the baffling from a three-pass to a four-pass arrangement. It was found that better results came from getting a lower stack temperature with the combination than from coal alone. The consequent reduction in draft in the uptake amounted to 10.9 per cent and over the fuel bed to 20.7 per cent.

Not much better efficiency of the boiler, furnace and grate was obtained with the combination fuel than with coal alone. The efficiency with gas alone was 11.35 per cent higher than with either the combination fuel or coal alone. The efficiency of the boiler and the furnace with the combination fuel was 2.8 per cent higher than with coal alone, and the efficiency with gas alone was 6.85 per cent higher than with coal alone.

The amount of combustible by weight in the ash was greater with the combination than with coal alone. The increase in this combustible amounted to 2.9 per cent of the total coal supplied to the furnace. Expressed in per cent of increase of combustible in the ash, this amounts to an increase of 33 per cent. The speed of the chain grate was only increased 4.52 per cent, so that the increase in combustible must be charged

	Coal* Alone	Coal and Gas*	Gas** Alone
Pounds of coal used per hour	4,374	4,426.3	
Pounds of equivalent coal used per hour		1,278.5	2,006
Equivalent pounds coal burned per square foot of grate surface	37.8	49.4	17.45
Cubic feet of gas burned per hour		29,163.0	47,785.00
Cubic feet of gas burned per pound of dry coal		6.61	
Per cent of ash and refuse to total coal	18.89	21.43	
Per cent of rating developed	162.25	213.	88.7
Temperature of flue gases leaving boiler (in deg. Fahr.)	640.1	683.5	516.6
Draft over fire	0.363	0.2875	0.0316
Draft in uptake under damper	0.920	0.820	0.0573
Efficiency of boiler grate and furnace in per cent.	61.4	61.6	72.95
Efficiency of boiler and furnace in per cent.	66.1	68.9	72.95
Pounds of combustible in ash	385.7	517.9	
Per cent combustible in ash to total coal burned by weight	8.8	11.7	
Speed of chain in inches per minute	6.64	6.94	
Cost to produce 1000 lb. of steam from and at 212 deg. Fahr. (in cents)	11.65	12.58	14.10
HEAT BALANCE—Per Cent:			
CO ₂ in flue gas	10.43	12.37	6.75
O in flue gas	10.50	4.85	7.85
N in flue gas	79.07	82.78	85.40
Over ventilation	102.0	29.1	53.5
Heat absorbed by boiler	61.38	61.62	72.95
Loss by moisture in coal	0.34	0.30	
Loss by burning hydrogen in coal and gas	4.13	6.16	12.58
Heat lost by dry chimney gases	16.87	13.72	9.59
Heat lost by unconsumed carbon in ash	9.50	9.76	
Heat lost by apron water	0.72	0.59	0.15
Heat unaccounted and unaccounted-for losses	7.06	7.85	4.73

The object of the series of tests conducted was to

against inability to burn owing to the introduction of the gas above the coal. However, taking into account the heat supplied by the gas as well as that supplied by the coal, the percentage of total heat lost by unconsumed carbon in the ash was practically the same for the combination as for coal alone, amounting to 9.76 per cent for the former and 9.50 per cent for the latter.

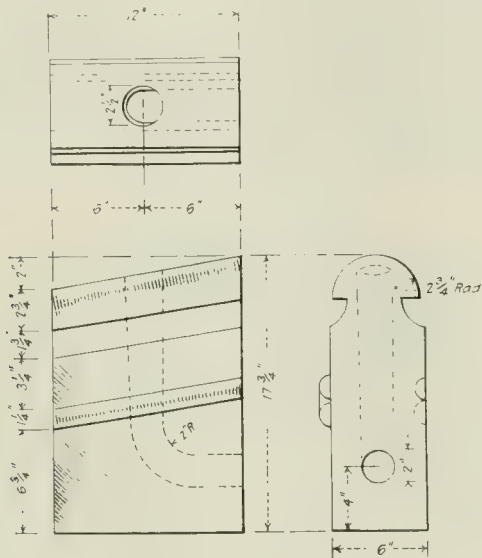


FIG. 5—SPECIAL GAS NOZZLE TILE USED TO CONDUCT GAS INTO FIRE BOX OVER COAL

It was considered that this loss was too high, and steps were taken to effect a reduction in it.

Owing to the low ultimate CO_2 (10.8 per cent) obtained by complete combustion of coke-oven gas, the ultimate CO_2 for combination of coal and gas will be lower than the ultimate for coal (20.9 per cent). When 6.11 cu. ft. (0.172 cu. m.) of gas is burned in addition to each pound (0.45 kg.) of coal, the ultimate is 16.9 per cent, while 7.11 cu. ft. to each pound (0.046 cu. m. per kg.) of coal is 15.4 per cent.

CONCLUSIONS ARRIVED AT

From the foregoing results it was concluded that the cost of evaporating 1000 lb. (45.4 kg.) of water from and at 212 deg. Fahr. (100 deg. C.) is 8 per cent higher for the combination fuel than for coal alone, and 21 per cent higher for gas alone than with coal alone. These figures were, of course, based on the cost of fuel as it was at the time of the tests; that is, November, 1916. Nevertheless, it was calculated that the added capacity with the combination fuel was obtained at 50 per cent less investment than would have been required with the coal.

Viewed from an operating standpoint, it will be observed that the company obtained 31 per cent added capacity with an 8 per cent increase in the cost of producing a pound (0.45 kg.) of steam. With the increased cost of coal becoming operative, this increase in cost over the cost of coal to produce a pound (0.45 kg.) of steam would be offset (Fig. 2). With these facts taken into consideration, it was believed that this method of obtaining increased rating is ideal where coke-oven gas or other gas is available at a reasonable price, and where a plant needs more boiler capacity and yet has not enough room to permit of the installation of additional boilers.

METHODS OF MAKING TEMPORARY MOTOR REPAIRS

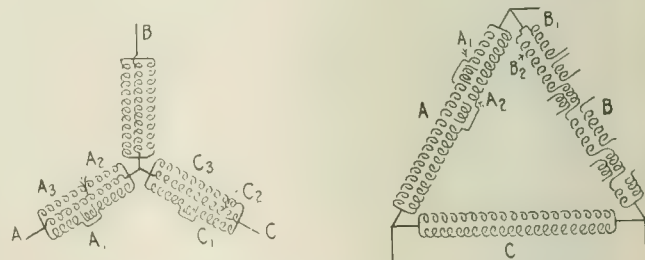
How Motors with Burnt-Out Coils Can Be Made to Give Temporary Service and Thus Prevent Large Loss in Production

By H. L. HAYES

While most large industrial plants carry spare motors for use in place of those that are burned out, many small plants do not always have spare units on hand, and even when they have it frequently takes a long time to install them. Since only a few coils rather than the entire motor usually burn out when a motor "breaks down," the machine can be kept running in many cases until it is convenient to make permanent repairs by cutting out the defective coils.

With small-size, low-voltage motors, which usually have single or two-circuit Y or delta windings, this does not involve much difficulty. Unbalanced current may be drawn from the line when coils are cut out, but as a rule this will not seriously affect the power system. It is simply a case of whether the motor can carry its load and whether the winding can stand the increased current. If the motor is not too heavily loaded, it is possible to cut out quite a large number of coils and still operate the motor. If a motor has a large number of coils, with only a few turns per coil, several coils per phase can be cut out, but in motors having comparatively few coils, with a large number of turns per coil, this cannot always be done.

Complications may arise when attempting to apply this emergency repair scheme to large motors which usually have multiple-circuit windings because cutting out a coil causes local currents. In such a case if coils are cut out of one circuit it is sometimes necessary to cut out coils in all circuits which are in parallel with this particular phase. While this change may leave the phases unbalanced with relation to each other, the individual circuits of the phases will be equal. For instance, consider Fig. 1, in which is shown a three-circuit Y winding with coils cut out of A-1 and C-1 circuits in phases A and C. In a winding like this, circuit A-1 and C-1 may be completely cut out, leaving only two circuits for these two phases, but this would reduce the capacity of the motor a great deal. If, however, an equal number of coils were cut out of the par-



FIGS. 1 AND 2—METHOD OF REPAIRING THREE-CIRCUIT Y WINDING AND TWO-CIRCUIT DELTA WINDING

allel circuits, the motor may carry practically its entire rated load.

The changing of the arrangement of connections, such as converting a two-circuit Y connection into a single-current delta type, may also often permit emergency operation. The different schemes outlined reduce the capacity of the motor, but if it is carrying a variable load, which is often the case, continued operation may

be maintained because even though the winding will heat up on the peaks, it can cool down during the light-load periods.

Different applications of these principles have been made in a New England paper mill, where 25-cycle, 440-volt, three-phase motors are used and shutdown of one motor often means a large loss of production. Prior to cutting out coils or changing connections, tests



FIGS. 3 AND 4—BURNT-OUT DOUBLE-CIRCUIT Y WINDING RECONNECTED INTO SINGLE-CIRCUIT DELTA WINDING

are made to detect open circuits, grounds or short-circuits between phases. This is done with an ordinary lamp extension having one wire open-circuited and connected with a 110-volt circuit. Although 110 volts can be used to indicate dead grounds or short circuits, and is relatively easy to handle, it is better to use the full motor voltage with a bank of lamps in series to make the final tests, because it frequently happens that 110 volts will not detect partial defects that the higher voltage will bring out.

With a motor having a single-circuit winding it is a simple process to disconnect the separate phases, but with multiple connections this is liable to involve considerable work. It is therefore much quicker to try operating the motor before disconnecting any leads, noting as nearly as possible where it flashes. The particular section which appears defective may then be disconnected and tested for faulty coils. The objection to this method is that more coils are liable to be damaged with every flash, but if time available for repair is limited such procedure permits a saving of several hours. Furthermore, small fuses can be connected into the circuit for the purpose of limiting the short-circuit current.

Following are a few examples of how motors have been kept running which would ordinarily have had to

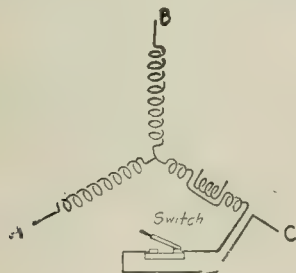


FIG. 5—DAMAGED Y WINDING CONNECTED FOR THREE-PHASE STARTING BUT SINGLE-PHASE OPERATION

be taken out of service for rewinding. A 50-hp. motor having a two-circuit delta winding broke down, spoiling a number of coils. On examination it was found, as shown in Fig. 2, that no coils in phase C were damaged. However, circuit B-1 of phase B was badly burned, so that it could not be left in circuit. A few of its undamaged coils were connected with parts of circuit B-2 to take the place of coils burned out in the latter, thus

making nearly a complete single circuit for this phase. As several coils in the A-2 circuit and only one coil in A-1 circuit were damaged, enough coils were cut out of A-1 to even it up with A-2. This motor would not have carried a heavy continuous load, but it was used for over two months during the cold weather to run a circular saw.

Another 50-hp. motor having a two-circuit winding broke down, injuring only two coils. With only these two coils cut out the winding heated up in a few minutes, though running light. The coils in this motor had an exceptionally large number of turns per coil and comparatively few coils per phase. Instead of trying this motor with coils cut out of other circuits, it was changed into a single-circuit delta winding. Thus changed, the motor was incapable of developing its rated power, but it did not have to carry a continuous load. The original and final connections with coils cut out are shown in Figs. 3 and 4.

In another case a motor with single-circuit Y windings, running a small pump, broke down, injuring one coil in one leg and several coils in another. Cutting out the injured coils permitted more than full-load current in one phase even with the motor running light. Ordinarily a small motor can easily be replaced, but there was no spare motor available at this time. Since this motor could handle the load when it was running single-phase, a switch was connected in series with the weak phase to permit starting three-phase. After the motor was up to speed, the switch was opened and the motor left running single-phase. The final connections are shown in Fig. 5.

Rotors cause comparatively little trouble, but one case occurred at this paper mill where a coil-wound rotor rubbed on the stator and injured a number of coils. The bars which formed the coils in this winding had been bent after they were put into the slots, so it was impracticable to take them out for retaping. Since no new bars were available, the bad bars were disconnected and replaced by ordinary wire cables passed through the arms of the spider instead of through the slots.

The cases mentioned illustrate that a motor is not necessarily "down and out" because it "shoots fire." While it is surprising how badly a motor may be damaged and yet be capable of carrying its load, it is not advisable to run motors in such condition any longer than necessary, as there is a loss of efficiency in both motor and line.

Progress of Electric Taxicabs in St. Louis and Elsewhere

The most recent installation of electric taxicabs, which are successful in Detroit, is in St. Louis, where six cars make up the nucleus of a fleet. The Electric Vehicle Section, N. E. L. A., is advised that an electric taxicab company is now being organized in Mexico City. Aside from the generally appreciated virtues of the electric taxicab, it is cosmopolitan, for it is also found in successful operation in Shanghai, China. Progress is being made in the matter of the initial fleet of about 500 electric taxicabs of the most advanced type, which it is intended to put into operation in New York City in the near future.

Illumination of Business Office Spaces

Lighting Requirements and Relative Advantages of Direct, Indirect and Semi-Indirect Lighting—Some Typical Examples of Different Kinds of Equipment in Old and New Buildings

BY C. E. CLEWELL

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SUMMARY.—This article reviews modern methods of illuminating offices, board rooms, and other spaces in office buildings. Emphasis is placed upon the illuminating qualities which are essential for the exacting work of such rooms, chief of which are quantity, distribution and freedom from glare. An example of a change-over from very inferior lighting to a much improved condition without change in the position of outlets is explained as typical of improvements which may be made in many older office buildings where antiquated fixtures and methods are still in use. The three present accepted schemes of direct, semi-indirect and indirect illumination are contrasted and outlined on a basis of actual installations. The effect of the lighting conditions on the occupants of offices is very important as the salaries in such buildings often amount to very large values per unit of floor area. Several special problems in the lighting of office equipment, such as filing racks and adding machines, are illustrated.

IN OFFICE buildings constructed ten or more years ago it is not uncommon to find antiquated lighting fixtures still in use which are not only totally inadequate for the needs of the work but for which there is no longer any excuse with the vastly improved methods of illumination now available. A good example of a recent change-over from such an old scheme is shown by Figs. 1 and 2. The lateral windows at one end of the office give a poor distribution of daylight during a large part of the day. Each of the old fixtures was originally equipped with three carbon-filament lamps. Later tungsten lamps were substituted. Since the entire lamps were visible from the floor the substitution of tungsten lamps greatly increased the glare.

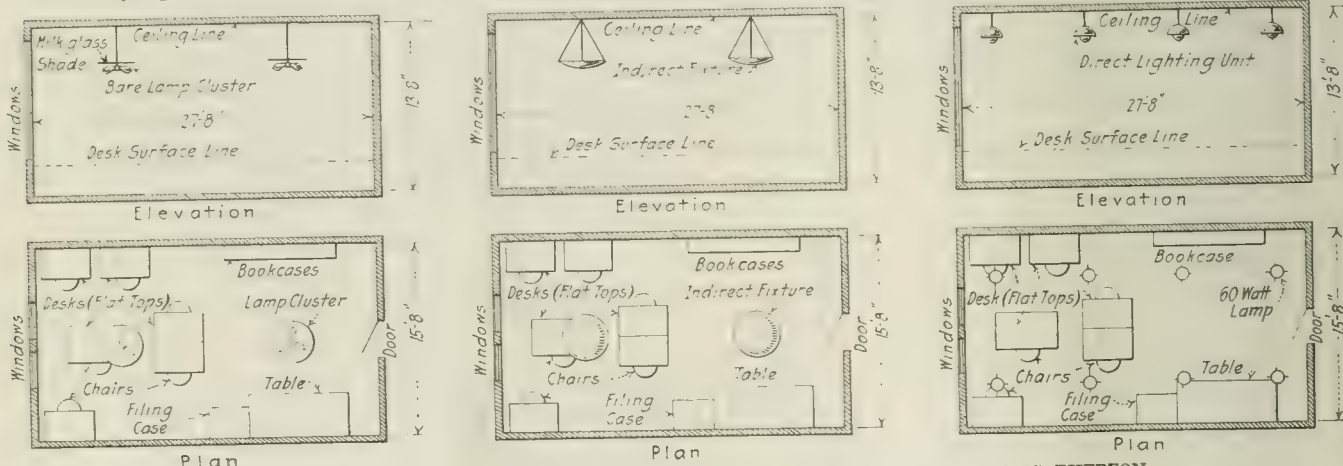
In studying this office preparatory to changing the

ceiling outlets. With these it is possible to work comfortably at the wall desks even on dark days and at night, the effect, however, being somewhat better at night than on dark days.

This example may be taken as typical of many cases in older buildings, and it shows that great improvements may often be made in the illumination by a careful selection of modern fixtures even with a poor arrangement of outlets as far as a direct-lighting system is concerned. With new buildings, where the outlets may be installed according to present ideas, direct lighting might be used in an office like that shown in Fig. 1 by arranging the outlets as shown in Fig. 3. Either of the schemes shown by Figs. 2 and 3 is vastly superior to that indicated by Fig. 1.

RELATIVE MERITS OF DIRECT, SEMI-INDIRECT AND INDIRECT SYSTEMS

A great deal of discussion has taken place on the relative merits of the three principal methods now used for the illumination of offices—that is to say, the direct, the semi-indirect and the indirect methods. In some cases the occupants of offices have been questioned extensively in an attempt to determine on a basis of the eye which method is fundamentally to be preferred. From the basis solely of effective lumens per watt on the desk surfaces the direct system is, of course, superior, but the exacting nature of much office work and the tax it places on eyesight make the factors of eye fatigue and eye comfort much more important than the mere efficiency of the lighting.



FIGS. 1, 2 AND 3—OLD METHOD OF LIGHTING OFFICES AND TWO IMPROVEMENTS THEREON

lighting system it was apparent that work was almost impossible on desks facing the wall on very dark days because of the poor distribution of the illumination and also owing to the shadows cast on the papers by persons sitting at the desks. To rearrange the outlets was difficult on account of the type of filled-in ceiling construction, so indirect fixtures were substituted for the old direct-lighting units and served from the original

Extended observation in actual cases leads to the conclusion that with the greatly increased concentration of light in very small lamp filaments there is little room for controversy in the choice of a system. With direct lighting the difficulty of completely inclosing the filament of tungsten lamps, coupled with the general inadequacy of inclosing glassware in keeping the intrinsic brilliancy of its surfaces down to a reasonable value,

makes this system at the present time undesirable for many office spaces.

For similar reasons the glassware of many semi-indirect fixtures, particularly when used with nitrogen-filled lamps, is usually so bright that the glare in offices of ordinary height is both objectionable and harmful.

rect method gives a certain flatness to the illumination of large office spaces. The almost perfect uniformity of the illumination tends to tire the eye because of the absence of relatively dark spaces which may be used for relaxing the eye now and then. Where artificial light is required only at dark portions of the day, and per-



FIGS. 4, 5, 6, 7, 8 AND 9—DIFFERENT METHODS OF ILLUMINATING OFFICE SPACES

A—Direct-lighting system employing 100-watt gas-filled tungsten lamps with intensive satin-finish reflectors placed 11 ft. above floor and producing 10 ft.-candles intensity on desk surfaces with power demand of 1.4 watts per square foot. B—Direct lighting employing linolite system. C—Wall brackets equipped with linolite fixtures. D—Semi-indirect system employing 400-watt

gas-filled tungsten lamps and semi-indirect fixtures 12 ft. above floor and producing average intensity of 6.2 ft.-candles with a power consumption of 1.5 watts per square foot. E—Indirect system employing single-unit 100-watt vacuum-type tungsten lamps. Each bay has an area of 320 sq. ft.; the ceiling height is 15 ft. 9 in.; the distance between the top of the bowl and the ceiling

is 30 in. Each bay contains four units giving a power demand of 1.25 watts per square foot. F—Indirect system employing multiple-unit fixtures containing three 100-watt vacuum-type tungsten lamps per fixture. The bays measure 13 ft. 3 in. by 16 ft., and the ceilings are 13 ft. high. The distance between the top of the bowl and the ceiling is 36 in.

Therefore lighting from concealed sources has a number of superior features over either of the other two methods just referred to.

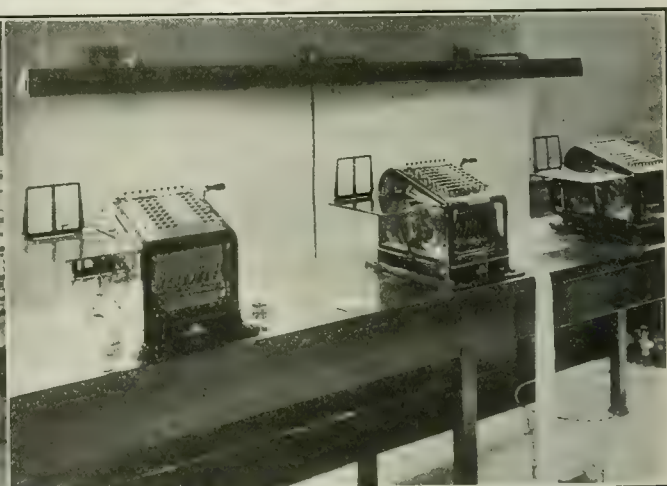
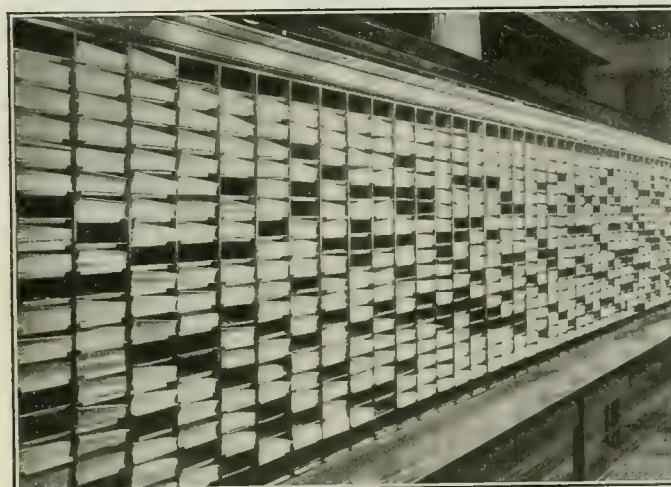
By virtually eliminating shadows, however, the indi-

haps very occasionally at night, the contrasts during day periods are rather more marked than at night, when the indirect units furnish the entire illumination. It is believed, therefore, on the average, that the in-

direct scheme of lighting, if properly installed, is by far superior to much of the direct or semi-indirect lighting at the present stage of its development.

There are, of course, special types of direct and semi-indirect fixtures in which the density of the glass is sufficient to prevent objectionable glare. Unfortunately, however, almost all of the strictly commercial units of these types are so objectionable for low ceilings, and particularly when used with the larger sizes of nitrogen-filled tungsten lamps, that their use must result in discomfort and ultimately in permanent injury to sight.

A step in the right direction has been made by the development of the so-called luminous bowl fixture, in which the superior qualities of the regular indirect system are realized. An under bowl serves to transmit a very low degree of light to the floor, thus rendering the light source "apparently" visible, and thus satisfying the taste of certain individuals who feel that completely to conceal the light source renders the system unnatural and cold in its appearance.



FIGS. 10 AND 11—SPECIAL CASES OF OFFICE ILLUMINATION. A TROUGH REFLECTOR IS EMPLOYED FOR LIGHTING THE WALL-TYPE FILING CASE IN FIG. 10. THE ADDING MACHINES IN FIG. 11 ARE ALSO ILLUMINATED BY A TROUGH-TYPE REFLECTOR

The influence which the mounting height has on the qualities of the lighting system should also be considered. What has just been said relative to the objectionable features of the direct and semi-indirect schemes applies fundamentally to the office of moderate ceiling heights, ranging, say, from 10 ft. to 14 ft. (3 m. to 4.2 m.). For interiors having considerably higher ceilings there is much less likelihood that the brilliancy of reflectors and translucent globes will be objectionable than when the equipment is nearer the floor and consequently more often in the line of vision. Moreover, the direct-lighting system, even with low ceilings, when small units are employed, may sometimes be made very effective and quite free from glare.

To illustrate the foregoing points, several actual installations will be considered. An excellent example of a well-designed direct-lighting system with small units is shown by Fig. 4. This night view in a large office demonstrates the almost perfect uniformity which may be realized by the proper selection of reflectors in conformity with spacing distances and mounting heights. The illumination intensity in this office is about 10 ft.-candles, a value considerably higher than average practice, but which is practicable with the new nitrogen-filled lamps with their lower energy consumption for given values of luminous flux.

Another interesting case of direct lighting is shown by Fig. 5, where "linolite" units are employed. The large extent of the light sources, backed by the white ceiling, tends to relieve the glare which would be produced were the candlepower all developed by a few concentrated lamp filaments. In Fig. 6 another application of the "linolite" unit is shown in a board room, where the effect is rendered very pleasing by the light-tinted walls and ceiling. As a general proposition, however, the use of wall brackets as suggested by this view is decidedly inferior to the overhead scheme.

Semi-indirect illumination with fairly large nitrogen-filled lamps is used in the office represented by Fig. 7. Here an intensity of more than 6 ft.-candles is produced from an installation of 1.5 watts per square foot, or more than four effective lumens per watt, which compares very favorably with the older vacuum tungsten lamps when used with efficient reflectors of the direct-lighting type. The light transmitted through the under bowls of the units used in this office tends to increase

shadow effects slightly. The contrasts thus afforded, coupled with the fact that the light source itself is visible through the medium of the bowls, gives this

DATA ON OFFICE LIGHTING SYSTEMS (TUNGSTEN LAMPS)

System	Rating of Lamp (Watts)	REFLECTOR OR FIXTURE		APPROXIMATE VALUES FOR			
		Style	Type	Ceiling Height (Ft. and In.)	Lamp Height (Ft. and In.)	Watts per Sq. Ft.	Intensity, Foot-Candles
General offices:							
Direct.....	60	Holophane	Intensive	10-0	9-6	1.44	3.9
Direct.....	60	Holophane	Concentrating	10-8	10-0	1.16	3.6
Direct.....	60	Holophane	Intensive	10-8	10-0	1.44	4.4
Direct.....	60	Holophane	Concentrating	10-8	10-0	1.48	3.2
Direct.....	60	Holophane	Intensive	10-9	10-0	1.00	4.5
Direct.....	60	Holophane	Intensive	10-9	10-0	1.73	3.7
Direct.....	60	Holophane	Concentrating	13-0	11-6	1.35	4.3
Direct.....	100	Holophane	Intensive	.....	11-0	1.40	10.0*
Semi-indirect.....	400	Monolux	No. 3320	.....	12-0	1.50	6.2†
Indirect.....	100	X-Ray	.....	15-9	13-3	1.25†
Factory offices:							
Direct.....	60	Opal	Intensive	8-9	8-0	1.33	4.3
Direct.....	60	Holophane	Intensive	9-0	8-6	1.83	2.9
Direct.....	60	Holophane	Concentrating	11-6	10-9	1.52	5.4
Direct.....	60	Holophane	Concentrating	13-9	13-9	2.00	3.5
Direct.....	60	Holophane	Intensive	16-0	10-0	1.14	4.5
Direct.....	150	Holophane	Concentrating	16-0	14-0	2.04	3.5

*See Fig. 4. †See Fig. 7. ‡See Fig. 8.

system a sense of warmth or life which is lacking with the indirect method.

The latter feature can perhaps best be illustrated by

reference to Fig. 8, which shows a large office equipped with small indirect units, one lamp to each fixture. Where the illumination facilities are as exceptional as in this case, the slight tendency toward coldness in the effect of the room can hardly be classed as an objection of any magnitude. Fig. 9 gives an idea of the effect produced by and the general appearance of larger indirect units.

IMPORTANCE OF KEEPING SURFACES CLEAN

A factor of much importance when indirect units are used is the gross neglect which is so likely to occur in keeping the interior reflecting surfaces clean. Furthermore, with multiple-unit fixtures, where several lamps are housed in one inclosure, it is very easy to overlook a burned-out lamp. Such neglect both in cleaning and in making renewals tends to impair systems of this kind, sometimes in a remarkable manner. The only safe course to pursue is to establish a definite and rigid cleaning and inspection schedule and not to depend on the complaints of the office occupants.

Special cases of illumination are shown in Figs. 10 and 11. Local lighting of this type may not be required, however, where a properly designed overhead lighting system is employed.

ENGLAND WORKING TOWARD CENTRALIZATION OF POWER

Results of Providing Entire Industrial Community
from Central Stations Placed at Economical
Points and Near Coal

Discussing economic problems which will follow the war, Robert Fleming, chairman Investment Trust Corporation of London, said:

"Many committees are at work trying to strengthen or reconstruct our industrial fabric. The one that to my mind seems to promise the greatest results is that dealing with coal consumption and power production.

"The idea is to link up the whole country through central stations placed at the most economical points and near coal, thereby providing the whole industrial country with power and light at a minimum cost. Some of the results would be:

"(1) A saving in coal consumption reckoned at 50,000,000 tons per annum, and consequently an equal increase in our available export coal tonnage; (2) an enormous saving in coal transportation; (3) an immense addition could be made to our machinery export trade through the non-use of engines and boilers at home, and (4) with our own electric power machinery requirements a home product of sufficient volume we would be able to compete successfully with any other country in overseas electrical business.

"Our country is small, but it is compact. Coal is close to every large industrial center, and no center is far from a good shipping port. With these natural advantages, and with a comprehensive system of cheap power—discarding uneconomical plants—the whole industry of Great Britain would receive an impetus approved alike by protectionist and free trader. Nor is it a wild idea to suppose that our whole internal transportation system would have its power supplied from the same source, so making available for export to less favorably situated countries the bulk of the coal now used by our own railroads."

HANDLING THE COAL FROM THE CARS TO THE STOKERS

Method Followed by a Tennessee Operating Company in Remote Steam Station Situated
Where Laborers Are Hard to Procure

BY J. A. LONGLEY

Engineer Tennessee Power Company

Since the Parksville steam station of the Tennessee Power Company is 16 miles (25.7 km.) from the nearest town, there is very little immediate labor supply to draw from; consequently the coal and ash-handling apparatus was designed to be operated with a minimum number of men. The coal cars are brought to the station yards over a private right-of-way, 6 miles (9.6 km.) long, from Ocoee station, the nearest railroad point.

From the foreign freight cars the coal is dumped into a concrete coal hopper which is flush with the ground.

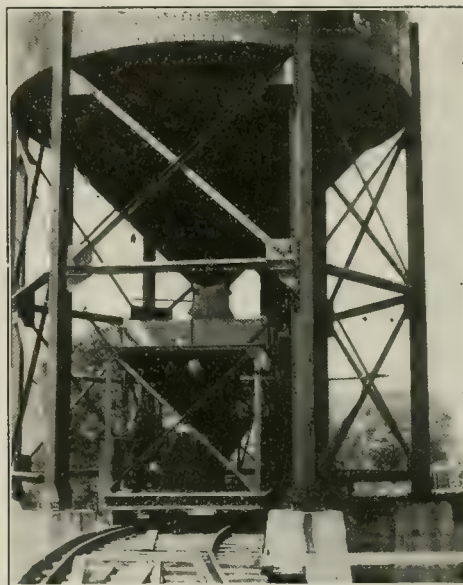


FIG. 1—TRAVELING COAL HOPPER UNDER STORAGE BIN

An inclined conveyor then takes the coal to a single-drum crusher, from which a bucket elevator hoists it into an overhead storage bin. This bin, which has a capacity of 300 tons (272.1 t.), is built of steel plates, is supported by columns and is lined with 3 in. (7.62 cm.) of concrete to prevent erosion. Running underneath the bin into the boiler room is a standard-gage track upon which a traveling coal hopper operates. The bottom of the coal bin is equipped with a valve, and immediately underneath the bin are platform scales for weighing the coal as it is loaded into the traveling coal hopper.

The traveling coal hopper was, in a measure, developed especially for this station. As shown by the accompanying detail drawing, it consists of a rigid channel-iron frame supporting a 4.5-ton (4-t.) pyramid-shape bin. The bottom of the bin has a sliding gate from which the coal discharges into a swinging screw conveyor driven through bevel gears by a 3-hp. motor. At one end of its travel (an arc of 80 deg.) the screw conveyor occupies a position underneath the bin, thus permitting the car to clear the columns of the overhead coal bin and the door to the boiler room. At the other end of its travel the screw conveyor overhangs

the side of the car and in this position discharges into the stoker hoppers.

The traveling coal hopper is propelled by a 5-hp. motor, which is connected by a double spur-gear reduction to one axle. A foot brake is provided which works on a drum mounted on the countershaft. The motors operating the screw conveyor and the main drive are

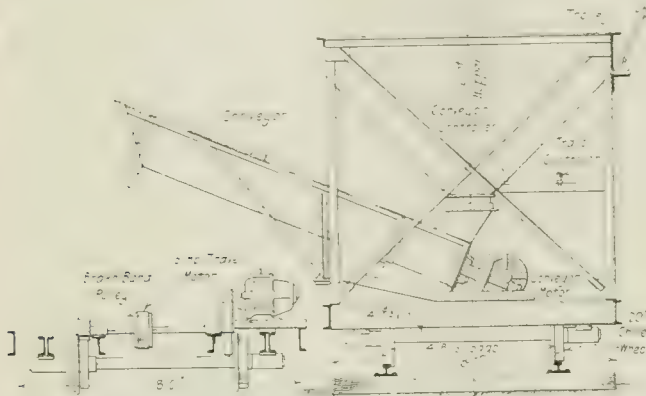


FIG. 2—DETAILS OF TRAVELING COAL HOPPER

both type SK Westinghouse motors designed for 1150 r.p.m. and 110-volt direct current. Energy is supplied through an overhead trolley wire. The coal-handling equipment was furnished by the Jeffrey Manufacturing Company.

This traveling coal hopper has been in nearly continuous service about eight months. It supplies eight 440-hp. Babcock & Wilcox boilers operating at 200 per cent of rating. Under maximum conditions 300 tons (272.1 t.) of coal are handled per twenty-four-hour day, which is equivalent to one round trip every twenty minutes. A round trip from the coal bin to the end boiler and back again is 750 ft. (228.6 m.), so it is apparent that the traveling hopper is kept busy, considering the time required to fill the stoker hoppers.

No record of the cost of operating the coal hopper

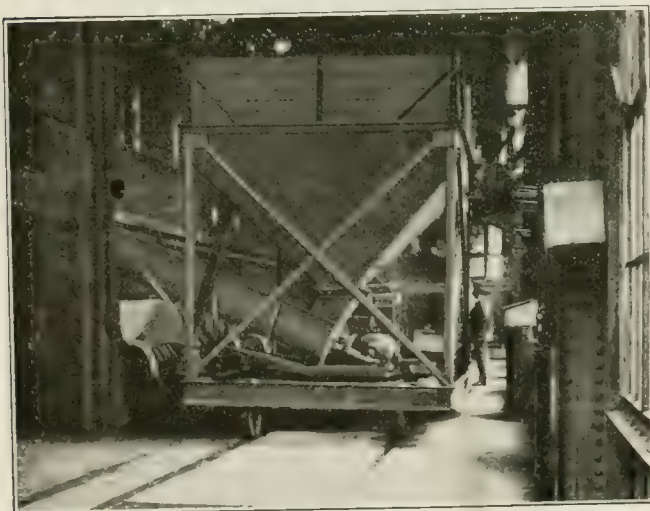


FIG. 3—TRAVELING COAL CHARGER FILLING STOKER HOPPER

alone has been kept. The total cost of handling the coal from the car to the boilers is kept, however, and this averages about 14 cents per ton (17 cents per t.). A large portion of the coal used by the station is delivered to the yard at a time when the storage bin is full. This has to be disposed of temporarily, so it is unloaded from a trestle and stored on the ground. From this point it

is picked up by a locomotive crane and again loaded into cars and dumped into the coal hopper. This double handling may seem inefficient, but it makes possible the purchase of odd lots of coal at low prices. Notwithstanding this double handling the labor cost is not excessive.

OBVIATING THE APPARENT DISADVANTAGES

Certain disadvantages have been experienced with this equipment, but they were due to lack of experience in this method of handling coal and can be easily corrected in other installations. For instance, the rigid base makes it necessary to keep the track in perfect alignment in order to avoid derailments. Moving the car for feeding stoker hoppers has been found to be very hard on the motors and controllers. The motors used are the standard-type open-end motors, consequently some trouble has resulted from dust—fully inclosed motors would have been better. The principal disadvantage of the traveling hopper from an operating viewpoint is that in case it breaks down there is no storage of coal available at the boilers, as would be the case with an overhead bin. In case of trouble with the car it is either necessary to drop load or move in coal by hand.

Except for the disadvantages mentioned, the car has proved very satisfactory and has accomplished what it was designed to do. It was low in first cost as it saved heavy steel work for supporting an overhead bin above the boilers. It saves conveyors and elevators in the boiler room where they would be in hot, inaccessible places. From an operating viewpoint it possesses the desired advantage of permitting coal to be weighed just as it is fired, putting the daily operation of the plant on the basis of a continuous test. The result has been that the operating expenses of the station have been closely watched, and economies have resulted that would not have been possible otherwise.

IMPROVED WAY TO RUN SYNCHRONOUS MOTORS

Motor Is Operated with Field Excitation Much Below the Amount Which Corresponds to Normal Excitation

In using a synchronous motor in connection with certain forms of alternating-current apparatus it is necessary that the motor run in absolute rotative-position synchronism with the generator supplying the alternating current, and further, that the synchronous motor shall respond very readily to any changes in the angular velocity of the controlling generator. Arthur R. Bullock of Cleveland, Ohio, in patent No. 1,223,472, shows that this condition can be arrived at by running the synchronous motor with the field excitation much below that corresponding to normal excitation. In running such a motor in this manner it has been found that the motor keeps in absolute synchronism with the generator whose alternating current it is using, and further, that the motor responds very quickly to any changes in frequency conditions which may occur on the line. So close is the regulation that a given point upon the rotor of a $\frac{1}{2}$ -hp. motor was found not to vary $\frac{1}{32}$ in. (0.79 mm.) on a 7-in. (17.8-cm.) radius from a similar point upon the generator rotor.

THE USE OF FUEL OIL
FOR STATIONARY PLANTS

Points for Consideration When Using This Fuel and
Results Attained by Operating with Coal
and Oil Fuels

BY FREDERIC EWING*

Fuel oil does not offer a universal solution to the problem of efficient power production, but it effects great savings in plants where the cost of coal handling is high, owing to location with respect to tidewater or rail delivery, or to inadequate coal-handling machinery, or to machinery whose installation is unjustified by the cost; where the fire-room labor cost is high; where limited boiler or stack capacity exists; where smoke regulations are strict, and in plants having long stand-by periods. The advantages due to fuel oil are high efficiency, resulting from perfect combustion with little excess air and even distribution of heat; high heat absorption, due to the cleaner tubes that may be maintained; no cleaning of fires required; low cost of handling fuel; low cost of maintenance, elimination of firing tools and grate bars; absence of dust, dirt and ashes; ease of regulation; saving in labor; increase of boiler capacity, and absence of smoke. Fluctuating loads can be handled with the utmost facility when using oil as a fuel.

On a 200-hp. return-tubular boiler about 3000 lb. (1360.7 kg.) of coal is used per week for banking fires at night and making new fires in the morning without doing any effective work. With fuel oil, only 310 lb. (140.6 kg.) of oil is required for this work. The cost of carrying two 500-hp. boilers in a New England plant on the line is \$300 a week when using coal for banking only. With fuel oil one fireman can handle ten to fifteen boilers. Another New England plant equipped with fifteen Babcock & Wilcox boilers aggregating 5500 hp., with three eight-hour shifts per day, requires sixty-three firemen on the payroll when burning coal, but after changing to fuel oil the number was reduced to seven.

Usually from 10 to 75 per cent increased boiler capacity can be obtained with fuel oil, as the stack area required is only 60 per cent of that needed for combustion of coal.

The manner in which the oil-burning equipment is installed and operated is more important than the type of burner selected. Steam is generally used as the atomizing agent under stationary boilers, and is more economical than air atomizing. Mechanical burners require from 1.5 to 3 per cent of the total steam generated for operating the oil pump and heating the oil; steam-atomizing burners require from 2 to 5 per cent. The mechanical burner is far less flexible as to control than steam atomizing and requires more attention and cleaning. Power fluctuations require spare burners under the boilers when mechanical equipment is used; a higher draft is required, and in many cases to obtain smokeless combustion a blower must be used.

A fish-tail flame burner is most satisfactory as it spreads the oil out in a thin sheet and provides for the most economical use of air for combustion. If the oil is heated above its fire point before atomizing, it will disintegrate and tend to clog the burner; if heated insufficiently, perfect atomization is not obtained and imper-

fect combustion will follow. In a properly designed furnace the grate bars are removed and a firebrick floor with carefully planned air openings is laid on pieces of 2-in. (5.1-cm.) pipe extending across the fire box. The air supply is admitted through these floor openings. Perfect combustion should take place before the gases come in contact with the boiler-heating surfaces. Oil used for fuel should have a flash point not under 150 deg. Fahr. (65.6 deg. C.) so that it can be used with the same safety as coal.

Air should be regulated by the stack damper, leaving the ash-pit doors open at all times. Automatic damper regulation operated by gas pressure in the furnace is most economical. The most efficient draft at which an oil-fired boiler should be operated is from 0.01 in. to 0.06 in. (0.25 mm. to 1.5 mm.), depending on the capacity at which the boilers are operated. With properly designed furnaces the best results are obtained by running near the smoky point. Fuel-oil installations should, if possible, be in duplicate and should include

COMPARATIVE BOILER TESTS WITH COAL AND FUEL OIL

Made at the Jenckes Spinning Company, Pawtucket, R. I., using two 520-hp. and one 460-hp. Babcock & Wilcox boiler

	Coal	Oil
Duration of test (hours).....	24	24
Steam pressure (lb.).....	107	120
Feed-water temperature (deg. Fahr.).....	210	215
Factor of evaporation	1.042	1.039
Temperature of flue gases (deg. Fahr.).....	448	440
Draft in stack (in.).....	0.372	0.06
Carbon dioxide (per cent).....	Not taken	13.5
Total water actually evaporated (lb.).....	667,192	1,235,000
Total water evaporated from and at 212 deg. Fahr.	695,214	1,283,000
Steam pressure to burners (lb.).....	....	50 to 60
Oil pressure to burners (lb.).....	....	30 to 40
Temperature of oil at burners (deg. Fahr.)....	....	130
Specific gravity of oil (Baumé).....	....	14.7
Heat value of fuel as fired (B.t.u.).....	14,600	18,300
Total fuel as fired (lb.).....	69,390	84,376
Boiler hp. (builder's rating).....	1045	1500
Boiler hp. (developed).....	839	1550
Per cent of builder's rating.....	80.2	103
Water evaporated per pound of fuel as fired from and at 212 deg. Fahr.....	10.02	15.21
Boiler efficiency (per cent).....	66.6	81.5

cross-connected pumps. The speed of the pumps should be regulated by a diaphragm valve connected to the main steam line. A suitable oil heater should be used, the exhaust steam from the oil pump being utilized to heat the oil before it reaches the burners. Duplicate strainers should be installed on the discharge side of each pump.

A circulating pipe system is also essential, so that when starting up the plant after the oil has been allowed to become cold in the pipes the burners can be bypassed and the oil circulated through the system and heater so that hot oil is supplied to the burners. Provision should be made for removing any condensation from the steam lines leading to the burners and the lines should be thoroughly insulated. In plants shut down on Sundays it is advisable to install a small auxiliary boiler which can be fired with wood or coal,

Under favorable conditions 1 lb. (0.45 kg.) of oil will evaporate from 14 lb. to 16 lb. of water (6.4 kg. to 7.3 kg. of water per kilogram of oil) from and at 212 deg. Fahr.; 1 lb. of coal will evaporate from 7 lb. to 10 lb. of water (3.2 kg. to 4.5 kg. of water per kilogram of coal), and 1 lb. of natural gas from 18 lb. to 20 lb.

* Abstract of discussion at Boston under auspices of A. I. E. E. and A. S. M. E.

of water (8.2 kg. to 9.1 kg. of water per kilogram of gas). About 3.8 barrels of petroleum are required to evaporate as much water as 1 ton (0.91 metric ton) of New River (West Virginia) coal. Data on the comparative evaporative powers of fuel oil and coals are published in the 1914 report of the United States Geological Survey on Petroleum.

Tests on the boiler plants of four New England mills with coal and fuel oil show that under similar conditions 85 B.t.u. from oil gives the same evaporation as 100 B.t.u. from coal, and that the fire-room labor cost is reduced 63 per cent, the cost of handling ashes also being saved. The details of a typical test are given herewith.

Graphical Determination of Alternator Regulation

Method Based on Potier's Scheme of Separating Armature Reaction and Reactance and Making Use of Power Factor of Load Directly

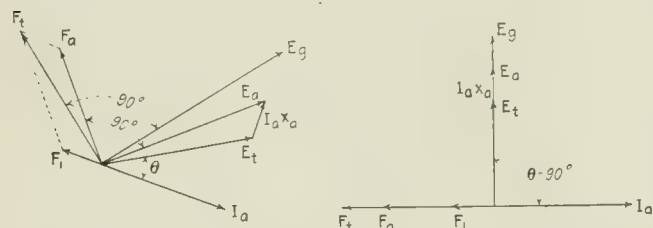
BY A. S. BLATTERMAN

SEVERAL methods have been suggested for determining the regulation of alternating-current generators under different load conditions which avoid the necessity of actually loading the machine. None, however, gives entirely satisfactory results when compared with test data unless the saturation characteristic of the machine is a straight line or nearly so. In most practical cases the emf. method indicates less than the actual values of regulation, while the mmf. method

has been that the voltage regulation of the apparatus is the difference between E_g and E_t . This consists of two parts—the reactance drop $I_a x_a$ and the effective drop due to armature reaction. To determine the regulation therefore the first requirement is to determine the value of $I_a x_a$ and the armature reaction for a given current. This may be done by plotting the open-circuit and zero* power-factor characteristics (ON and O'N' respectively) as shown in Fig. 3. Any two points, P_1 and P_2 , which correspond to the same field excitation will then be separated from each other by a horizontal distance equal to the armature reaction and by a vertical distance equal to the leakage reactance drop.

SEPARATION OF ARMATURE REACTION AND REACTANCE

On the basis of the preceding analysis the armature reaction and leakage reactance may be separated as follows: Short-circuit the armature and adjust the field excitation so as to produce the required armature current. The field current for this condition is plotted at O' (Fig. 3). Load the machine with an underexcited synchronous motor, raise the field excitation to a point



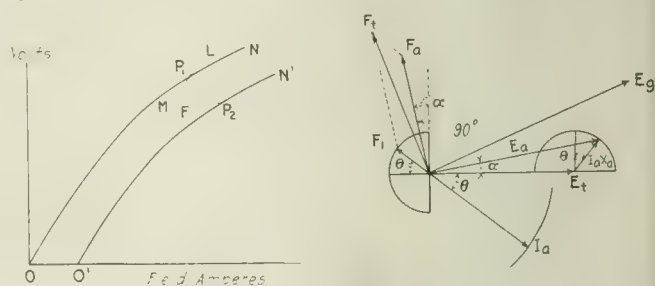
FIGS. 1 AND 2—VECTOR DIAGRAMS FOR ALTERNATOR OPERATING WITH LAGGING AND ZERO POWER FACTORS RESPECTIVELY

The terminal voltage is represented by E_t , the current by I_a , and the armature leakage reactance drop by $I_a x_a$. This vector added to E_t gives the resultant voltage, E_a , generated by the air-gap flux, which is the resultant of the field and armature magnetomotive-forces. The demagnetizing effect of the armature mmf. is shown at F_1 . F_a is the resultant mmf. producing the air-gap flux which generates E_a and is 90 deg. in advance thereof. F_t , the combination of F_a and F_1 , represents the main field excitation. Owing to it there will be generated the voltage E_g , which exists at the terminals of the machine at no load.

gives larger than actual values. Potier's method, which is really a combination of these two, gives results which are more nearly accurate than either of them. Calculation of regulation by use of the complex number seems hardly justifiable since the accuracy of the result is very doubtful at the outset.

To avoid some of the objections mentioned the writer has developed a graphical method which is quick to use and which at the same time gives results as reliable as can be obtained by calculation. It is based on the Potier method of separating armature reaction and reactance and makes use of the power-factor angle of the load directly instead of the angle between the armature current and the generated voltage, an angle which is never accurately, or even approximately, known at the start. The resistance drop is neglected because it is generally small compared with the other reactions and at all events is considerably overshadowed by the inaccuracies of the other (magnetic) assumptions.

From the relations shown by Figs. 1 and 2 it may



FIGS. 3 AND 4—NO-LOAD AND ZERO-POWER-FACTOR CHARACTERISTICS AND VARIATIONS OF DIFFERENT QUANTITIES WITH POWER FACTOR

$P_1 F$ represents the armature reaction plotted to the scale of field amperes. $P_2 F$ represents the leakage reactance drop in volts. For any given load current, changes in power factor will cause the extremities of the vectors $I_a x_a$ and F_1 to move along the arcs of semicircles of radii $I_a x_a$ and F_1 respectively, in which θ is the phase angle of the load. F_a , the effective mmf. producing E_a , always moves so as to be at right angles with E_a . Its value changes with changes in the value of E_a , the relation between the two being represented by the magnetization curve of the machine. The vector sum of F_a and F_1 gives F_t , the main-field excitation required for the given terminal voltage. This produces the voltage E_g , which can be determined from the saturation curve when F_t is known. E_g is, of course, the no-load voltage desired for calculation of regulation.

*The zero power-factor characteristic corresponds practically with that obtained under short-circuit conditions.

well up on the knee of the magnetization curve, maintaining the armature current at the same value as was used for the short-circuit test, and read the terminal voltage and field current. This locates the point P_2 . Through P_2 draw P_2M equal and parallel to $O'O$ and from M draw a line ML parallel to the open-circuit characteristic at the origin. A perpendicular dropped from the intersection of this line with the open-circuit curve gives $P_1F (= I_a x_a)$ and $P_2F (= F_1)$, the armature reaction in terms of field current.

The regulation of the machine will be predicated entirely by the magnitude and phase of these two quantities with the additional assumption that both are constant for the given armature current irrespective of saturation and power factor. In the problem usually encountered the load current, power factor and terminal voltage of the alternator are given and it is desired to know to what voltage E_t will change if the load is entirely removed. A closely allied factor is the field

as θ draw the radii F_1 and $I_a x_a$ in their respective circles parallel to each other and at an angle θ with the horizontal. Draw E_a and, with this as a radius and the center at the origin, swing the short arc 1 to cut the vertical axis of emfs. Project this point horizontally to the open-circuit curve and vertically down to the axis of field excitation, thus locating F_a , which produces E_a . With radius OF_a swing arc 2 to cut the line of E_a , locating thereon the field excitation F_a in its proper phase and magnitude with respect to the armature reaction F_1 . Combine F_1 and F_a to obtain the total field excitation F_t and return this to the axis of field current through the arc 3. The ordinate to the open-circuit curve at this point gives the value of E_g , the total generated (no-load) voltage. The regulation is then $(E_g - E_t) \div E_t$. The construction also shows the value of field excitation, F_t , required to maintain the terminal voltage, E_t , under given load conditions.

COMPARISON OF ACTUAL PERFORMANCE WITH RESULTS OBTAINED BY GRAPHICAL METHOD

To test the accuracy of the graphical method described, the following test data were obtained on a three-phase, 15-kva., 220-volt, 60-cycle delta-connected machine. As a more severe test only one phase of the armature was used, the other two windings carrying no current.

(1) Careful determination of the saturation characteristic of the machine yielded the curve ON (see Fig. 5).

(2) With the armature short-circuited the field current required to produce full-load armature current (23 amp.) was 0.83 amp.

(3) While the alternator was loaded with an under-excited synchronous motor, the armature current was maintained constant at full-load value (23 amp.) and the field current was varied. Data were obtained as follows:

I_{field}	1.9	2.82	4.18	5.26	6.3
E_t	82	123	172	206	233

From this and the short-circuit data (2) the zero power-factor characteristic was constructed by the Potier method as shown in Fig. 5. Only one of the points is actually needed.

(4) With the machine loaded with resistance and variable reactance in series, the power factor was adjusted to two different values, the terminal voltage being set at 220 volts for full-load current in each case. The load was then disconnected and the rise in voltage noted. The results were as follows:

	E_t	I_a	E_g (No Load)	Regulation (Per Cent)
$\cos \theta$				
0.5	220	23	251	14.1
0.87	220	23	237	7.7

By the graphical construction (Fig. 5) the values of E_g and regulation for the two preceding power factors are as follows:

	E_g	Regulation (Per Cent)
$\cos \theta$		
0.5	549.5	13.4
0.87	238	8.2

The construction for $\cos \theta = 0.5$ is shown in full in Fig. 5. It may be seen that the two sets of results agree very closely. The check has been found to be generally better for three-phase machines than for single-phase machines.

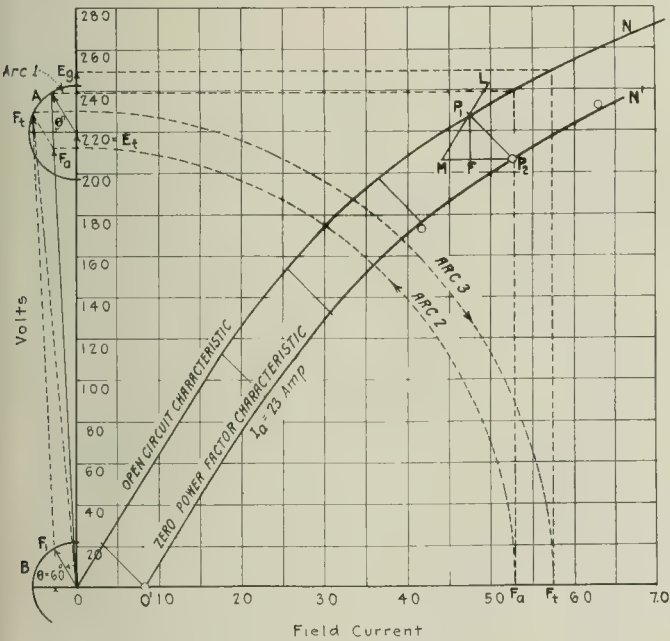


FIG. 5—GRAPHICAL CONSTRUCTION FOR DETERMINING REGULATION OF ALTERNATOR AT FULL LOAD AND 50 PER CENT POWER FACTOR

current. To what value must this be adjusted to produce the rated terminal voltage under load?

Reference to Fig. 4 will show that the angle α between F_a and a vertical to E_t is always the same as the angle between E_a and E_t . It is therefore possible to swing the emf. vectors ahead through 90 deg. so that E_a and F_a lie in the same line and E_t is laid off vertically. This makes it possible to handle the vector diagram together with the saturation curve on one sheet of paper in a graphical construction which at once determines the regulation and the necessary field excitation.

METHOD OF MAKING GRAPHICAL CALCULATION

Thus, in Fig. 5, lay off E_t equal to the given terminal voltage under load and draw the semicircle A with radius $I_a x_a (= P_1F)$ as determined by the Potier method previously described. Describe the second semicircle B with its center at the origin O and radius equal to the armature reaction F_1 in terms of field amperes $(= P_2F)$. For any given phase angle of the load such

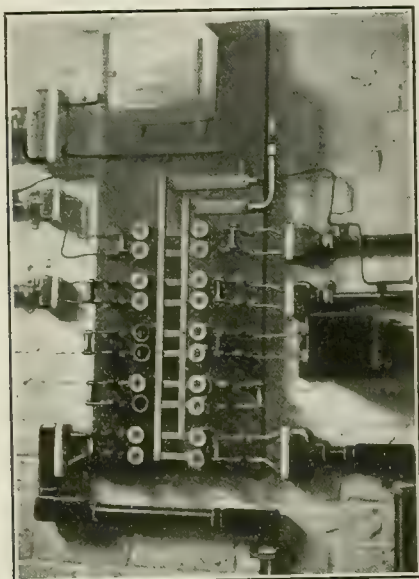
STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

COMPACT STATION-SERVICE PANEL

Circuits Terminate in Condulet—Portable Lamp Tap and Bell-Ringing Transformer

A compact station-service panel in use at the Bircham Bend (Mass.) station of the United Electric Light Company is illustrated herewith. The feed wires and meter are at the top, and on each side of the busbars the usual taps are made for local service through fuses and knife



SWITCH AND METER PANEL FOR STATION SERVICE

switches, with short connections to condulets. A bell-ringing transformer is mounted at one side, and on the other provision is made for inserting a screw plug into a fuse receptacle for portable lighting on the gallery. The left-hand switch terminals in the latter case are short-circuited by copper wire, the line being broken only at the receptacle. A single fuse plug is used.

WATER RHEOSTAT FOR STARTING HOIST MOTOR

How an Emergency Starting Rheostat Was Constructed to Avoid Delay in Waiting for Apparatus to Replace That Destroyed by Explosion

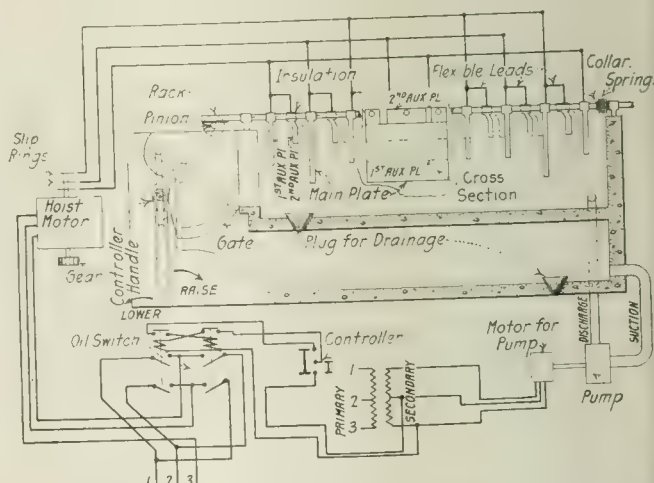
BY FRED DUBRUIEL

The starting rheostat described and illustrated herewith was developed by the writer when called to a mine where an explosion of an air tank had wrecked almost all of the resistance boxes used in connection with a hoist motor. It was necessary that service be resumed in as short a time as possible and it was out of the question to wait for the manufacturer of the destroyed apparatus to replace the resistance boxes. Consequently a double-compartment concrete-tank water rheostat was built in which the electrodes are held stationary (ver-

tically) and the electrolyte level is varied to change the immersion of the plates. The change in elevation of the electrolyte is accomplished by pumping water out of the lower compartment into the upper one and adjusting the crest of a spillway. The metal parts were made and fitted together while the concrete was drying. In six days the rheostat was complete and in service.

To operate the rheostat the controller handle is moved to the right, thereby partly raising the gate and allowing the water to raise and immerse the main plates. By moving the controller handle to the second notch the water will rise enough to immerse the first auxiliary plate, thus allowing the motor to gain speed more rapidly than if only the main plates were immersed. With the controller in the third notch the gate is raised still further and the second auxiliary plates are immersed. Further movement of the controller automatically shifts the second auxiliary plates to the position shown by the dotted line, where the secondary circuits are short-circuited. By changing the gap between the second auxiliary and main plates good speed regulation of the motor is obtained. The pump is kept running continuously, thereby causing a steady flow of water which keeps the plates cool, the water passing over the gate having time to cool before it reaches the upper compartment again. With the construction employed a wide range of resistance is obtained in fairly compact space. The wide range of resistance is possible since the main plates which are immersed are very far apart.

The dimensions of the plates are as follows: Main plates, 18 in. by 12 in. by $\frac{1}{2}$ in. (45 cm. by 30 cm. by 1.27 cm.); first auxiliary plates, 18 in. by 9 in. by $\frac{1}{2}$ in.



CONSTRUCTION AND CONNECTIONS OF EMERGENCY RHEOSTAT

(45 cm. by 22.8 cm. by 1.27 cm.); second auxiliary plates, 18 in. by $5\frac{1}{2}$ in. by $\frac{1}{2}$ in. (45 cm. by 13.9 cm. by 1.27 cm.). All of the plates are made of soft steel. Starting with water at 20 deg. C., the temperature of the electrolyte will rise to about 33 deg. or 35 deg., sometimes 37 deg., with the gate in the first position.

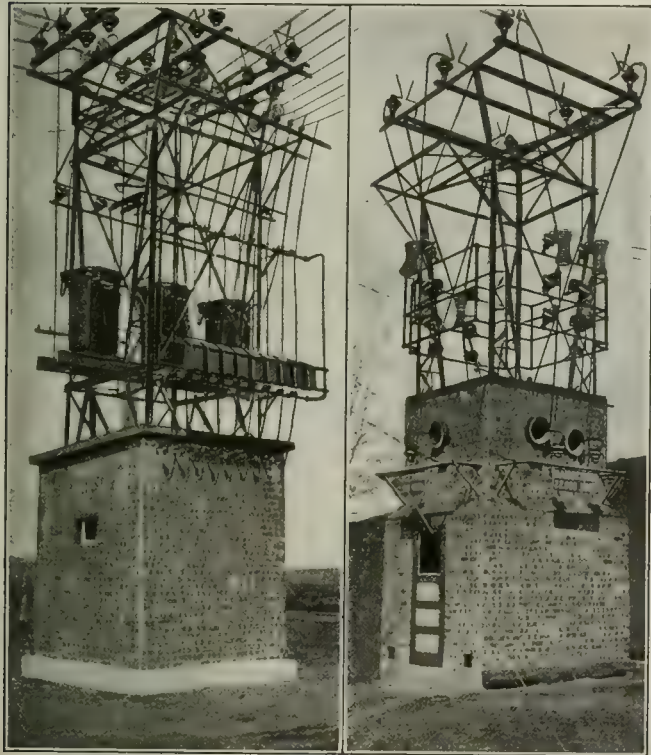
During the next step the temperature of the water is about 27 deg. or 30 deg., sometimes as low as 26 deg. During the third step the temperature is between 26 deg. and 28 deg. A difference of about 3 deg. to 7 deg. exists between the temperatures of the upper and lower compartments.

It should be pointed out that the handle which operates the rheostat gate also actuates the electrical controller which starts, stops and reverses the hoisting motor. It is impossible to operate the hoisting motor without first energizing the transformer which operates the circulating pump motor, as the relays controlling the hoist motor are energized by the secondary of the circulating pump transformer.

OUTDOOR SUBSTATION COSTS

Data Based on Supplying Commercial Energy in Conjunction with Railway System

Commercial light and power business has been developed by the Des Moines (Iowa) Inter-Urban Railway Company in conjunction with the operation of its 74-



FIGS. 1 AND 2—OUTDOOR SUBSTATION SERVING SMALL TOWNS;
SPECIAL TOWER INTERCONNECTING POWER SYSTEMS

mile (119-km.) railway system. In so far as possible the lighting business is a wholesale one, the retail lighting representing only a small portion of the total. The power business, on the other hand, is thus far done on a retail basis. To date, light and power are being furnished to six small towns either on the right-of-way or a short distance from it. The power business is confined at present to supplying several coal mines, a gravel pit and washer and a large canning factory, each of which requires from 6000 kw.-hr. to 25,000 kw.-hr. per month.

One of the substations in use is shown in Fig. 1. The tower is built of galvanized-steel angles and channels and iron pipe. The equipment was furnished en-

tirely by the Delta-Star Electric Company, and was shipped knocked down to the point where it was to be erected. The tower is provided with three mast arms to facilitate the removal of transformers for repairs, etc.

Fig. 2 shows a standard tower arranged to accommodate a 22,000-volt sectionalizing switch and meter-

SUBSTATION CONSTRUCTION COST

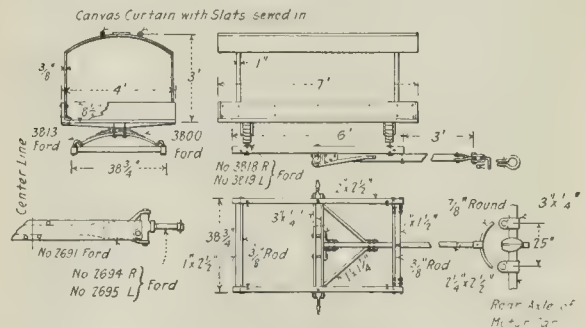
One steel tower, i.o.b. cars Des Moines.....	\$400.00
Loading and hauling material.....	18.76
Foundation, labor and material.....	71.88
Erecting tower, labor.....	84.29
Connecting and cutting in.....	7.31
Finishing	42.98
Setting transformers	41.92
Brick structure, material and labor.....	150.00
Metering equipments, etc., installed.....	150.00
Transformers, three, 20 kva.....	500.00
Total	\$1,467.14

ing and remote-control equipment. Through this station power is either supplied to or taken from the transmission line of the Fort Dodge, Des Moines & Southern Railroad. The oil switch is operated by a solenoid remotely controlled from a substation 3 miles distant, power being supplied to the closing coil direct from the 600-volt trolley wire. It will be noted that the arrangement of this tower has been changed to accommodate both an incoming and outgoing line of high potential by eliminating the air-break switch at the top of the tower. This work has been carried on under the direction of F. C. Chambers, electrical engineer of this company.

TRAILER INCREASES VALUE OF COMPANY'S RUNABOUT

Runabout Hauls Trailer to and from Locality Where Work Is to Be Done—Trailer Built from Front Axle and Spring of Ford

By an investment of about \$50 in a trailer, the Elmira (N. Y.) Water, Light & Railroad Company has greatly increased the service that can be rendered by its Ford runabout. In using this outfit the desired equipment is piled into the trailer and the runabout hauls it to the scene of action, where the trailer is left and the Ford is free for other purposes. Several jobs



DETAILS OF TRAILER

may have to be done in the same locality, in which case the workmen can readily push the trailer from one point to another. When the work is completed the runabout comes around and hauls the trailer back again.

The construction details of the trailer are shown in the drawing herewith. It was built of the front axle

and front spring of a Ford car and will carry 900 lb. (408 kg.) on pavement. To hold the car rigid when standing two hinged props are provided on the rear of the body. A similar prop is provided in front to hold up the tongue.

TELLTALE LAMPS ATTACHED TO FEEDER CIRCUITS

Used to Indicate Interruption of Service, Cables Ready for Service and for Synchronizing Purposes

Having been delayed several times by defective telephone connections in locating faulty cable, the Pacific Gas & Electric Company has devised a new method which dispenses with the telephone, or at least utilizes it only as a supplementary means. Potential transformers have been installed on the power-house cables ahead of switches, current coils and all auxiliary apparatus. The low-potential side of each potential transformer feeds a lamp installed on the control panel for the corresponding feeder or cable. Thus, after a service interruption, a glance at the board shows what leads have been affected, the burning lamps indicating what cables are available for immediate service without waiting to get in touch with the operator in any substation or the power house.

It has been found desirable to connect the secondary side of these potential transformers to a synchronizing busbar by means of suitable receptacles to permit synchronizing the cables directly and do away with the synchronous motor set ordinarily used to accomplish the same results. By using six-point receptacles it is possible to register the voltage on each cable at all times on the control board.

This scheme has been found so effective that it has been made standard throughout the system and is now considered a most effective means of synchronizing and checking voltages.

LIGHTNING PROTECTION FOR OUTDOOR SUBSTATION

Liquid-Electrode Arrester Used Which Consists of an Air Gap in Series with a Number of Electrolytic Cells Between Each Line and Ground

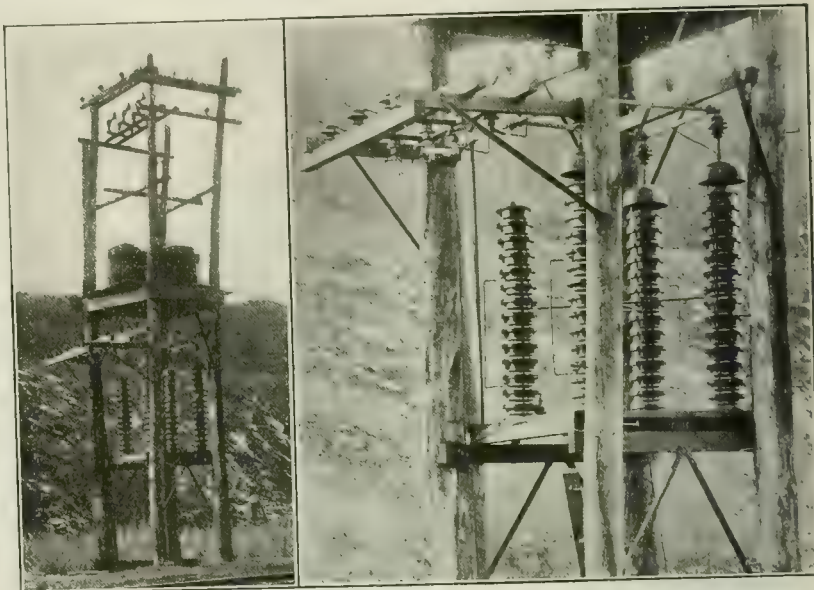
BY JOHN O. MONTIGNANI

General Manager Despatch Heat, Light & Power Company, East Rochester, N. Y.

An interesting type of lightning arrester has been placed in service at the outdoor substation of the Rochester & Pittsburgh Coal & Iron Company, Genesee Docks, Charlotte, N. Y. The line supplying this installation is a branch from a 11,000-volt, 25-cycle main line, and on account of its exposed location has been peculiarly subject to the effect of lightning disturbances. After investigating the merits of various types of lightning arresters, the Rochester (N. Y.) Railway & Light Company decided that an aluminum-cell arrester which requires charging daily would not be a suitable device

for this installation, and that the type described here gave promise of the best protection.

This device, known as the liquid-electrode arrester, consists of an air gap in series with a number of electrolytic cells between each line and ground. One electrode of the air gap consists of a metal sphere and the other of an umbrella-shaped hood placed over it to protect the gap from the weather. The hood is mounted eccentrically so that by turning it the gap can be varied according to the setting required. Columns of tile sections which serve as separators for the vessels in which the electrolyte is placed form the remaining part of the arrester. The tiles also protect the cells from the weather. Connections between adjacent electrolyte vessels are made by central metal electrodes extending from the bottom of each vessel to the surface of the electrolyte in a vessel below. This arrangement closes



OUTDOOR SUBSTATION EQUIPPED WITH LIQUID-ELECTRODE ARRESTERS

the circuit between the arrester gap and ground.

When lightning causes a discharge across the gap, the generator current following blows the electrolyte away from the tips of each electrode for an instant, opening the circuit and extinguishing the arc. As the arcing takes place between a metal and a liquid electrode, the tendency of the metal vapor to maintain the arc is eliminated.

It is impossible to maintain any alternating-current arc with a liquid as an electrode except at a very high voltage per cell, much higher than that at which the cells of this arrester are operated.

This is due to the low vaporizing point of water in the electrolyte and the impossibility of heating the water to a temperature that will throw off conducting ions. Any arc which is formed is extinguished at the end of the half cycle at which it takes place and the arrester is then ready for a subsequent rise in voltage if it occurs. The arrester was furnished by the General Electric Company.



CONSTRUCTION OF ARRESTER AIR GAP

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat

A BIG POWER USER'S
IDEA OF BUYING ENERGY

Brooklyn Company Points Out That Central Stations
Are Willing to Back Their Sales Arguments
with Definite Propositions

It is not always easy to obtain a free expression of what a power user really thinks about central station service. The Bush Terminal Company, Brooklyn, N. Y., served by the Brooklyn Edison company, published, without the knowledge of the central station company, in a recent issue of its bulletin, *The Bush Magazine*, under the title of "Buying Power Under Guarantee," an article showing that central stations are willing to back their sales arguments with definite propositions. Coming as it does from one of the largest power users in the United States, this article is naturally of more than passing interest to the power salesman and the commercial manager.

In part the article says:

In view of present-day difficulties with coal supply, many manufacturers are for the first time giving serious study to the proposition of buying power from a central electric station.

Too frequently in the past central stations were not given a really fair chance to ascertain whether or not they could save the manufacturer money. This was not always the manufacturer's fault. The central station power salesman, partly or wholly ignorant of the details of the manufacturer's operating conditions and power requirements, would make a proposition or suggestion so vague or so contrary to facts that there seemed no advantage to the manufacturer in going into details. On the other hand, it frequently has happened that the manufacturer resented even an implication that his private power plant might not be the best in the world, and refused point-blank to listen to argument or examine proof.

A very successful power salesman stated at a recent electrical convention that his hardest task is to induce manufacturers to ascertain what their own private plants really cost to operate. Items which should be charged against the cost of privately generated power are lost under general headings such as "supplies." . . . The private power plant, in other words, is very frequently a sort of "grafter" which lives partly or largely upon items charged to other departments of the business. Ninety-nine times in every hundred this condition is not appreciated by the manufacturer—also, ninety-nine times out of a hundred he resents being told the truth by the power salesman. He looks upon such assertions as a reflection upon his managerial ability.

It must be realized that the sale of power by a central station is, first of all, a business proposition. The electric company, like the manufacturer, is in business to make money—and, we may add, it has as much right to make money as the manufacturer has. To make money the electric company must sell its power, and it is just learning that the best way to sell power is by guaranteeing the cost of service.

That is to-day the electric company's proposition. If you will tell it, or let it find out, exactly how much your power now costs, it will tell you exactly how much you can save by using central station service and it will give a fair guarantee to back its assertion. The difficulty is, and always has been, to find out the exact truth about private plant generating costs.

The manufacturer frequently has said that buying power

through a meter is like buying "a pig in a poke." He has wanted to know in advance exactly what he was to pay. Then immediately he turned the "pig in a poke" argument wrong side about by refusing exact facts about his private plant and asking the central station to make a definite estimate of costs based upon guesswork. But the present coal situation is changing all this. It has made many a manufacturer give thought to learning the actual truth about his power plant instead of accepting rough guesses, and just as soon as the manufacturer does that, the proposition of buying ready-made power takes on a practical aspect.

DEMONSTRATIONS AS A
MEANS OF EDUCATION

Churches and Women's Clubs Offer Opportunities
for Gathering Together Many Who Can Be
Interested in Electrical Ways

There is no doubt that demonstrations of electrical appliances and their method of operation are too little used by the central stations in their educational program. The great value of these demonstrations, it is evident, is not in the immediate sales results, although they are appreciable, but rather is in the education of the public in electrical ways of doing things. The public has to be educated; on that point there is no question.

Central station electric shops and offices offer one class of places for holding these demonstrations, but there are other places, such as church parish houses and the rooms of civic and women's clubs, that offer possibly greater opportunities for gathering women together. As an indication of the value of this class of demonstration place, there follows a list of such places at which the Montclair (N. J.) district of the Public Service Electric Company has held demonstrations in the last few weeks, together with the attendance at each demonstration:

The Women's National League of North Fullerton Avenue	
Methodist Church, Montclair.....	70
St. James' Parish House, Upper Montclair.....	75
Verona Chapter Red Cross, Verona Methodist Episcopal Church	40
Montclair Women's Club, Spaulding High School.....	275
Federation of Women's Clubs, North Fullerton Avenue Methodist Church.....	100
Unity Church of Montclair.....	100
Union Christian Congregation Church, Cooper Avenue, Upper Montclair	200
State Delegation of Associated Charities, Commonwealth Club, Upper Montclair.....	450
First Baptist Church, Montclair.....	65

These demonstrations were conducted by Mrs. E. Hampton, appliance representative of the Montclair district, who displayed a complete line of electrical appliances, coffee being served in each instance, made with the electric percolator. Before each meeting the president of the society announced the exhibit and the assistance given by the Public Service Electric Company, which was enthusiastically received. These demonstrations afforded the representatives of the company

exceptional opportunities to meet the public upon a different footing from that afforded by their regular work. Many friends for the company have been made, valuable leads have been secured, and the following appliances were sold during the demonstrations: Two sewing machine motors, one grill, four vacuum cleaners, three electric sewing machines, one percolator and eleven flatirons.

DETROIT EDISON CHANGES TO BI-MONTHLY BILLING

Labor Shortage Brought About by Government
Needs for Army and Navy Force Company to
Conserve Available Supply

Beginning with the current month, the Detroit (Mich.) Edison Company will bill residence customers on a bi-monthly basis. The minimum charge of 50 cents per month will be changed to \$1 for the two-month period, and the number of kilowatt-hours formerly billed at the primary rate of 14 cents will be doubled.

Customers were advised of the change by a post-card

TWO MONTHS BILL

To The Detroit Edison Company, Dr.
(Alternating Current Service)

For Electric Supply as per Meter Readings	
Units at	Cents
Oct	Units at 4 Cents
Aug	Units at Cents
	Units Gross
Cash Discount only if paid on or before November 10, 1917	
	Cash Discount
	Net
	Unpaid Balance
	Mdse. Balance
	Total

at the Company's Office,
COR. STATE STREET AND WASHINGTON AVENUE
Office Hours from 9 a. m. to 5 p. m.
or at Branch Banks and other authorized
Collection Agencies.

CUSTOMER REQUESTED NOT TO USE THIS SPACE

NEW BILL FORM USED BY DETROIT EDISON COMPANY

We have in Detroit and in the adjacent villages over 123,000 customers using electric light for their residences. The average annual payment by each of these customers was in 1916 \$18.66 net. We rendered to each of these customers twelve bills, the average monthly bill being, ob-

Detroit, July 1, 1917.

Please be advised that your residence electric meter will be read every two months after the June reading instead of every month as heretofore (your meter will not be read in July). Your bills will accordingly fall due every other month, the last day for cash discount being as follows:

September 20, 1917	March 20, 1918
November 20, 1917	May 20, 1918
January 21, 1918	July 20, 1918

THE DETROIT EDISON COMPANY.

POST-CARD ANNOUNCEMENT SENT TO EVERY CUSTOMER

viously, \$1.55. We now propose to render bills for residence service every second month—customers on the west side of Woodward Avenue receiving bills in July, September and November, and so forth, while customers on the east side of Woodward Avenue will receive bills in August, October, December, and so forth. This change, with the present number of customers, would save us in each year the labor required for 738,000 meter readings, the figuring and making of the same number of bills, and would save customers 738,000 trips to pay bills, or else writing and paying postage on checks in the case of those of them who pay by check.

We think that the saving of time to Detroit people is worth while, and we have not been able to figure out that any harm would be done to the

public. We stand to lose a little money by defaulting customers getting away with two months' service, instead of one month, but we will take our chance on that. Such losses are very small in Detroit.

It does not appear that our proposal requires any official action by the Common Council, but we respectfully ask that this communication be referred to the appropriate committee with authority to consider the details with us and to advise us for the common good. Yours truly,

THE DETROIT EDISON COMPANY,
Alex Dow, President.

CHARGING FOR WORK ON CONSUMERS' PREMISES

Statement Made That Little or No Difficulty Will Be
Experienced in Convincing Customers of
Fairness of Policy

There is an enormous amount of money being spent by central stations throughout the country for work done on consumers' premises without charge, and as a matter of sound economy this policy is receiving more attention on account of the new high levels of cost of material and labor.

At the recent mid-year convention of the Empire State Gas and Electric Association, J. P. MacSweeney, of the Rochester Railway & Light Company, advocated

announcement, which is here reproduced. A reproduction of the new form of bill is also shown.

The principal reason for this action is one concerning labor, as is set forth in the accompanying letter, which is a copy of the one sent to the Detroit Common Council announcing the new plan and the reasons therefor:

May 11, 1917.

To the Honorable Common Council of the City of Detroit.

Gentlemen:—A number of the employees of this company have since the beginning of trouble joined the army and navy; others have been called out as members of the Naval Reserve or to officers' training camps, and a number are under warning that they may be called any day. This is the condition before any call under the new army law, and inasmuch as the average age of our employees is thirty-two years, we shall certainly be required to release a great many men to the military service of the nation.

It will be impossible to replace all these men and difficult to replace any large part of them. Up to the present time our serious troubles have been the high cost of coal and of construction material and the difficulty of getting these. Now we are going to be short of help.

Like every person and corporation in the country, we also face the necessity of economical operation in order that we may carry the burdens directly or indirectly to be laid upon us by the entrance of the United States into the war.

Following our custom of discussing with the Common Council in advance any change in our operations in which the general public will be concerned, we respectfully ask your attention to the following:

that when a trouble man is sent out on a "light's out" complaint and he finds the trouble is caused by defects in the consumer's lighting system, such as blown fuses, a charge of 25 cents for the call, plus the retail price of the fuses, may properly be made. "To be sure," the paper stated, "it will be found necessary to answer a few questions as to the 'why' and 'wherefore' of such a charge, but little or no difficulty will be experienced in convincing customers as to the fairness of the policy in this regard. So long as the principle involved in charging for this work is just, then we need only be concerned with the fairness of the charges made and the methods used in initiating them. Charging amounts that could reasonably be construed as favoring the idea of getting all that the traffic will bear must be avoided, and we must remember that we have educated the public to expect more than is just and equitable and that therefore we should not expect consumers to assimilate agreeably in one gulp the difference between a free service and one for which they must pay. The educational process should be a gradual one, and experience proves that this question of charging for work on customers' premises heretofore done free is much less dangerous than most of us think it is."

**FACTORS IN NEW BUSINESS
DEPARTMENT ORGANIZATION**

**Responsibilities and Duties of a Central Station Sales
Manager—Ideas on the Conduct and
Activities of Salesmen**

Speaking before the commercial men of the Indiana Electric Light Association, Thomas Donohue, manager of the General Service Company, Lafayette, Ind., reviewed the considerations which face the central station manager when he is confronted with the problem of inaugurating a commercial department.

"The most important factor in a new-business organization," said Mr. Donohue, "is the head of the department. Every new-business organization should have some one who is responsible for the results of the department. The title given this particular person does not in any way affect his duties or responsibilities. It makes no difference whether he is called commercial agent, sales manager or new-business manager. However, the success of the department depends entirely on his ability.

QUALIFICATIONS OF THE DEPARTMENT HEAD

"The person selected for the head of the department should be a man who has had previous experience and is familiar with the modern systems and practices in the sale of appliances, and he should be familiar with the office and accounting end of the business in so far as it applies to the sale of appliances. He should possess a practical as well as a theoretical knowledge of domestic, industrial and commercial lighting, sign lighting and house wiring.

"He should be a man capable of analyzing a power installation and should be able to make proper recommendations. He should have a personality that will create a favorable impression among the general public, as well as one which will insure obedience and respect from the personnel of the organization.

"The sales manager should be responsible only to the

manager of the company. He should manage his department as though it were a separate business and upon sound business principles. He should purchase the material and appliances required and price them according to good business practice, with the view of not conflicting with the business of local dealers in these appliances.

"He should keep in close personal contact with the local electrical dealers and contractors and co-operate with them in every possible manner, assuring the company of their support rather than their enmity. In all matters not affecting the general policy of the company he should be empowered to make such decisions as his judgment dictates and be assured of the support of the management. He should receive the full and hearty co-operation of the rest of the organization from the manager down, for without this co-operation he will be able to accomplish but little.

CONDUCT OF SALESMEN

"The central station salesmen should be possessed of good appearance, be sober, honest and industrious. They should be responsible to the new-business manager, and to him only. Any information or instructions from the rest of the organization should be transmitted through the manager to enable him to keep in close touch with the work.

"Salesmen should report for duty at 8 a. m. to receive their instructions and the list of prospective customers in time to reach their territory at 9 a. m. It is not advisable to make any residential calls in the morning, except by appointment, after 11.30 o'clock, since at that time housewives are preparing the noonday meal and do not always take kindly to an interruption which might be welcome at another hour.

"The time to return after lunch is at 1 o'clock or shortly thereafter, as in good weather women wish to go out about 2.30 or 3 p. m. At this time the calls in the business district should be made, except those on the retail merchants, until about 4.30, when the salesman returns to the office and reports the results of the day's work.

"In case of rainy or bad weather, it is not advisable to make any calls in the residential section except by appointment. In view of the fact that trade will at this time be dull, an excellent opportunity is offered to call on the retail merchants. Otherwise these calls should be made in the morning before going to the regular territory. In addition to the 'prospect' calls, the salesman should make from ten to fifteen regular calls each day, turning in a card for each call, containing in accurate form the information requested.

PROPORTION OF SALESMEN TO POPULATION

"One salesman should be employed for each 10,000 inhabitants, whether the company is operating a combination gas and electric property or not. Each should be assigned to definite territory, and all inquiries arising from this district should be referred to the salesman for his attention. His results should be reported daily to enable the manager at all times to know accurately what is being done."

In his paper Mr. Donohue also discussed office location and management, the residential survey, the commercial survey and the power survey, bringing out facts and making interesting recommendations on these points.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

CHARACTERISTICS OF IRON WIRE FOR TRANSMISSION PURPOSES

Relative Advantages Derived from Three Kinds of Iron Wire—Not a Great Deal of Improvement to Be Expected from Steel Alloys

BY L. W. W. MORROW

Associate Professor of Electrical Engineering, University of Oklahoma

EXPERIMENTS to determine the electrical and mechanical constants* of stranded iron-wire conductors such as may be used for transmission purposes have been conducted at the University of Oklahoma, the results supplementing such data as have already been compiled. Three kinds of wire were tested— $\frac{1}{4}$ -in. (6.4-mm.) E. B. B., $\frac{1}{4}$ -in. (6.4-mm.) Siemens-Martin steel and $\frac{5}{16}$ -in. (7.9-mm.) standard Bessemer-steel messenger cable. Seven-strand conductors were used in each case. In order to approximate practical operating conditions a 1-mile (1.6-km.), single-phase, 2200-volt wood-pole line was constructed with conductors mounted 24 in. (61 cm.) apart on 2300-volt insulators. The line was built in the form of a loop so that measurements could be made on the generator and load end of the line with the same instruments.

The electrical test consisted of measuring the power input to the line, the impressed and terminal voltages, the line current, the efficiency of transmission, and the regulation. The impedance, effective resistance, ohmic resistance and reactance were calculated. Results of these tests are shown graphically in Figs. 1 to 3.

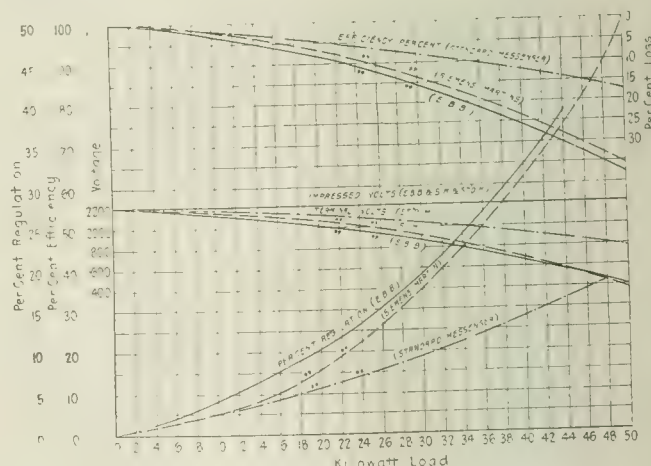
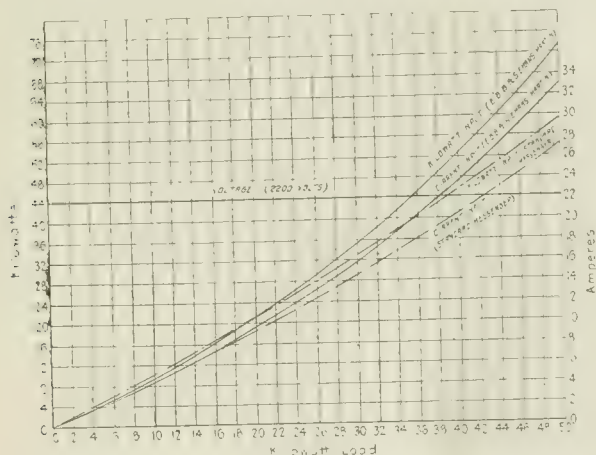
stant, owing to skin effect and magnetic properties of the iron. It increases rapidly until saturation is approached, when it becomes almost constant. The Siemens-Martin cable did not show saturation effects. Its resistance increases less rapidly with current than that of any of the other wires tested and is higher than that of E. B. B. cable for currents less than 15 amp., but less for currents greater than 15 amp. The permea-

RESULTS OF MECHANICAL TESTS ON THREE KINDS OF WIRE

Kind of Cable	Elastic Limit (Lb.)	Elongation Up to Elastic Limit for 8-In. Section	Elongation per Deg. Fahr. (in.)
$\frac{1}{4}$ -in. E. B. B. cable.....	1050	0.016	0.00000736
$\frac{1}{4}$ -in. Siemens-Martin steel	2600	0.028	0.00000632
$\frac{5}{16}$ -in. standard messenger	3250	0.026	0.0000073

bility also has a marked effect on the reactance, that of Siemens-Martin cable being much less than that of E. B. B. cable of the same size.

For the range of load considered (0 amp. to 50 amp. at 2200 volts) there was very little difference in the efficiency of transmission with E. B. B. and Siemens-Martin cables, the losses being more than 35 per cent at 33 amp., corresponding to 50 kw. At the same load the regulation is 50 per cent, indicating the prohibitive losses and poor regulation of iron wire when used at high-current density.



FIGS. 1 AND 2—ELECTRICAL CHARACTERISTICS OF THREE 1-MILE IRON-WIRE EXPERIMENTAL TRANSMISSION LINES

Mechanical tests were also conducted on several samples of each wire to determine their elastic limits and coefficients of expansion. The results shown in the tables were obtained.

The effective resistance for a mile of wire or the resistance to 60-cycle alternating current is not con-

From the mechanical tests made it is concluded that the great strength of iron wire compared with copper enables the use of longer spans and hence reduces the number of poles and towers required. Therefore the interest on the investment saved may partly or wholly offset the inefficiency of transmission of iron wire. Siemens-Martin wire has the lowest coefficient of expansion and the greatest strength. Its resistance and

*Data on solid iron wire, Bureau of Standards Scientific Paper No. 252, and by H. B. Dwight, *Proceedings A. I. E. E.*, 1916.

reactance increase less rapidly with the current than for any of the other wires, and with heavy current the resistance, reactance and impedance are individually less than the same values for other types of iron wire of the same size. At low current values Siemens-Martin

COMPARATIVE RESISTANCES OF IRON AND COPPER WIRE AT 2200 VOLTS

Current	Copper	E. B. B.	Siemens-Martin
0	1.172	7.75	9.25
5	1.172	8.12	9.35
10	1.172	8.85	9.60
15	1.172	9.96	9.96
20	1.172	11.45	10.45
25	1.172	13.40	11.10

wire has higher impedance than resistance. On account of the effect of iron or steel on the electrical characteristic of alloys it is doubtful whether better transmission results can be obtained from the latter than with the

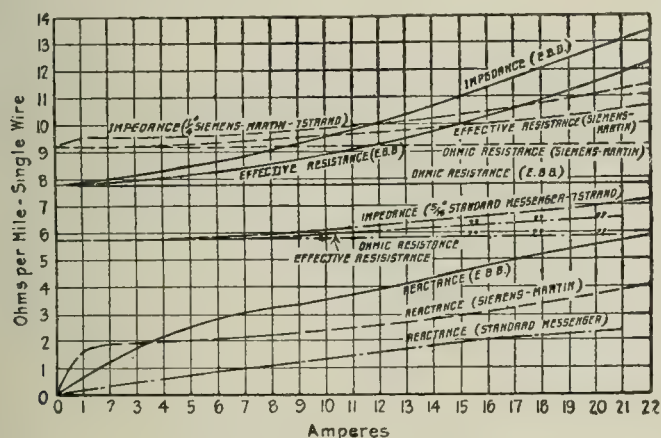


FIG. 3—IMPEDANCE, RESISTANCE AND REACTANCE OF THREE GRADES OF IRON WIRE

plain iron or steel wire. Conditions as to cost of copper, power to be transmitted, voltage, etc., will determine the advisability of using iron instead of copper wire, and also determine the type of iron wire which should be used.

Generators, Motors and Transformers

Theory of Armature Windings.—S. P. SMITH.—Part of a paper presented before the British Institution of Electrical Engineers. Rules for connecting closed windings and conditions for obtaining symmetrical lap and wave windings are taken up in this section.—*London Electrician*, June 1, 1917.

The Compounding of Alternators.—M. LATOUR.—The compounding of alternators is often obtained by means of automatic regulators which act upon the excitation circuit of the alternator. There are, however, systems of direct compounding which have given excellent results. The author describes the different methods which have been employed up to the present, giving particular attention to the method of compounding by the operation of shunt and series transformers, of which he is the inventor.—*Revue Gén. de l'Elec.*, June 16, 1917.

Lamps and Lighting

Incandescent Lamps.—A. BOUTARIC.—Second part of an article of which the first part, published June 2, dealt with the laws of radiation, values of light flux, etc.,

found to be yielded by luminous sources. In this part the principles of manufacture of various types of incandescent lamps are summarized, consideration being given successively to carbon filaments, metallic filaments, the Nernst filament, and the gas-filled bulb.—*Revue Gén. de l'Elec.*, June 16, 1917.

Generation, Transmission and Distribution

Resistance of Earth Connections.—L. BIRKS and E. WEBB.—Results of measurements made on the transmission line supplying Christchurch, New Zealand. From the tests made it appears that once a pipe reaches a depth of 6 ft. to 7 ft. (1.8 m. to 2.1 m.) increase in depth has little effect on the resistance of the earth connection. Considering the exceedingly high resistance of both dry soil and pure water, the conductivity in the immediate neighborhood of earth connections must be attributed solely to salts, alkalies or acids in solution. From tests made of the resistance of 70-ft. and 80-ft. (21.3-m. and 24.4-m.) artesian wells it was found that their conductivity is of the same order as that of a pipe driven 6 ft. (1.8 m.) deep in the same district. It therefore appears that the depth and area of the pipe in contact with the earth affects the resistance only to a limited extent. From a cursory examination of the result obtained it is concluded that single-pipe earths, no matter how well salted, will not give the value of resistance desired. Connecting a group of pipes in parallel will help, however, it being desirable to drive the pipe 6 ft. to 12 ft. (1.8 m. to 3.6 m.) apart to secure the best results. The tests indicated that better results can be obtained with a bare pipe driven in the ground than with a pipe packed in coke, provided that the former is perforated and filled with salt and water. For salting the pipe it was considered best to use coarse salt for the initial charge and rock salt for the final one, as the latter takes considerable time to dissolve.—*London Electrician*, June 1, 1917.

Installations, Systems and Appliances

Electricity Supply at Keighley, England.—HARRY WEBBER.—Features of the construction and operation of a new generating station of the Keighley electricity works are described in this paper. Data on the amount charged for energy supplied to various industrial concerns served from this central station are given.—*London Electrical Review*, June 15, 1917.

Plowing Electrically.—Editorial suggesting that plows be operated through the means of flexible cables and temporary transmission lines to speed the work of plowing.—*London Electrical Review*, June 15, 1917.

Burning Anthracite Coal.—W. H. BOOTH.—Problems involved in burning anthracite coal and methods of solving them.—*London Electrical Review*, June 15, 1917.

Fuel Economy.—Editorial pointing out that the way to save coal is to use more electrical energy. In the body of the paper suggestions were given as to a possible substitute for the grades of fuel ordinarily employed in generating plants.—*London Electrical Times*, June 14, 1917.

Units, Measurements and Instruments

Average Eye for Heterochromatic Photometry.—E. C. CRITTENDEN and F. K. RICHTMYER.—This paper records the results of investigations made to approximate the average normal eye in measuring light intensities where color differences are involved. In particular results obtained by flicker photometer and by an equal-

ity-of-brightness photometer, with different degrees of color differences, are compared. In terms of the Ives-Kingsbury test solutions, for which the proposed normal ratio of transmissions (with a 4-w.p.c. carbon lamp) is 1.00, the average of 114 observers gives a ratio of 0.99. By using these test solutions results obtained on the flicker photometer by a small number of observers can be corrected so as to give normal values with a high degree of accuracy. On the average, equality-of-brightness measurements also vary in proportion to the test ratio, but erratic variations often overshadow these systematic differences. For sources having relatively high intensity in the blue, flicker values tend to fall below those obtained on the usual standard photometers, but the difference is comparable in magnitude with the uncertainty of the latter values.—*Bureau of Standards, Scientific Paper No. 299.*

Self-Recording Electrometer.—W. A. DOUGLAS RUDGE.—Description of a simple and inexpensive self-recording electrometer for measuring atmospheric electricity.—*London Electrician*, June 1, 1917.

Measuring Insulation Resistance on a Large Distribution System.—G. W. STUBBINGS.—A method of measuring the insulation resistance of a large three-wire network is described. It is based on the alteration of the neutral potential and the creation or removal of an artificial fault. The current in the earth connection is measured with the resistance short-circuited and again with the circuit breaker or fuse open. Calling these currents I' and I respectively, and the potential of the neutral with the circuit breaker open E , the insulation resistance of the network is ascertained by the formula $R = E \div (I' - I)$. If the conditions are such that readings of the earth ammeters are very small with the circuit breaker closed, an artificial fault of known resistance can be inserted in one of the outer legs to increase the reading. The insulation resistance as calculated will include this resistance. In order to obtain accurate values of the separate insulation resistances of the three mains, the voltage across each side of the system may be altered. First the voltage on the positive side can be raised, then that of the negative side, the voltage across the outer legs meanwhile being maintained constant. The alteration in the potential of the neutral from earth with a moderately high resistance in the earth's circuit is obtained, and from the observed data the insulation resistance of the three mains can be calculated. It is not necessary to open the circuit breaker in the earth connection if means are employed for determining with fair accuracy the alteration in the current in the earth connection. If conditions are such that the current in the earth connection is very small, artificial leaks can be introduced to give good reading. This test will, of course, fail if the fault on the neutral is so great as to cause current to circulate between it and the neutral busbar. Details of making the last two tests are given in the paper.—*London Electrical Review*, June 8, 1917.

Miscellaneous

Induction Apparatus for Locating Projectiles in Human Bodies.—ST. PROCOPIU.—An article describing a device for discovering foreign substances of a magnetic nature in the bodies of the wounded which differs both from the electrovibrator and the electromagnetic balance. With the electromagnet the projectile is discovered by the touch, and with the induction balance by

means of the telephone. The apparatus here described utilizes a galvanometer to detect the presence of a bullet or other magnetic substance, and makes it possible to discover the depth to which it has penetrated. The chief distinguishing characteristic of the apparatus is the employment of a galena detector to rectify the induced currents.—*Revue Gén. de l'Elec.*, June 9, 1917.

Electric Cooking Apparatus.—(Abstract of first report of commission on heating and cooking apparatus.) The practical requirements of electric cooking apparatus, electrical insulation thereof, connections between heating elements and terminals, accessories, efficiency of electric cooking and various practical points in the design of cooking appliances are subjects discussed in this paper.—*London Electrician*, June 8, 1917.

Derivation of the General Equation for Wave Motion in an Elastic Medium.—J. A. FLEMING.—The paper explains a simple method of arriving at the general differential equation for wave motion; viz.,

$$\frac{d^2\varphi}{dt^2} = c^2 \left(\frac{d^2\varphi}{dx^2} + \frac{d^2\varphi}{dy^2} + \frac{d^2\varphi}{dz^2} \right),$$

where c is the velocity of propagation of the wave. A wave motion consists in the propagation of some form of strain through an elastic-dense medium or one having comparable qualities. Corresponding to this strain there is an analogous stress in the medium, and we can express this stress mathematically in two ways—viz., kinetically, as the product of the density and the time rate of change of the strain, or by $m \frac{d^2\varphi}{dt^2}$ per unit of volume, and also statically as the space increment of the expression $e \frac{d\varphi}{dr}$, where e is a coefficient of elasticity and r is a vector denoting direction of propagation. Hence, for plain waves we can write the equation

$$\frac{d^2\varphi}{dt^2} \delta r = \frac{d}{dr} \left(e \frac{d\varphi}{dr} \right) \delta r,$$

or if m and e are independent of distance, we have

$$\frac{d^2\varphi}{dt^2} = \frac{e}{m} \frac{d^2\varphi}{dr^2},$$

which is the known differential equation of wave motion for plane waves. Its solution is $\varphi = F \left(x \mp \sqrt{\frac{e}{m}} t \right)$,

where F is some function. In the same manner for spherical waves originating in a point source we can write the stress equation

$$4\pi r^2 m \delta r \frac{d^2\varphi}{dt^2} = \frac{d}{dr} \left(4\pi r^2 e \frac{d\varphi}{dr} \right) \delta r,$$

which at once gives

$$\frac{d^2\varphi}{dt^2} = \frac{e}{m} \left(\frac{d^2\varphi}{dr^2} + \frac{2}{r} \frac{d\varphi}{dr} \right);$$

or if $r^2 = x^2 + y^2 + z^2$, we have

$$\frac{d^2\varphi}{dt^2} = \frac{e}{m} \left(\frac{d^2\varphi}{dx^2} + \frac{d^2\varphi}{dy^2} + \frac{d^2\varphi}{dz^2} \right).$$

The solution of this last equation is

$$\varphi = \frac{1}{r} F \left(x \mp \sqrt{\frac{e}{m}} t \right),$$

where F is some function. The general equation for electromagnetic-wave propagation in a pure dielectric may also be obtained in the same manner.—Abstracted from paper presented before Imperial College of Science in *London Electrician*, May 25, 1917.

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

COAL PRODUCTION COMMITTEE IS BESIEGED FOR RELIEF

**Telegrams Pour in Daily Telling of Difficulties in
Obtaining Fuel—Some Relief Afforded Central
Stations in New England Territory**

The committee on coal production and distribution of the Advisory Commission of the Council of National Defense is receiving between fifty and a hundred telegrams a day asking for assistance in obtaining coal, according to a statement made to a Washington correspondent of the ELECTRICAL WORLD by F. S. Peabody, chairman of the committee.

"Notwithstanding the fact that we have no powers in law," said Mr. Peabody, "such as are proposed in the so-called food bill now pending in the Senate, we are doing the best we can to be of service to the industries. In this work the electrical industries are receiving their full share of attention, and Mr. Elliott and Mr. Storrs, representing respectively the electric light and power industries and the street railway industries, are reporting to me that everything that can be done is being done. Our system is, upon receipt of these telegrams, to find sellers who have coal and place those who want it in touch with the sellers. This is working out successfully."

Mr. Peabody said he was not able to state which companies in the electric industries have been so helped. There has been no geographical limitation, he said. All are being treated alike. It was admitted in Washington, however, that the committee was able to afford some measure of relief to the utilities in New England.

Asked whether his committee intends to urge Congress to pass the coal provisions in the so-called food bill, Mr. Peabody said that is unlikely. The committee feels a certain diffidence, it is understood, in going before Congress, because it has no official standing.

WHAT THE INDUSTRY FACES BECAUSE OF WAR

**Some of the Problems Imposed, and How the Public
Utilities Will Meet Them—Conservation of
Fuel and Investment Necessary**

How the electrical industry may assist the government to bring the war to a successful issue was the subject of an address given by John W. Lieb, president of the National Electric Light Association, before the New York Jovian League on July 11. The industry, he said, is alternately optimistic and pessimistic. Some of its difficulties will be corrected through the intervention of the national government, but the labor problem will not be among them. Not the least of the problems will be managerial, for all companies will find it increasingly difficult to secure the necessary capital for expansion and imperative extensions. The present

war is one involving primarily engineers, materials and supplies. Ingenuity is being taxed and brain matches brain. The electrical industry will be called upon to play a major part. As for central station companies, they are doubly patriotic. They send many of their men to the colors, and with the rest maintain unimpaired service so that industry may become more productive and the army and navy lack nothing. Abroad the whole aim now is to stimulate the electrical industry, so as to conserve the supply of fuel. Public utilities in this country will co-operate for the same purpose, and, besides, interconnect their systems to obtain maximum use of equipment.

HEARING SET FOR RATE INCREASE IN INDIANA

**Commission to Hold a Three-Day Public Hearing at
Indianapolis on Petition of Indiana Electric
Light Association for Surcharge**

The Public Service Commission of Indiana has set aside July 23, 24 and 25 for the hearing on the petition of the Indiana Electric Light Association for a 30 per cent surcharge on each bill rendered for electric service. Thirty-six companies, whose services cover most of the State, join in this petition. The decision may govern the attitude of other companies also. The hearing will be held at the State House, Indianapolis, and will be open to all.

Summarized, the petitioners allege:

1. That the rates now in effect are based on the average of normal or prevailing prices of coal, labor, material and taxes.
2. That during the past year the petitioning utilities have been compelled to bear an extraordinary and unprecedented increase in these costs and of all other elements entering into cost production and distribution.
3. That the utilities are unable to contract for future deliveries of coal except at a very great advance over the normal prices, and believe it will not be possible during the continuance of the war to purchase either coal supplies, materials or labor except at prices far in excess of normal.
4. That the average percentages of increase of prevailing prices over normal prices are: Coal, 194; labor, 32.67; copper, 144.86; miscellaneous supplies, 65.91; taxes, 48.41; equipment, 51.14; general operating, 45.50.
5. That for some months utilities have suffered financial losses; that such losses will result in the curtailment of present service, inability to finance necessary extensions and additions, and in insolvency of many utilities if temporary relief is not given immediately.

The petitioners allege that the demands of the government for material and products will result in requiring extensions, improvements and additions to existing plants and more intensive operation, and that the credit of such public utilities should be maintained to finance these demands. The petitioners allege that in England such steps were taken after the beginning of the war and that the surcharge has been increased to 50 per cent.

ARMY CANTONMENT WORK SHOWS RAPID PROGRESS

In Many Instances the Electrical Distribution Lines
Are Installed Long Before the Structures Are Finished

Several of the army cantonments have been completed. The first to be ready was that at Fort Douglas, Utah, that being the first contract let. This contract was let May 12, and the contractors, James Stewart & Company, turned it over to the government on June 26. Contractors who are building these canton-

ment shall not be more than \$250,000. If the largest cantonment to be built—that at American Lake, Wash.—for instance, which will house 40,000 men, costs \$6,000,000, there will be a profit in it when the bills are audited of only about 4 per cent. The maximum profit is said to be about 6 per cent. The smaller cantonments, such as that at Fort Douglas, which will house 9000 men, will cost, it is expected, when the bills are finally audited about \$500,000.

The plans for the cantonments are based upon a unit system. To increase the size or to decrease the size of a cantonment merely means adding to or lessening the



ARMY CANTONMENT AT FORT DOUGLAS, UTAH, ELECTRIC SERVICE TO WHICH ANTEDATED ITS ERECTION

ments, who have offices in Washington, are highly pleased with the co-operation afforded them by the government. Since the Fort Douglas cantonment was begun there has been established the emergency construction committee of the Munitions Board of the Council of National Defense, which is working with committees on lumber, cement, electrical materials, etc., composed of experts in these various business lines. These committees inform the office of Colonel Littell, who is in charge of the construction of the cantonments, as to where materials are to be found and the prices it is recommended that the contractors should pay for them.

Allotment schedules, specifying materials, sizes, quantities, prices, etc., are then sent by Colonel Littell's office to the constructing quartermaster of the army at each cantonment under construction. These schedules not only contain the names of firms and companies from which the materials should be purchased but quote the prices which should be paid. If the contractors can beat the prices to be paid, it is up to them to do so. If the question of delivery is more important than the question of price, then the question of delivery controls. The constructing quartermaster at each cantonment decides the point when it is submitted to him by the contractor.

COST PLUS PERCENTAGE BASIS NOT FOLLOWED

There is no opportunity for "profiteering" in this work. There is no allowance for administrative expense. Not a cent is allowed for overhead charges, such as work done at main offices or branch offices. When information in regard to the building of the cantonments was first allowed to become public it was stated that a system of cost plus 10 per cent payment would probably be adopted by the government. That has not been done. A sliding scale of payment has been adopted under which the profit on the largest canton-

ment shall not be more than \$250,000. The cheapest electrical construction, as to wiring, etc., conformable to safety from fire is being used. In every case sites have been selected so that the cantonments may be connected with local power plants as well as water. In most cases sewers have been especially built.

LITTLE ROCK CENTRAL STATION GETS CONTRACT

The Little Rock (Ark.) Railway & Electric Company has closed a contract with the War Department to fur-



THE FORT DOUGLAS CANTONMENT WAS ERECTED BY THE ARMY
OF ELECTRICITY

nish a 1000-kw. demand for electric light and power at the Twelfth Divisional Cantonment, which is near Little Rock. Several miles of transmission lines will be run, besides a large amount of 2300-volt distribution all of which are to be in service by Sept. 1. The con-

tract was closed in Washington on Saturday, July 7, by C. J. Griffith, general manager of the Little Rock Railway & Electric Company, and E. T. Selig, commercial engineer of the United Gas & Electric Engineering Corporation.

PROBLEM OF ENERGY SUPPLY UNDER CONDITIONS OF WAR

Director George Otis Smith of the Geological Survey
Asks Public Service Commissions to Co-operate
in Power Study

Director George Otis Smith of the Geological Survey has written to state public service commissions in regard to the problems pertaining to the supply of energy under war conditions. He says that a few of the problems which must be given careful consideration either at once or later are:

1. The furnishing of an adequate fuel supply to existing plants.
2. An increase in the output of hydroelectric energy to conserve fuels for other uses.
3. A proper correlation of new industries with existing power supplies.
4. The extension of existing power systems and an increase of power output to supply new industries.
5. The interconnection of power stations to improve load factors.

The Geological Survey, through its Division of Mineral Resources, has for many years been studying the fuel supplies of the country. Its water resources branch has been similarly engaged in the investigation of water power. The land classification board has been charged with the administration of water-power sites on public lands and has thus become familiar with the public utility viewpoint. I am confident, therefore, that through previous experience and accumulated data this organization is well qualified to act as a national clearing house on power questions. The Secretary of the Interior has authorized the survey to co-operate with public utility commissions, and I believe that work of this character cannot be undertaken too soon.

NO TAX ON ELECTRICITY IN SENATE MEASURE

Substitute for Food Bill Provides Sufficient Revenue
Without Including Added Burdens on Users
of Central Station Service

Senator Simmons, chairman of the Senate finance committee, has informed the Washington correspondent of the ELECTRICAL WORLD that he is informed that the proposed substitute for the so-called food bill which is to be introduced into the Senate by the committee on agriculture will dispose of the distilled-spirits question in such a manner as will make unnecessary the recasting of the war tax bill. It has been believed that if the government lost a large amount of taxes on distilled spirits it would be necessary to recast the war tax bill so as to include taxes on the electrical industries other than telephone and telegraph.

There is authority among the members of the Senate finance committee, in view of what Senator Simmons is quoted above as saying, for the statement that taxes on electrical energy, etc., will not be added to the war tax bill so far as the Senate tax committee is concerned.

The Senate has tentatively agreed to vote on the food bill on July 21. This permits the tax bill to come up in the Senate on July 23, and Senator Simmons estimates that one month's time will be required between the day

the Senate gets the bill and the day the President receives it. In other words, there will be a long debate on the bill, and the question of what the House of Representatives will endeavor to do in regard to restoring the taxes on electricity which the Senate committee has stricken out remains at this writing an open question. The Senate bill will be reported retaining proposed taxes on telephone and telegraph messages.

FLOODLIGHTING FOR THE BALTIMORE COMPANY

Lexington Building, New Home of Consolidated Gas,
Electric Light & Power Company, Made
Beautiful by Night

Flooded with light, the Lexington Building, the new home of the Consolidated Gas, Electric Light & Power Company of Baltimore, is as beautiful by night as it is by day. The illustration is a reproduction of a photograph, not retouched.



NEW HOME OF CONSOLIDATED GAS, ELECTRIC LIGHT & POWER
COMPANY

Lighting of the northern and western façades is accomplished by eighty-six 250-watt concentrated-filament gas-filled lamps, which are placed in three batteries of floodlighting projectors on the roof of the old building, northwest corner of Lexington and Liberty Streets. Each reflector was separately adjusted in order that the lighting might be uniform. Approximately twice as much light is thrown on the upper floors of the building as on the lower floors.

Later the southern and eastern façades were similarly lighted, making the structure a beacon of progress visible from all points of Baltimore as well as from all approaches to the city.

INQUIRY ON ELECTRIC RATES BY CITY OF DAYTON, OHIO

William J. Hagenah, Who Is Making an Investigation on Behalf of the Municipality, Tells Status of Work

Replying to a letter from the ELECTRICAL WORLD, William J. Hagenah of Hagenah & Erickson, Chicago, writes in regard to the situation at Dayton, Ohio, which he has been engaged to investigate:

"I have your letter requesting a statement regarding the status of the work which I am doing for the city of Dayton in the matter of its electric rate controversy with the Dayton Power & Light Company. It might be better for you to communicate on this subject with H. M. Waite, city manager of Dayton, under whose direction the investigation is being made. He could give you more authoritative information than I can.

"The investigation which the city of Dayton is making of the Dayton Power & Light Company is occasioned by the expiration of the term for which the present schedule of rates was adopted. Subject to the usual right of appeal in such matters, the city of Dayton possesses the authority to prescribe rates to be charged for electric service in that city. While there may be some question as to the extent of that authority, there is no question about the city's right to fix the legal maximum rate.

"On the expiration of the rate period referred to, the company submitted a new schedule of lighting rates which was a considerable improvement over the existing rates and also offered some reduction. The city, however, did not accept this schedule, but asked the company for the privilege of making such an investigation and preparing such data from the company's records as were deemed necessary in order to enable the city's officials to pass on the issues intelligently and with due regard for the interests of the public.

"For the purpose of making such investigation and compiling the data desired, the city of Dayton engaged my services last year, and certified public accountants in my employ have made an analysis of the company's financial operating records for the last three years. A study has also been made of the operating statistics, such as the number of customers, connected load, load factor, kilowatt-hour output, and the sales to the different classes of customers, and other data required in an investigation seeking the net earnings of the company, the approximate investment in operating plant and the range of cost of service.

"This work has been carried on from time to time since last autumn, there having been postponements in the work in order to observe the effect on the operating expenses of the recent large increase in commodity prices and the price of labor in many industries. The company has co-operated in the examination of its books and records for the above period and has extended to the city every courtesy and facility.

"The situation has been somewhat complicated recently by the company's filing with the Ohio Public Utilities Commission an amendment to its present schedule seeking an increase in the rates in a number of classes of service. Against the granting of this increase the city has protested. The action of the company came as a surprise, since the city had been entertaining the belief, which appeared to be sustained

by the facts disclosed in such parts of the investigation as had been completed to date, that the company was extremely prosperous and that the lighting customers of the city might with good reason expect a substantial reduction in the existing schedule.

"Of course, I am not determining the policy of the city in this matter, and therefore cannot speak officially as to the probable steps which will be taken. Especially is this matter still in doubt since the investigation work contemplated at the outset has not all been concluded. I feel safe in assuming, however, that the city will not take any action, except to protect its rights, until it feels that it is fully conversant with the facts involved in the making of the rates in question and the bases on which the new schedule should be founded. The entire subject matter is now being carefully analyzed, to the end that strong and convincing data may be presented to sustain whatever course of action the city finally decides to adopt."

COST OF GETTING BUSINESS REJECTED FOR CINCINNATI

Ohio Supreme Court Approves Public Utilities Commission Order with Exception of \$375,000 for Attaching New Business

Through a decision on July 3, the Ohio Supreme Court has approved the order of the Public Utilities Commission fixing the value of electrical properties of the Union Gas & Electric Company of Cincinnati for rate-making purposes, with the exception of the amount in the capitalization claimed for attaching new business. This item was \$375,000 and was fixed by the commission engineer. The court said:

"The placing of a value upon such an item to be included in the permanent capitalization of a company, which is to be used for the purpose of fixing rates to be paid by the public during long periods of time, is necessarily uncertain, theoretical and somewhat arbitrary. The engineer of the commission himself testified that the amount fixed was his estimate of what it probably would cost to secure a given number of customers.

"It is apparent that such customers would have to be secured under varying circumstances, which, when estimated in advance, would be purely hypothetical. The burden of the proof was upon the companies to establish this item by direct evidence. We think this was not done in this case, and the order of the commission in so far as that item is concerned is disapproved."

The total value of the property as fixed by the commission is \$8,945,125.

CALL FOR MEETING OF THE OHIO ASSOCIATION

Gathering at Columbus on July 19—Round Tables on Association Work and Central Station Operation for 1917-18

Active members of the Ohio Electric Light Association are to meet in the Hotel Deshler, Columbus, on July 19. The meeting takes the place of the annual convention, which was to have been held at Cedar Point during the same week, but was abandoned on account of war conditions.

The morning session on July 19 will be devoted to a

round table on association work, including oral reports and suggestions from chairmen of standing committees and a report of the nominating committee.

In the afternoon there will be a round table on central station operation for 1917-18 and the election of officers.

TESTS OF FAHY PERMEAMETER BY THE BUREAU OF STANDARDS

Experimental Tests to Determine Precision and Find to What Extent Various Factors May Affect Accuracy

The Fahy permeameter for magnetic testing was fully described in the *ELECTRICAL WORLD* of Feb. 17, 1917. The Bureau of Standards has carried out experimental tests to determine the accuracy of this instrument under various conditions of use. This work was done by C. W. Burrows and R. L. Sanford, and will be published complete in Scientific Paper No. 306.

This study of the permeameter was made with the view of determining its precision and of finding to what extent various factors might affect its accuracy. The following factors were examined in the course of the work:

- (1) Consistency on repetition.
- (2) Length of specimen.
- (3) Projection of specimen beyond the test coil pole face.
- (4) Reluctance of joints.
- (5) Effect of iron in the neighborhood.
- (6) Position of specimen on pole face.
- (7) Absolute accuracy
- (8) Use uncompensated.

The ability of this apparatus to repeat readings on the specimen under the same conditions is all that could be desired. The consistency is so good that the apparatus may be used to detect small changes in magnetic characteristics due to aging, mechanical strains or variations in heat treatment.

This apparatus is designed to take specimens 10 in. (25.4 cm.) long, but it happens frequently that it is necessary to test specimens of other lengths. Tests carried out with greater lengths of specimens showed very little effect due to length. This is true provided the specimen does not project beyond the test-coil pole face, but if specimens are very much shorter than the prescribed length an inaccuracy is introduced. It is not necessary that the specimen be lined up accurately, and no trouble is to be expected from inaccurate adjustment in the position of the test piece.

It is to be expected that in an apparatus of this type reluctance of the surface of contact will affect the accuracy. This was tested by placing sheets of paper between the specimen and the pole face. The greatest effect was found for values in the region of maximum permeability. The test showed that when the specimen alone is in place the reluctance of the joint does not give rise to any serious source of error. For precision work, however, it is desirable to have a good magnetic contact at the pole face.

Pieces of iron in the neighborhood of the apparatus do not produce any appreciable effect unless they are very close. If actually in contact with the test-coil pole face they will cause appreciable error.

Identical results were found for all positions of the

test specimen on the pole face. It was shown that symmetrical location was not essential.

The absolute accuracy of measurements taken by this permeameter was determined by the comparison of the same specimen in the Burrows form of apparatus. Carefully prepared standard rods were used for this purpose. In every case the measurement agreed within 5 per cent, which is sufficient accuracy for most commercial tests. In fact, this agreement is more than is necessary in testing many materials, because the inhomogeneity of commercial material is usually greater than this. Thus the permeability of transformer steel may differ from part to part of a single sheet by as much as 10 to 20 per cent.

Measurements taken without first properly compensating the apparatus showed that the error thereby introduced is not greater than the error existing in several types of permeameters now in use; consequently the Fahy permeameter may be used without compensation for many kinds of shop testing where only comparative results are desired. In materials of the same grade the characteristics would be nearly identical and relative results would be the same. The advantage in omitting the compensation lies in the greater speed of operation.

These tests have determined that the Fahy permeameter represents a distinct advance in apparatus for the measurement of magnetic qualities. It excels in accuracy the direct-reading permeameters which are generally available, for consistent results can be obtained to a good degree of accuracy. Hysteresis measurements are accurate within the limits of commercial requirements and the uniformity of commercial materials.

COMPETITION FOSTERED BY SAVANNAH DECISION

Georgia Railroad Commission Holds that Framers of Constitution Were Distrustful of Even Regulated Monopoly

A decision in the Savannah rate case has been rendered by the Georgia Railroad Commission. It says that the constitutional provisions had in mind the encouragement and fostering of competition in its fullest sense, and "expressly forbade the Legislature from authorizing any transaction between corporations that would defeat or lessen competition. The anticipated benefits of competition could only be reflected in rates and service. Having safeguarded the public against unreasonable and unjustly high rates, the framers of the constitution evidently had in mind securing for the public the lowest rates and the best service that competition might bring about. The constitutional framers were evidently distrustful of even regulated monopoly.

"There is, in our opinion, nothing in our laws which prohibits a public utility from giving the public the benefit of a lower rate than may be prescribed by the commission, should it appear to the interest of the corporation in the existence of a sound business policy so to do, provided, of course, it does not unlawfully discriminate in so doing.

"We are of the opinion that our public policy, as evidenced by the constitution and statutes of the State and as uniformly followed by the courts and the com-

mission, has been to encourage corporations so to favor the public.

"The commission will therefore provide in its order that if the utility charges any class of patrons a lesser rate than the maximum prescribed by the commission for that class, a like percentage of reduction shall be given all other classes."

The commission orders that "the giving or contracting for flat rates or any other than meter rates shall be wholly discontinued."

The Savannah Lighting Company contended that the commission should make actual rates, from which there should be no deviation to a lower level or from which there should be no deviation except by permission of the commission. The Savannah Electric Company opposed a minimum rate, contending that the commission had authority to establish only maximum rates.

TIDE WATER POWER COMPANY ANNOUNCES RATE INCREASES

New Rates as Reasonable as Are Consistent with
Maintenance of the Property and Service
to the Public

The Tide Water Power Company, Wilmington, N. C., has announced that on account of the great increase in price of coal, gas, oil and other supplies of all kinds it has become necessary to increase rates for electric light and power and for gas. Increased schedules were filed with the Corporation Commission before public announcement was made and there has been no appeal to that body.

The notice addressed by the company to consumers, which has been received by the ELECTRICAL WORLD from A. B. Skelding, general manager, says in part:

It seems advisable to make a general statement that conditions, due directly and indirectly to the war, will make it necessary to economize in every department. To accomplish this end it will be essential from time to time to make changes in schedules, methods and amount of service.

The increased cost of all materials and supplies, especially the increase in the cost of coal (for fuel and for the manufacture of gas) and of the crude oil used, will make necessary certain increases in rates.

The policy of the company will be to make new rates which are as reasonable as consistent with due regard to the maintenance of the property, and to giving to the public the service that can be expected under the conditions prevailing.

It has been the policy of the company during the past fourteen years to reduce rates and improve service wherever possible. This policy would have been continued were it not for the present conditions which are affecting adversely the whole civilized world.

PROVIDENCE CENTRAL STATION RATE INCREASE IS FORECAST

President Barrows Points Out That Rising Costs
Due to War and Other Causes Make
Action Necessary

Forecasting application to the Rhode Island Public Utilities Commission for authority to increase lighting rates, a formal notification was addressed recently by the Narragansett Electric Lighting Company to Mayor Gainer of Providence that the company's exclusive franchise would be allowed to lapse.

President Barrows pointed out that rising costs due

to the war and other causes have made it necessary for the company to make provision for increasing prices. Under the franchise terms the company was restricted as to rate increases with the exception of house and small retail lighting. In addition to clearing the way for rate advances, cancellation of the franchise tax of the company, amounting to one-half of 1 per cent of the gross earnings, follows the lapsing of the franchise. This totals about \$7,000 per year at present.

President Barrows reviewed numerous rate reductions by the company in the past five years, which of late have been based upon a coal cost of \$3.85 per ton and copper at about half its present cost. Cost of coal has increased from an average of about \$3.85 per ton, including transportation charges, to an average for about 47,000 tons during January to May, 1917, inclusive, of \$8.87 per ton. Other costs, including materials and labor, have risen, and if these continue or increase, higher prices for electric light and power are quite inevitable.

The company anticipates that it may be necessary for it to proceed toward a rate increase within the next six months.

ST. LOUIS COMPANY OCCUPIES NEW BUILDING

General Offices of Union Electric Light & Power
Company All Housed in One Eleven-
Story Structure

The new building of the Union Electric Light & Power Company, St. Louis, has been completed, and the general offices and electrical merchandising store have been moved into it. The building, eleven stories high, 149



NEW OFFICE OF UNION ELECTRIC LIGHT & POWER COMPANY,
ST. LOUIS, MO.

ft. by 100 ft. (45.41 m. by 30.48 m.), and having 7400 sq ft. (700 sq. m.) of floor surface, is at the corner of Locust and Twelfth Streets. Practically all of the space on the first floor fronting the streets is given over to the merchandising, sales and application departments.

FALL RIVER TRANSMISSION TIE-LINE PROJECT APPROVED

Company Wins on Ground of Economic Necessity
and Advantage of Interconnection as General
Policy and War Measure

Permission to construct a 66,000-volt two-circuit transmission line from Fall River to Seekonk has been granted the Fall River Electric Light Company by the Massachusetts Gas and Electric Light Commission. Considerable opposition developed on the ground that the proposed line would cut down taxes otherwise resulting from steam plant enlargement in Fall River.

The decision points out that the Fall River company will have a capacity of 16,000 kw. in operation within a few weeks; that the present station building will then be fully occupied, and that the proposed line will have a capacity of about 20,000 kw., half of which will be contracted for at first. The line will tie the local system into the 56,000-kw. and 45,000-kw. systems of the New England Power Company and Narragansett Electric Lighting Company respectively.

The Fall River company's power load has doubled in the last year, and a maximum load of about 10,000 kw. is expected this fall, with further increases of business. The estimated cost of the line is \$300,000, compared with more than \$1,000,000 for a station addition of like capacity, and the line can be erected within a few months as against about two years for the station addition.

The commission says in part: "It is of the utmost importance to the welfare of Fall River that this company shall make prompt and adequate provision for the industrial power requirements of the city. The proposed line is an effective and the only practicable step to that end. . . . A full and skillful execution of this scheme offers not only possibilities for better operating efficiency and lower generating costs at large power stations but also substantial economy in permanent investments. High-tension transmission of electricity has given a wider aspect to the solution of the problem, and has made possible and desirable that the developed sources of power, both steam and hydroelectric, throughout the State shall be so co-ordinated by connecting lines as to result in utilizing all plants more uniformly and in the end in substantial economies of investment and operation.

"Moreover, it has brought to the aid of the industries of the State, and particularly by means of the lines of the New England Power system, water powers heretofore only partially developed and in the broad sense unused because inaccessible. A progress having so much promise of a real conservation of the natural resources, both of coal and water, and of their most efficient devotion to the production of power, is highly important to the welfare of the State and nation.

"It appeared at the hearing that the mills of Fall River use more than 100,000 hp., that additional power is needed for mills which the exceptional industrial activity of the present period is opening, and that many of the older mills are facing in the near future the necessity of renewing their power plants. The concentration of generating capacity in one plant, if properly planned, should work substantial economies in operating costs, release for industrial purposes capital which must otherwise be tied up in a number of separate

power plants, and give the community as a whole in the end the benefit of lower unit costs and therefore lower prices for electricity.

"Such a development requires great prudence because so closely related to the prosperity of the one dominating industry of Fall River (textiles) and because its success depends on a great output of electricity, which, to hold the business, must be sold at a narrow margin of profit. One important and wise step in its accomplishment is to tie in this company's plant with a reliable and adequate source of power so that it may meet promptly, but without an undue expansion of its own station, all requirements of the community for energy. Such a policy wisely followed is in the opinion of the board consistent with the public interest. The proposed line, so essential in the present emergency, is equally essential to the public convenience.

"This conclusion is not affected by the fact that the relation of the Fall River company to the New England Power system will be through a foreign corporation, nor does it necessarily follow, as urged at the hearing, that the Fall River company will thereby come under the dominance of any other interest. Fall River is too well located for the economical production of steam-generated power to make it probable that it will ever become permanently dependent upon power generated elsewhere, save only in such amounts and at such prices as will be advantageous to its industries.

"It was stated at the hearing that it is the company's policy, apart from the erection of the line, to develop its station as fast as the growth of its business may demand and the condition of the market for labor and equipment may permit. Even were it possible to provide for the company's immediate needs by increasing the capacity of its present station, yet at some time this proposed line would be needed to assure the industries of Fall River reliable and low-priced service."

PROPOSED INDEX FOR THE NATIONAL SAFETY CODE

Bureau of Standards Issues Supplement with a
Request for Examination and Constructive
Criticism by Engineers and Administrators

Dr. S. W. Stratton, director of the Bureau of Standards, in requesting criticism of a proposed index of the National Electrical Safety Code, writes:

"Users have suggested that an index should be prepared. The bureau recognizes this need for a subject index, and since the latest revisions of the code and its publication in November, 1916, such an index has been prepared with the aid of a number of outside engineers.

"We now take pleasure in submitting the index which is the result of this co-operative effort to those engineers best acquainted through their previous study with the code rules and to the administrators most concerned in the application of the code to practice. Their examination of this index is requested. Through their co-operation we hope to be able to repair deficiencies of importance, whether of omission or error. Such an index must, of course, be a compromise between completeness and reasonable brevity. The comments received will be compared and utilized in a revision which will be printed and distributed without unnecessary delay."

LOCATION OF NAVY AND MARINE CORPS CANTONMENTS

Electrical Equipment Is in All Cases Necessary and Service Will Be Obtained from Public Utility Companies

For certain reasons of their own, officials of the government at Washington are not willing to have published as many technical details of the construction of the navy cantonments, training stations and camps and the Marine Corps cantonments which are now being built for the navy as the army has allowed to become known in regard to its cantonments. Nevertheless, the representative at Washington of the *ELECTRICAL WORLD* has succeeded in obtaining for publication some of these details.

At Newport, R. I., there is being constructed a training station for 2000 men; at City Park, Brooklyn, a



INTERIOR OF MARINE CORPS BUILDING AT QUANTICO, VA.

barracks for the receiving ship to accommodate 3000 men; at Pelham Park, N. Y., a camp for 5000 men; at the Philadelphia Navy Yard a camp for 5000 men; at Cape May, N. J., a camp for 2000 men; on the Jamestown Exposition site in Virginia, which the government has recently acquired, a training station for 10,000 men; at the navy yard at Charleston, S. C., a camp for 5000 men; at Pensacola, Fla., quarters for 1000 aviators; at Key West, Fla., a camp for 1000 men; at the Great Lakes naval training station in Chicago, a training station for 17,000 men; at the Mare Island Navy Yard, California, a camp for 5000 men; at the Puget Sound Navy Yard, a camp for 5000 men. There are, besides, a few smaller establishments in the vicinity of Boston. There is also a projected camp for 3000 men on the exposition grounds at Gulfport, Miss. The camp for the Marine Corps at Quantico, Va., has been completed, and the work at Philadelphia, Charleston and Pensacola has also been practically completed.

STILL OTHER SITES ARE PROJECTED

The selection of the sites for these camps has been under the direction of Rear Admiral Palmer, chief of the Bureau of Navigation, and the work of construction is being completed under the direction of Rear Admiral Harris, chief of the Bureau of Yards and Docks. The new quarters for the navy and the Marine

Corps, when completed, will provide accommodations for approximately 80,000 men at a cost of \$9,000,000.

The cost of the navy construction is naturally much less than that of the army cantonment construction. The army cantonments are expected to house from 500,000 to 1,000,000 men. The majority of the navy structures differ from those of the army in the fact that in the navy structures the men will be furnished sleeping quarters in hammocks instead of in bunks or cots. The navy buildings are uniform, of wood, generally on wooden posts, bringing the floors 2 ft. 6 in. (75 cm.) off the ground. In northern latitudes they are being warmed by steam.

All the navy buildings are lighted by electricity. Their sites have been picked out so far as possible to enable contractors to "hook up" to local electric plants, either light and power plants or street railway plants. The electrical work specified is exposed knob and tube work, made with a view to reducing the fire risk to a minimum. Contracts are based for the navy work on a cost plus 10 per cent basis for work by the principal contractor with an allowance of 5 per cent on work he lets by sub-contract, with the understanding that another person employing labor at the side of the work is a sub-contractor.

The naval establishments are being built in two classes—camps and training stations. Camps are generally places for assembly, to house men near the seashore, so as to have them in readiness to send to sea, while training stations, such as Newport, Chicago and Jamestown, are of the broader scope in that men are there given a complete course of training.

The size and general character of the mess halls in the navy establishments is quite different from the mess halls of the army and not uniform. At the Philadelphia navy establishment men will be messed in groups of 200; at Jamestown they will be messed in groups of 500; at several other points they will be messed in groups of 1000. At Chicago they will be messed in groups of 1700.

PUBLICATIONS COMMITTEE OF N. E. L. A. OFFERS SERVICE

F. D. Pembleton, Chairman, Suggests Possible Publications Which Will Be Developed if Demand Warrants That Action

F. D. Pembleton, chairman publications committee of the Commercial Section of the National Electric Light Association, writing to the commercial managers, says that the committee desires to assist member companies in every way possible during this crisis and the period of high prices.

The committee could help much more intelligently if it knew just what the central station commercial managers needed, and therefore it suggests a number of possible publications which will be developed if the demand warrants.

The list suggested includes shop-window lighting, store lighting, electrical advertising, seasonable campaign literature, ranges and electric cooking, electricity on the farm, one thousand (or more) uses of electricity, educational literature for instructors in domestic science, electrical comforts for babies, "house organs," street-car cards and display cards.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Reduction in Power to Earn.—Where prior to electric shock a minor was an able-bodied man but at time of trial was suffering from neurasthenia, accompanied by insomnia, loss of appetite and nervous headaches, verdict for \$898 was not excessive, the Court of Appeals of Kentucky held (195 S. W., 476).

Liability for Injury to Trespasser.—An electric company which permits its wires to sag so low over a railroad track as to endanger persons on the top of cars cannot, it was held in the North Carolina case of Ferrell vs. Durham Traction Company (L. R. A. 1917 B, 1291), escape liability for the wires throwing a person off a car by the fact that he was a trespasser on the train.

Customer Entitled to Adequate, Not Comparative Service.—In an action for failure to furnish adequate electric power pursuant to contract, testimony regarding the current furnished previous to the contract's execution is inadmissible, even for purpose of comparison, where plaintiff, under the claimed contract, was entitled to adequate and not comparative service, it was held by the Supreme Court of Vermont (100 A. 768) in Roben vs. Ryegate Light & Power Company. The general manager of an electric power company who is also its president has no implied authority to contract to enlarge the plant's capacity. He has authority to bind the corporation by promising a probable customer that the company will not take on more business than it can handle.

Right to Maintain Poles in Highway.—The right of a telephone and telegraph company under its franchise to maintain poles in a highway is qualified by the paramount right of the county authorities to keep the highway in reasonable condition for ordinary use by the public, and the damage which necessarily follows to such licensee from an improvement of the highway without negligence by the county authorities would not be a taking or damaging of property within the meaning of the law which provides that no private property shall be taken or damaged for public or private use without just compensation having been made, it was held by the Supreme Court of Washington (165 P. 102). It follows that if the county is not liable, the contractor, who was the agent of the county in doing the work, and had agreed to do the work in accordance with the plans and specifications of its contract with the county, and under the direction and superintendence of the county engineer, would not be liable, in the absence of negligence on its part being shown.

Question of Negligence in Case of Injury to Young Boy.—For the jury is the question of negligence of an electric company which maintained a highly charged uninsulated wire 34 ft. above the ground, only a few inches above the comb of the roof of a large grain warehouse with a lean-to, the roof of the main part having slope of 32 deg., and that of the lean-to extending to within 8 ft. of the ground, and accessible from the top of cars on a side track, having a slope of only 16 deg., boys of the town having in some degree been in the habit of playing on the roof, and a boy of ten, playing with others thereon, having, like them, taken off his stockings and climbed to the top of roof and taken hold of the wire, thinking, as he said, that it was a telephone wire, the Supreme Court of Washington held in Talkington vs. Washington Water Power Company (165 P. 87). A verdict for \$5,500 for injury to a boy ten years old from grasping a high-power electric wire, both hands being severely burned, from which he suffered great pain for two months, requiring dressing by a physician forty-three times, and leaving them deformed and their usefulness permanently impaired to a considerable extent, cannot be said to be so high as to show prejudice of jury.

Powers of Commission in Fixing Rates.—The function of making rates to be charged by an electric power company is legislative, and the only ground upon which the courts may interfere with it is that the specific order impairs constitutional rights, and interference will not be made unless on a clear showing that constitutional rights have been invaded, the Supreme Court of California held in San Joaquin Light & Power Corporation vs. California Railroad Commission (165 P. 16). Where the Railroad Commission fixed 8 per cent as reasonable return on the investment of an electric power corporation and apportioned rates which the corporation asserted would produce but 6½ per cent, the court could not hold as a matter of law that the rate was confiscatory. A power corporation owning hydroelectric plants with extensive water rights is entitled to have the value of such water rights considered in fixing its rates, the water rights being "property." The burden is upon electric power corporation, in certiorari to review an order fixing its rates, to show the existence of any value of property claimed by it. In estimating the value of an electric company's plant for purpose of fixing rates, the value of the company's right to divert 6 per cent of the water from a stream could not be fixed at 6 per cent of the total damage that would accrue to the riparian owners if the entire flowage were withdrawn, such a basis being too speculative. In computing rates of electric power corporation, it was not entitled to charge off a deficit incurred during development period, where the rates indicated that after the development period such deficits had been more than overcome by profits in excess of the standard 8 per cent.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

New Jersey Companies Ask for a Coal-Price Clause in Rate Schedules.—The New Jersey Board of Public Utility Commissioners has ordered the Bridgeton Electric Company and the Electric Company of New Jersey, operating at Bridgeton and in Gloucester County respectively, to suspend the proposed new light rates as per schedules filed with the board until further hearings are held. The companies propose to adopt a new rate schedule based on the existing price of coal, adding 1 per cent to consumers' bills for each 10 cents per ton of the average cost in excess of \$3.50 per ton, the prevailing price at the power plants, and to deduct a like percentage for each 10 cents per ton below this figure that the coal may cost.

Ohio Utilities Get Favorable Ruling.—The Ohio Public Utilities Commission made the following ruling in connection with the application of the Northwestern Ohio Railway & Power Company for leave to increase power rates: "Contracts as to electric power are not binding in any way even if same have been made part of a light ordinance in connection with domestic lighting, as city councils have not the authority or right to regulate power rates for any utility. Each month the utility may file a supplemental rate based upon the actual cost of fuel, labor, material, etc., that have gone into the cost of production of power for that month. However, the commission will not allow increase in ordinance rates to cities and villages for lighting purposes."

Stock Issue Authorized in Massachusetts.—The Massachusetts Gas and Electric Light Commission has authorized the United Electric Light Company, Springfield, to issue 4000 shares of new stock, par value \$100, at \$185 for such of the cost of enlarging its generating plant as has been incurred subsequent to Dec. 31, 1916, or may be incurred hereafter, "and for no other purpose." The company had asked for authority to issue 5000 shares to meet liabilities now or hereafter incurred for additions and extensions to plant and property. Solomon Lewenberg dissented from the price of \$185, upon which Commissioners Weed and Schaff agreed. The board "trusts that the company will enter seriously upon the redemption" of an issue of \$250,000 preferred stock given as a dividend to shareholders. It says that "when this preferred-stock dividend was declared the directors of the United company must have realized the need for the enlargement of its generating station for which immediate and substantial provision would have to be made."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Bonbright & Company, Inc.—Announcement is made that hereafter the investment banking house of William P. Bonbright & Company, Inc., will be known as Bonbright & Company, Inc.

Investigation of Reading (Mass.) Municipal System.—A report of an investigation of the Reading (Mass.) municipal light department has been made by C. W. Whiting, consulting engineer, Boston. The investigation was made for the town.

Value Placed on Property in Albany, Ore.—The Oregon Power Company has placed a price of \$250,000 on its property in and adjacent to Albany, Ore. This followed a request of the City Council, which is required by charter to call for a bid from the owners of a public utility before proceeding to install publicly owned works.

Will Sell Municipal Light Plant.—Service Director Hornberger of Cincinnati will introduce an ordinance in the City Council authorizing disposal of the Madisonville municipal light plant at public sale. A resolution to abandon the plant on Aug. 31 was adopted recently. Madisonville is now a portion of the city of Cincinnati.

High Coal Cost May Mean Suspension of Service.—On expiration of its contract for coal the Owingsville (Ky.) Electric Light Company announced that it would probably suspend service. The company has been unable to renew its contract for fuel at a low price. Plans are being discussed for converting the plant into one operated by oil engines, while there is also a possibility that water power will be developed from a nearby stream.

Factory Lighting in Wisconsin.—The Industrial Commission of Wisconsin has requested the United States Public Health Service to co-operate in its campaign for better lighting in Wisconsin. The commission has appointed John A. Hoeveler deputy in charge of shop lighting. The United States Public Health Service has detailed Davis H. Tuck, its illuminating engineer, to co-operate with Mr. Hoeveler in securing better factory lighting.

Investigations for Pittsburgh.—The finance committee of the City Council of Pittsburgh has decided to have investigations made of the electric railway, electric lighting and natural-gas companies. Bion J. Arnold, Chicago, will be employed to investigate the Pittsburgh Railways; Edward W. Bemis, Chicago, is to investigate the Duquesne Light Company, which has announced an increase in rate for natural gas supplied to manufacturers but not to domestic consumers; F. W. Ballard

& Company, Cleveland, Clayton W. Pike, Philadelphia, and W. Edgar Reed, Pittsburgh, have also been engaged.

Workmen's Compensation Acts.—The National Industrial Conference Board, of which Frederick P. Fish is chairman and Magnus W. Alexander secretary, has issued a summary of a report issued by the board on "Workmen's Compensation Acts in the United States—The Legal Phase."

Manhattan Electrical Supply Stock Listed.—The New York Stock Exchange has listed \$1,121,500 of 7 per cent first preferred and \$2,856,800 common stock of the Manhattan Electrical Supply Company, with authority to add \$328,500 preferred and \$143,200 common, making the totals \$1,450,000 preferred and \$3,000,000 common.

Buckeye Power Company to Take Over Eastern Ohio Properties.—In connection with consolidation of the Steubenville & East Liverpool Railway, the East Liverpool Traction & Light Company and the Ohio River Passenger Railway as the Steubenville, East Liverpool & Beaver Valley Traction Company, the Buckeye Power Company has been organized to purchase the light and power properties heretofore operated by these companies.

Western Ohio Railway Company Increases Power Business.—In explaining its reason for omitting the July dividend to the first preferred stockholders, the Western Ohio Railway Company, Lima, stated that the growth of power business had so far exceeded expectations that \$37,336 of its funds available for dividends had been turned to capital account in the development of this field, in comparison with \$7,166 for the previous year. The income from this source for the year ended May 31, 1917, was \$221,425, while for the previous year it was \$160,003. For the seven months ended May 31 there was an increase of 18½ per cent in the output. However, coal cost \$48,943, or 108 per cent more for the same period. These two items, the company states, made it advisable to omit the dividend for the period.

Electro - Metallurgical Plant for South.—By reason of hydroelectric power available from nearby plants it has been possible for Chattanooga, Tenn., to add an industry that is not only new in that city but is the first of its kind in the South. Ferro-alloys for the manufacture of steel will be produced by the Southern Ferro-Alloy Company, capitalized at \$210,000 and incorporated under the laws of Tennessee. Preliminary work on the plant has been begun. The power contract placed by the Southern Ferro-Alloy Company with the Tennessee Power Company was the largest single order for energy ever given by a company in Chattanooga, calling for 3000 hp. All electrical equipment contracts have been placed. The plant was designed by the Fitz-Gerald Laboratories, Niagara Falls, N. Y. The president of the new industry, P. J. Kruesi, is active head of the American Lava Company, Chattanooga.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Utah Section, A. I. E. E.—A. S. Peters has been elected secretary of the Utah Section of the A. I. E. E.

Boston Section, A. I. E. E.—At a recent meeting of the Boston Section of the A. I. E. E., I. M. Cushing was elected secretary.

Chicago Section, A. I. E. E.—C. A. Keller was elected secretary of the Chicago Section of the A. I. E. E. at a recent meeting.

International Association of Municipal Engineers.—The annual convention of the International Association of Municipal Engineers will be held at Niagara Falls, Sept. 11-14 inclusive. Clarence R. George of Houston, Tex., is secretary.

Association of Iron and Steel Electrical Engineers.—The eleventh annual convention of the Association of Iron and Steel Engineers will be held at the Bellevue-Stratford Hotel, Philadelphia, Sept. 10 to 14 inc. Wednesday, Sept. 12, will be devoted entirely to a patriotic program, with addresses by army and navy engineers on vital subjects concerning the industries.

San Francisco Electrical Development and Jovian League.—At the June 27 meeting of this association, the last gathering until September, six past-presidents of the organizations were present to make brief talks about the association—what its experience has shown, how its activities should be broadened, and what opportunities the future holds in store for it. As a number of members have gone or are going to the front in Europe, it was decided to appoint a committee whose function would be to see that the men thus entered upon the "honor roll" should be kept in touch with activities of the organization and that, in turn, reports from the men should be received by the association.

Empire State Gas and Electric Association.—On July 13 the second meeting of the electric production committee of the Empire State Gas and Electric Association was held at the Hotel Iroquois, Buffalo, N. Y. The principal subjects of the meeting were "Power-House Organization," "Hours of Labor" and "Wages and Bonuses." The executive committee of this association at its regular monthly meeting in June voted that the committee on war measures investigate the question of methods of conserving the coal supply. The committee also approved the investment of \$1,000 of the association's funds in Liberty Loan bonds. It was also decided that the annual meeting of the association be held on Friday, Oct. 5.



F. J. POSTEL

Fred J. Postel, consulting engineer, Chicago, has been appointed State supervising engineer for Illinois. In this capacity he will have charge of the operation and maintenance of all institutional power plants in the State and of the design of all new plants for such places. His jurisdiction covers not only the electrical but also the mechanical and hydraulic equipment of some thirty plants. In 1898 Mr. Postel served as a sergeant in the Second Volunteer Engineers for the Spanish-American War. In 1899 he was graduated from the University of Illinois with the degree of electrical engineer. From 1899 to 1905 he worked with Charles G. Armstrong, consulting engineer, Chicago. In 1905 he entered the consulting engineering business, forming the firm of Postel & Linn. In 1910 he acquired Mr. Linn's interest in the company and renamed the firm Fred J. Postel & Company. Mr. Postel is the representative of the Western Society of Engineers on the Chicago Commission of Ventilation; he is also a member of the American Institute of Electrical Engineers. As consulting engineer for the Miller's Mutual Fire Insurance Companies, he wrote the first electrical codes for that organization.

W. H. Price, for the past six years general manager of the Etowah (Tenn.) Water & Light Company, has resigned to accept a position as secretary and general manager of the Crystal Ice & Cold Storage Company of Etowah. This company owns an electrically driven raw-water ice plant.

C. E. Bennett, for the last two years mechanical and electrical engineer for Hugh L. Thompson, Waterbury, Conn., has resigned his position to become associated with Curtis A. Mees, consulting engineer, Charlotte, N. C. Prior to becoming identified with Mr. Thompson Mr. Bennett was electrical engineer for the Northern Contracting Company and the Georgia Railway & Power Company of Atlanta and was principal assistant to Charles O. Lenz on the Tallulah Falls development in Georgia. Previous to this time he had been associated with L. B. Stillwell and the J. G. White Company of New York City.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

Allen M. Schoen, chief electrical engineer of the Southeastern Underwriters' Association, Atlanta, Ga., is a member of the newly appointed Board of Consulting Engineers of the city of Atlanta. The purpose of this board, the idea of which originated with Mr. Schoen, is to take politics out of city engineering. The board has five members, who are engineers of the highest reputation. Mr. Schoen is particularly well known in the electrical field, being a fellow in the American Institute of Electrical Engineers and having been at one time one of the managers of that body. He was born in Richmond, Va., in 1869 and when twenty years old was graduated from the Virginia Military Institute, after which he took up civil engineering as a profession. Later he took up electrical engineering, and in 1892 he was engaged as an electrical expert at the Lynn (Mass.) factory of the Thomson-Houston Electric Company. He afterward became assistant superintendent of the Richmond (Va.) Railway & Electric Company, from which position he resigned to become electrical inspector for the Southeastern Underwriters' Association. He has been associated with this organization ever since. He was a member of the electrical committee of the Underwriters' National Electrical Association, which formulated the National Electrical Code, and he has written considerably on technical subjects. He recently received a commission as Class A major in the Officers' Reserve Engineering Corps, and while not in active service at present, is acting in an advisory capacity in connection with the Silver Lake cantonment and locating drill grounds for the Seventh Regiment of Engineers.

Samuel Lindsey Nicholson, who has been sales manager of the Westinghouse Electric & Manufacturing Company since 1909, has been promoted to the position of assistant to vice-president, with headquarters at East Pittsburgh. Mr. Nicholson was born in Philadelphia, received his education in the William Penn Charter School of that city, and began his business career as an apprentice with the Belmont Iron Works in 1887. He became associated with the Novelty Electric Works in Philadelphia the following year, and a few months later accepted a position with the Chadbourne-Hazleton Company of Philadelphia, sole sales agent for the Sprague Electric Railway & Motor Company. This company organized the Equitable Electric Railway Construction Company, and Mr. Nicholson was sent to Reading, Pa., as assistant superintendent of construction



S. L. NICHOLSON

to build the Neversink Mountain Railway. Returning to Philadelphia, he was placed in charge of the sales of dynamos and motors of the Wenstrom Dynamo & Motor Company of Baltimore. Later he was sent by the Equitable company to Bristol, Tenn., to build the Bristol Belt Line Railway. In 1892 he became connected with the Philadelphia office of the Short Electric Company and subsequently with the New York and Cleveland offices of this company. Upon the absorption of the Short company by the General Electric Company in 1893 Mr. Nicholson accepted a position with the Technic Electric Works, Philadelphia, owned by Pepper & Register, contractors, who had the contract for the construction work incident to the electrification of a number of the street railways in Philadelphia. After a year's work as superintendent of this company, Mr. Nicholson went with James Boyd & Brothers, agents for a number of mill supply concerns, and organized for them an electric railway supply department. In 1896 he joined the forces of the Cutter Electric & Manufacturing Company and successfully exploited for them a new circuit breaker. A year later he went with the C. & C. Electric Company, as sales representative in New York City, where he introduced the company's engine-type generators and stationary motors. In 1898 Mr. Nicholson became sales representative of the Westinghouse company in New York City, subsequently having charge of the city and industrial division of the New York office. On the reorganization of the sales department in 1904 he was made manager of the industrial department, which position he successfully filled until his selection as sales manager of the company in 1909.

Obituary

Frank L. Stearns, electrical engineer for the Chicago, Milwaukee & Puget Sound electrification, died recently as the result of inhaling gas and smoke caused by the burning of insulation in the substation of the East Portal of the long tunnel of the company in western Montana.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

SITUATION IN LAMP MARKET BECOMES MORE PROMISING

The Period of Greatest Stress Is Now Felt to Be Past—Tendency Toward Even 25-Watt Sizes Is Becoming Evident

At present an optimistic note seems to prevail in the incandescent lamp situation. It is confidently believed by lamp manufacturers that the period of greatest stress is past, and that the future will see the beginning of a restoration of balance between supply and demand.

Since the development of incandescent lamps for commercial use manufacturing processes have been perfected which permitted the manufacture in 1916 of 154,000,000 lamps. No figures are yet available relative to the probable production for 1917. However, there is less anxiety in the market this year than was apparent a twelvemonth ago, due partly to a less disturbed view of the situation and partly to the time-saving and labor-saving lamp-making machinery developed within the last two years. Factory capacities are also being increased as rapidly as the labor and material market will permit. General facilities for lamp production are being increased through improved processes and increased space.

Labor market conditions have influenced lamp production to a considerable extent, but difficulty from this source is thought to be practically past.

There is a noticeable tendency of demand toward "even 25" wattages, with a corresponding falling off of demand for the heretofore most popular 40-watt and 60-watt sizes. It is believed that the higher standards of illumination now prevalent affect this tendency and will govern it to the possible elimination of the 40-watt and 60-watt lamps in favor of the 50-watt and 75-watt sizes.

MANUFACTURERS OF WIRE WORK WITH GOVERNMENT

Committee Formed to Accept All Orders, Make Binding Prices and Apportion Orders Out Among Manufacturers

Insulated wire and cable manufacturers have been very active in lending their support to the government since a state of war was declared. Immediately the United States entered the war practically every wire manufacturer placed his entire organization at the disposal of the national government.

Now this co-operation is taking on a more tangible form. The manufacturers were called to Washington recently to confer with navy officials and at that time three of their number, LeRoy Clark of the Safety Insulated Wire & Cable Company, Edward Sawyer of the Atlantic Insulated Wire & Cable Company and Wallace Clark of the General Electric Company, were appointed a committee to represent the entire insulated wire and cable industry in connection with purchases of wire by the Navy Department.

It was then agreed that all navy orders for insulated wire should pass through this committee's hands. The prices would be fixed between this committee and the Navy Department and the committee would distribute all work of manufacture, the distribution to be made according to the capacity of the plant and to the ability of the manufacturer to ship promptly.

The wire manufacturers have agreed to these conditions,

and already they are in force and orders have been placed by the government in accordance with them.

From the standpoint of the government this offers one of the best possible ways of placing orders. No favoritism is shown and orders are placed in such a way as least to disrupt the market and assure quickest deliveries.

No individual manufacturer is loaded down with government business, the market is stabilized, and the effect on the trade is much smaller than it would be otherwise.

Prices are based on a certain wire base, the copper for which the government agrees to furnish. By the manufacturer, of course, this is welcomed, because he does not have to sell to the government his own stock of copper at considerably less than he paid for it or could replace it for.

The first order was for 1,000,000 ft. of lead-covered submarine cable, which was wanted right away. This order, which would normally have required eighteen months to fill, was accepted and deliveries commenced in thirty days. In sixty days the order was completed. This order was followed by orders for several million feet of other kinds of cable, which were apportioned among sixteen manufacturers.

Prices on this business, it is understood, were much better than the government could have made in the market, and deliveries were much quicker than they would otherwise have been. Therefore, from the standpoint of the government, this method of handling orders has been found to be very satisfactory and very reasonable.

EDUCATING THE RETAILER IN USE OF DEALER HELPS

Western Electric Company Has Compiled a Book Containing All of Its Dealer Helps, Showing How to Tie Up with National Publicity

It has frequently been said that there are three classes of merchandisers—(1) those who depend entirely on their own advertising efforts, (2) those who freely use dealer helps as prepared by the manufacturers and jobbers, and (3) those who do little or no advertising and have no policy in that direction.

The second group is here considered. It includes largely concerns that believe in advertising but which financially are not able to pay for it and have not within their organization the ability to put out convincing copy, booklets, window displays, folders, etc. This group is undoubtedly the backbone of the retail distribution of merchandise.

Each year tons of dealer helps are distributed promiscuously to the trade and central stations on electrical merchandise, a considerable quantity of which brings to the manufacturer or jobber absolutely no return. There is no doubt that in a large number of instances the plan of distributing this material is unsound, principally because the dealer has not been properly educated in the use thereof. It is no uncommon sight to see this stuff thrown into vacant houses, cellars, ash cans, etc., nor infrequently are windows found put together in haphazard fashion and allowed to remain until the material is fly-specked, dusty and unsightly.

Dealers have not been taught how properly to use these dealer helps, on which the national distribution has put the energies of its high-priced advertising specialists, to tie up with national advertising.

Now that paper is so high, the problem of getting results out of dealer helps becomes more acute. Distributors are

now considering how to place these dealer helps that they may produce maximum returns. For this reason the book recently put out by the Western Electric Company entitled "We Are Selling the Idea! Are You Selling the Goods?" is of unusual interest.

In this twenty-eight-page book are found samples and reproductions of that company's complete line of free selling helps designed for the retailer's use. The book has been put together with a constructive plan. Each piece of merchandise is described, and with it are shown the dealer helps that pertain to that product. Also, the selling points of that product are plainly stated so that the retail distributor can merchandise on a firm basis. Details of construction are indicated and explained. Information is included on how to use the dealer helps.

Reproductions of the national advertising of that company are included with information on how to use dealer helps to tie up with it.

The book has this message: If the national advertising that this company is doing is to mean increased business for the dealer, it is up to him to make it easy for the public to buy the articles that it wants.

EFFECT OF THE WAR ON
OUR EXPORTS TO CANADA

Investigation Reveals No Material Increase in the
Volume of Trade with the Dominion as
Regards Electrical Goods

Reports were prevalent a few weeks ago that the entry of the United States into the war in Europe had stimulated to a considerable degree electrical trade with Canada. While such reports may have been true for other manufacturing industries, a careful investigation has disclosed no material increase in electrical exports to Canada. In fact, in some instances it was found that America's entry into the war was a signal for decreasing trade. This was found to be particularly true of the Canadian paper and pulp industry, much of the electrical equipment for which is of American manufacture. A number of projects were scheduled for development shortly, but simultaneously with the entrance of America into the war these plans were either abandoned or postponed indefinitely.

Of course, it must not be lost sight of that some of the larger American manufacturers have established Canadian factories or have connections in Canada in which they have substantial interests whereby goods of Canadian manufacture but identical in design with American goods are marketed in Canada. These plants, which are largely financed by American capital and buy probably most of their raw materials from the United States, have been established in Canada as a means to compete in the Canadian market without the necessity of having to pay import duty.

MARKET ABROAD FOR HEATING
AND COOKING APPLIANCES

High Cost of Coal in Foreign Countries Stimulates
Export Demand for Electrical Mer-
chandise from America

Owing to the high price of coal abroad there is a strong foreign demand for electric heating and cooking apparatus. It is doubtful, however, if much of this trade can be handled by American manufacturers because they are working to capacity on domestic orders placed long ago. Present incoming business is slow, and if manufacturers are not booked too far ahead the foreign business may prove to be very beneficial to manufacturers in a few months.

To engage very actively in this market it may be necessary for American manufacturers to change appliance design and perhaps to specialize on certain appliances not in great demand in the United States. Little has been done to develop products, especially for the foreign market, probably because the demand has not previously warranted it.

THE WEEK IN TRADE

WITH the exception of household appliances there was little change in prices during the past week. The staples seem to be holding up well and prices are maintained. The demand stiffened this week all along the line, and a number of inquiries of large size were made. Some contracts for cantonment supplies were awarded at prices very favorable to the government. Deliveries appear to be getting better as time goes on, and before winter comes it is hoped that they will be much nearer to normal.

Dealers are right now in what is normally the fan season, but owing to the unseasonableness of the weather from coast to coast retail sales are very small. Dealers purchased heavily this year, and unless some real prolonged hot weather comes soon heavy stocks will be carried over, as happened in 1915.

NEW YORK

There was little or no change in general conditions during the week. Prices for staples were maintained, and there was little indication of any sudden change in the near future. Inquiries were particularly good during the week, and the volume of business is being maintained at its height. There is, of course, a big market for wiring supplies and fittings for cantonments, while the demand for general building is slowing up in a very marked way. Practically the only building outside of cantonments showing any considerable activity is that for industrial purposes. Distributors of specialties sold to department stores have been asked to hold up their deliveries inasmuch as the stores are curtailing their buying as far as possible. Deliveries are getting better, barring porcelain, on which, owing to the strike, orders are very far behind. Manufacturers since the first of June have been seeking more and more to effect collections, in which they have been generally very successful.

WIRING SUPPLIES.—Prices have been maintained during the last week with no indications at present of a change in price, either up or down, in the near future.

INSULATED WIRE.—The last few days have brought forth an increase in the volume of inquiries and orders, the most important of which are those for the cantonments. Most of the wire for these cantonments is No. 14 size. An initial order was placed in this district during the last week for 9,000,000 ft. to 10,000,000 ft. of this wire. Further orders will be placed from time to time as the work progresses. These orders are being divided up among different manufacturers, according to available capacity and ability to ship promptly. Prices are based on a certain wire base, copper for which the government furnishes. Very small stocks of large-size wire are being carried now by manufacturers, and it is consequently rather difficult to place an order for other than government purposes. In addition to the material for cantonments, considerable submarine cable has been purchased. While there is slight fluctuation in electrolytic copper, there was no change in the price of wire during the week.

POLE-LINE HARDWARE.—The demand for this class of material is very large, but it is extremely difficult to obtain supplies owing to the general steel conditions. There has been no change in prices.

ELECTRIC RANGES.—The third increase in three months went into effect on June 15. While not all ranges were affected, the average increase on those affected was about 10 per cent. The demand has increased considerably, and it has been found very difficult to obtain sufficient stock owing to the conditions in the steel market.

ELECTRIC FLATIRONS.—An increase on certain irons of 50 cents goes into effect on July 15, bringing the price of irons up to \$5.50 or \$6, as the case may be. It is expected that the minimum price on irons will be \$6 before long. The new business in flatirons has decreased because central stations and dealers were stocked up prior to the advance in price to what was considered to be their full 1917 requirement.

VACUUM CLEANERS.—There was an increase in the price of vacuum cleaners of about 10 per cent on July 1, owing to the increased cost of manufacture. One item in this increase is rubber hose, which has gone up about 120 per cent. Another big factor is motors, which are costing considerably more. There has been an unusually brisk demand for the larger type of machine, especially from factories. Machines for office buildings, hotels, etc., have also sold very well, while stationary cleaners have been selling as in normal times.

FANS.—The largest manufacturers are practically sold out of fans. The demand this year is very great, and it came not only from the regular electric channels but also from other merchandising channels such as furniture houses and drug stores. Owing to the unseasonable weather, which has been cool and rainy, the sale of fans in this territory by dealers has been less than normal. Unless some prolonged and very hot weather comes shortly there is every indication that dealers will carry an unusually large stock over to next year.

WASHING MACHINES.—On account of the difficulty in getting domestic help, owing largely to the big drop in immigration, the demand for washing machines has been unprecedented.

CHICAGO

The lighting sales section of the industry has been busy in the last week figuring on cantonment jobs. Reports coming from Rockford, Ill., and from Rantoul, Ill., tell of the amazingly rapid construction going on in those camps. At Dayton it is said that immediate delivery on motors to drive construction machinery was secured by taking idle direct-current machines out of a large industrial plant in the city. Conditions have been somewhat upset in the contracting trade at Chicago by a lockout. There have been a few changes in prices, the trend being upward.

The condition of jobbers' stocks in the Kansas City territory is probably better to-day than it has been at any time during the past few years. Deliveries along certain lines, are still poor, but improvements have been noticed in many lines, particularly in manufacturers' stocks of rubber-covered wire. The customers of jobbers as a rule are operating on low stocks, and are buying only for their immediate needs, owing to the fear that a break in the market may occur at any time. Advices from a representative jobbing house in the Kansas City territory are to the effect that its sales are holding up well and its volume is approximately 40 per cent greater than the corresponding period of last year. This has been somewhat of a surprise as jobbers in that territory have been led to believe that the extremely high prices would decrease the demand to such an extent that increased prices would not make up the volume of business done last year.

There is very little going on in the building line, but the activity in the oil and mineral section of Missouri, Kansas and Oklahoma has been sufficient to keep up an active market. There has also been more or less activity in municipal work. A number of the small towns in Kansas and Oklahoma are installing municipal lighting plants, and others are making improvements and additions to existing plants. Collections are good on the whole in the Kansas City territory.

ELECTRIC RANGES.—When war was first declared the electric range industry expected a slump in orders. Its belief that this falling off would occur was soon increased by the news that automobile retailers were feeling a tightening up. To date, however, this expected decrease in range business has failed to materialize. Orders are continuing to come in at the regular rate. The surmise is, however, in view of these conditions, that if the feeling of uncertainty caused by war had not developed the influx of orders would have been enormous.

RUBBER-COVERED WIRE.—Slight fluctuations occurred in prices of the larger sizes of rubber-covered wire, although the prices were on the whole very steady.

FLATIRONS.—Prices on flatirons increased from the quotation of the former week, which was \$3.75 to \$3.85, to \$3.75 to \$4.20.

BOSTON

A slight reduction in the volume of business is noted in New England electrical jobbing circles at present, and the advent of the two principal vacation months is without doubt a factor in the situation. The country is settling down to work on a war basis, and each week sees less fear of any serious disorganization of the electrical industry on this account. New England is a region of intensive manufacturing, and the diversified products of its shops and mills exert a very favorable influence on electrical consumption both of goods and of energy. War orders are still being filled in the Northeast, and the demands of the government upon the textile industry and upon the machinery makers are important sources of revenue, whose good effects are felt all along the line.

High prices of material and labor have discouraged residential building this year, and central stations are in many cases looking askance at extensions unless the revenue from these is unquestioned and immediately in prospect. Credits are a little below normal in some quarters, collections being a trifle slow. Prices are about the same as a week ago, except that an advance of \$1 in the retail selling price of several representative makes of electric flatirons took place July 10. Deliveries are improving on the whole.

The second-hand electrical machinery market is not quite so active as a few weeks ago, and one prominent dealer advised the ELECTRICAL WORLD that there is a slight falling off in the demand for motors, due in his opinion to the uncertainties of the legislative situation at Washington with respect to the revenue bill. There is no question that the failure of the Interstate Commerce Commission to rise to the occasion and recognize the financial needs of the railroads in its recent decision was a blow against business confidence, particularly in view of the absence of the former volume of opposition to a substantial rate increase. The fundamentally sound electrical industry in New England is, of course, not directly affected by this decision, but its indirect effect in threatening railroad credit and restricting purchasing power, at a time when "Full speed ahead!" should be the motto of regulating bodies and operating organizations alike, is bound to be unfavorable.

The electric railway situation in New England looks slightly better. Fare increases are beginning to be seen to be necessary, even by the public, and one of the most heartening events of recent months in this great field of electrical activity was the recent "getting together" of the Bay State Street Railway and a large and representative portion of its public before the Massachusetts Public Service Commission in the interests of higher fares for a six months' trial period.

ELECTRIC FANS.—Subnormal temperatures have much hampered the distribution of fans in New England this summer. Retail stocks are being depleted slowly by a sustained demand which increases sharply for a short time following a day or two of seasonable heat, but as New England has had no protracted hot waves as yet, the general movement of fans cannot be regarded as satisfactory.

STORAGE BATTERIES.—Business is poor in isolated plant batteries, but it is excellent in equipment for industrial electric truck service. Batteries for navy yard and submarine chaser service are in much demand, and manufacturers are accumulating a fair stock of lighting and starting batteries for automobile service ready for early shipment. Contrary to the opinion expressed in some quarters, government work is not interfering with commercial orders to any great extent. No immediate price advances are in sight unless material or labor costs rise.

INDUSTRIAL ELECTRIC TRUCKS.—These little equipments are enjoying a rapid increase in popularity in New England. Prominent dealers are very busy in campaigns for better efficiency through this form of industrial transportation, and the outlook was never so good as at present. It is said on good authority that no price advances are at present in contemplation, the effort being to lower unit production costs by prorating them over an increased volume of business.

ELECTRIC MOTORS.—These continue in demand, and one central station which maintains a normal stock valued

at \$25,000 has had its motor inventory depleted to \$5,000 by the industrial requirements of its territory. Consequently it is purchasing motors from all possible sources, and former discriminations are held in abeyance. Deliveries on motors of over 5-hp. rating are still affected by the necessary preference given to government orders, but in the small sizes earlier shipments are being obtained and stocks are larger. No immediate price changes are in sight.

FLOODLAMPS.—Business is good in these equipments, but a summer lull is beginning to be felt. Manufacturers' stocks are beginning to accumulate somewhat, and immediate shipments can be made in many standard types. The first rush of the military demand has been met. A large demand is a feature of the market for new units of 1000-watt to 500-watt rating for railroad yard and other extended-area outdoor lighting. Deliveries can be made in from two to four weeks on the newer styles. It is rumored that a further price advance on floodlamps may be put into effect about Aug. 1.

LAMPS.—The volume of business holds well to previous outputs. Deliveries are improving rapidly, especially with respect to standard lamps.

WIRE AND CABLE.—After an active spring, a falling off is noted in domestic wire and cable orders. The small amount of house wiring and central station line extension work put through this year has been a factor in this situation. Stocks are now accumulating as a result of the ability of cable manufacturers to obtain bare wire and on account of the reduced demand. Twelve months ago a representative manufacturer could not keep a foot of No. 14 wire in stock over night. Within a comparatively few days an order of 1,000,000 ft. of this size for army cantonment service was filled inside of thirty-six hours. The opinion is held that high wages should lead by fall to a broadening of the market for wire, especially in house equipment work. Under present conditions there is little prospect of further stiffening of prices.

ATLANTA

There is no change in the general situation and all lines seem to be enjoying a good business. A little uncertainty, exists however, regarding the future, not that the trade expects a falling off, but rather as to how much business it should prepare for. Jobbers and contractors find it hard to anticipate government requirements for the federal prison additions, German prison barracks at Atlanta, Silver Lake cantonment and other training sites in the Southeast, since it is rumored that all orders for large quantities of material may be placed direct with the manufacturers instead of depending on present local and scattered stocks. However, manufacturers and jobbers report a very healthy condition and good collections.

Contracting business is very active, especially in the industrial field. Residence and building work is normal, with collections fair.

TRANSFORMERS.—Increasing prices and long shipments do not seem to affect the demand for larger sizes; shipments on the smaller sizes show no change.

MOTORS.—Demands are less urgent owing to federal investigation of coal situation. Stocks depleted in all but fractional horsepower sizes.

COPPER.—Prices are steady and stocks very low.

CONDUIT.—A steady demand exists despite uncertain prices. Stocks are depleted with the exception of a few holdings.

CABLE.—Requirements show wide variation and long deliveries are expected. Orders are being placed for November deliveries on varnished cambric.

METERS.—There is a strong demand for all standard sizes with reasonable deliveries.

LAMPS.—Buying is scattered. Stocks are sufficient to handle additional demands.

HEATING APPLIANCES.—The recent price advance has curtailed immediate demands. Stocks are in fair shape.

WIRE.—Southeastern stocks will be badly depleted if the government calls on this section for training camp needs.

WIRING DEVICES.—The market is active with a much better outlook for increased volume of buying. Stocks appear to be able to stand the pressure.

POLE AND LINE MATERIAL.—Demands are increasing slightly. Prices on glass insulators are advancing and improved shipments are reported. Hardware prices are strong and deliveries are uncertain.

FANS.—The delayed seasonal weather came with a rush, causing a brisk movement of the popular 8-in. to 12-in. fans. Stocks, however, bearing up well.

SEATTLE

No particular change in stock conditions was noticed by Northwest dealers during the week July 3-10. There was a slight increase in price of wiring devices purchased for fall and winter stocks. Buying continues to be conservative. Demands of shipbuilding concerns are holding up.

During the week a slight falling off in sales of electrical material was noted. While there was a small advance in the real estate market, there were no noticeable changes in demands for building material, as prospective builders are withholding intended operations until materials decrease in price.

Freight is moving about the same as during the last two weeks. As yet no decision has been made as to whether material for the American Lake (Wash.) cantonment will be purchased in the East or in the West. Credits and collections are good.

COPPER.—Quotations remain unchanged. Strikes at the mines, while having no immediate effect on the available supplies, if maintained will considerably decrease fall and winter supplies, with a consequent jump in price.

CONDUIT.—Prices are unchanged, but indications are that there will be further advances in the near future, and that a sufficient supply will be difficult to obtain.

DOMESTIC APPLIANCES.—The market for heating and other appliances used in the home remains about the same, due to the unseasonable weather.

FANS.—There is very little movement on fans or other hot-weather appliances, as the season is always short in the Northwest.

METAL MARKETS CONDITIONS

Slight Falling Off Noted in Copper and Brass Quotations—Tin Stronger

The week was generally weak in metal transactions. Tin strengthened somewhat, while there were further concessions in electrolytic copper and brass. Holders of copper seemed inclined to part with some of their stocks on Monday at prevailing market prices. The strikes out in the mining regions may have a serious effect on fall and winter deliveries, but since the smelters have sufficient supply to keep them going for a couple of months the labor situation is having but little effect on the spot and summer supply.

Nominal quotations on electrolytic were as follows on Monday last: July, 31 cents; August, 30 cents; third quarter, 30 cents; fourth quarter, 28.75 cents.

NEW YORK METAL MARKET PRICES

	July 2			July 9		
	£	s	d	£	s	d
Copper:						
London, standard spot.....	130	0	0	130	0	0
Prime Lake	30.50	to	31.50*	30.50	to	31.50*
Electrolytic	31.50	to	31.75*	30.75	to	31.25*
Casting	29.25	to	29.75*	29.00	to	29.25*
Wire base	37.00	to	38.00*	37.00	to	38.00*
Lead, trust price.....			11.00			11.00
Nickel, ingot			50.00			50.00
Sheet zinc, f.o.b. smelter.....			19.00			19.00
Spelter, spot			9.17 1/2			9.12 1/2
Tin, Straits			62.00			62.75
Aluminum, 98 to 99 per cent.....	55.00	to	57.00*	54.00	to	56.00**

OLD METALS

Heavy copper and wire.....	27.50	to	27.75	26.50	to	27.00
Brass, heavy	17.00	to	17.50	15.50	to	16.00
Brass, light	14.00	to	14.50	13.50	to	14.00
Lead, heavy	10.00	to	10.25	9.50	to	9.75
Zinc, old scrap	6.75	to	7.00	6.50	to	6.75

*Nominal.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor		List, per 1000 Ft.
B. & S. Size		
No. 14 solid.....		\$61.00
No. 12 solid.....		71.00
No. 10 solid.....		90.00
No. 8 solid.....		106.00
No. 6 solid.....		145.00
No. 10 stranded.....		95.00
No. 8 stranded.....		115.00
No. 6 stranded.....		160.00
No. 4 stranded.....		205.00
No. 2 stranded.....		266.00
No. 1 stranded.....		315.00

Twin-Conductor		
No. 14 solid.....		104.00
No. 12 solid.....		135.00
No. 10 solid.....		185.00
No. 8 stranded.....		235.00
No. 6 stranded.....		370.00
No. 4 stranded.....		575.00

NET PRICE PER 1000 FT.—NEW YORK

Single-Conductor		
No. 14 solid:		
Less than coil.....	\$54.90 to \$61.00	
Coil to 1000 ft.....	48.80 to 59.17	
No. 12 solid:		
Less than coil.....	63.90 to 71.00	
Coil to 1000 ft.....	56.80 to 68.87	

Twin-Conductor		
No. 14 solid:		
Less than coil.....	\$78.00 to \$104.00	
Coil to 1000 ft.....	75.00 to 80.00	
No. 12 solid:		
Less than coil.....	121.50 to 135.00	
Coil to 1000 ft.....	108.00 to 130.95	

CHICAGO		
Single-Conductor		
Discount.....	+10% to 10%	

Twin-Conductor		
Discount.....	—10% to 10%	

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg....	+12% to 10%
1/5 to std. pkg.....	10% to 20%
Std. pkg.....	24% to 44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg....	12% to +20%
1/5 to std. pkg.....	20% to List
Std. pkg.....	30% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel....	.31	.32
Barrel lots....	.28	.29

BATTERIES, DRY—Continued CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12....	.39 to .40	.39 to .40
12 to 30.....	.34 to .35	.34 to .35
50 to barrel....	.29½ to .31½	.30½ to .32½
Barrel lots....	.28 to .28½	.29 to .29½

CONDUIT, METALLIC FLEXIBLE

Size, in.	Ft. per Coil	List per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1¼.....	50	26.00
1½.....	25-50	35.00
2.....	25-50	45.00
2½.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less than Coil	Coil to 1000 Ft.
¾-in. single strip.....	\$67.50 to \$75.00 \$60.00 to \$68.75
¾-in. double strip.....	71.75 to 75.00 63.75 to 72.00
½-in. single strip.....	90.00 to 100.00 80.00 to 93.00
½-in. double strip.....	95.00 to 100.00 85.00 to 96.00

NET PER 1000 FT.—CHICAGO

Less than Coil	Coil to 1000 Ft.
¾-in. single strip.....	\$71.25 to \$75.00 \$60.00 to \$63.75
¾-in. double strip.....	75.00 to 78.75 67.50 to 71.25
½-in. single strip.....	95.00 to 100.00 80.00 to 85.00
½-in. double strip.....	100.00 to 105.00 90.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, in.	List, per Foot	Size, in.	List, per Foot
7/32.....	\$0.05½	1.....	\$0.25
1/4.....	.06	1¼.....	.33
3/8.....	.09	1½.....	.40
1/2.....	.12	1¾.....	.47
5/8.....	.15	2.....	.55
¾.....	.18	2¼.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.....	\$36.67-\$55.00	\$21.50-\$24.75
1/4-in.....	\$36.67-\$55.00	\$21.50-\$24.75
1/2-in.....	\$40.00-\$60.00	\$27.00-\$30.00
3/4-in.....	\$40.00-\$60.00	\$27.00-\$30.00

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.....	\$36.66-\$55.00	\$23.10-\$24.75
1/4-in.....	\$36.66-\$55.00	\$23.10-\$24.75
1/2-in.....	\$40.00-\$60.00	\$25.20-\$27.00
3/4-in.....	\$40.00-\$60.00	\$25.20-\$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38	Conduit, List per Foot
Size, in.	
1/4.....	\$0.08½
3/8.....	.08½
1/2.....	.08½
3/4.....	.11½
1.....	.17
1¼.....	.23
1½.....	.27½
2.....	.37
2½.....	.58½
3.....	.76½

Couplings, List	Elbows, List
1/4.....	\$0.05 \$0.19
3/8.....	.06 .19
1/2.....	.07 .19
3/4.....	.10 .25
1.....	.13 .37
1¼.....	.17 .45
1½.....	.21 .60
2.....	.28 1.10
2½.....	.40 1.80
3.....	.60 4.80

DISCOUNT—NEW YORK

1/4 In. to 1/2 In.	3/4 In. to 3 In.
Less than 2500 lb. 6% to 8%	8% to 10%
2500 to 5000 lb. 9% to 11%	11% to 13%
(For galvanized deduct six points from above discounts.)	

DISCOUNT—CHICAGO

Less than 2500 lb. 3.1% to 7.1%	5.8% to 9.8%
2500-5000 lb. 6.8% to 10.8%	8.8% to 12.8%
(For galvanized deduct six points from above discounts.)	

FLATIRONS

NEW YORK

Net.....	\$3.15 to \$3.50
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CHICAGO

Net.....	\$3.75 to \$4.20
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FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.....	\$5.75 to \$6.30
1/5 to std. pkg.....	4.50 to 5.25
Standard package, 500. List, \$0.07.	

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.....	\$6.25
1/5 to std. pkg.....	5.25
Standard package, 500. List, \$0.07.	

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt-B.....	100	\$0.27
60-watt-B.....	100	.36
100-watt-B.....	24	.65
75-watt-C.....	50	.65
100-watt-C.....	24	1.00
200-watt-C.....	24	2.00
300-watt-C.....	24	3.00
Round bulb, 3 1/2 in., frosted:		
15-watt-G 25.....	50	.50
25-watt-G 25.....	50	.50
40-watt-G 25.....	50	.50
Round bulbs, 3 1/2 in., frosted:		
60-watt-G 30.....	24	.72
Round bulbs, 4 3/8 in., frosted:		
100-watt-G 35.....	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.....	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.....	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)....	\$30.00 to \$35.17
Coil to 1000 ft.....	21.00 to 26.73

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)....	\$37.20 to \$37.84
Coil to 1000 ft.....	27.00 to 28.38

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100.....	\$18.00 to \$29.00
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CHICAGO

Net per 100.....	\$20.00 to \$30.00
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OUTLET BOXES

Nos.	List, per 100
101—A, A1 1/2, 4 S.C., 6200, 320.....	\$30.00
102—B.A., 6200 S.E., 300, A.X. 1 1/2, 4 S.....	30.00
103—C.A., 9, 4 R, B 1 1/2.....	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.....	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list	33% to Net list	27% to List
\$10.00 to \$50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list	40% to 43%	35% to 37%
\$10.00 to \$50.00 list	50% to 53%	40% to 48%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.....	\$14.00 to \$20.00
1/5 to std. pkg.....	13.00 to 15.00
Standard package, 2200. List per 1000, \$20.	

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.....	\$14.00 to \$18.20
1/5 to std. pkg.....	13.00 to 16.90
Standard package, 2200. List per 1000, \$20.	

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.....	\$10.50 to \$24.30
1/5 to std. pkg.....	9.75 to 12.15

CHICAGO

	Per 1000 Net	Std. Pkg. 3500	Nail-it—N.C. Std. Pkg. 4000
Less than 1/5 std. pkg.....	\$10.20 to \$18.00	\$20.75 to \$28.00	
1/5 to std. pkg.	9.00 to 9.75	16.30 to 21.50	

SOCKETS AND RECEPTACLES

	Std. Pk.	List
1/2-in. cap key and push sockets.....	500	\$0.33
1/2-in. cap keyless socket.....	500	.30
1/2-in. cap pull socket.....	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	Net list
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	List
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	List
30-amp. S. P. S. T.....	\$0.80
60-amp. S. P. S. T.....	1.20
100-amp. S. P. S. T.....	2.25
200-amp. S. P. S. T.....	3.48
300-amp. S. P. S. T.....	5.34
30-amp. D. P. S. T.....	1.20
60-amp. D. P. S. T.....	1.78
100-amp. D. P. S. T.....	3.38
200-amp. D. P. S. T.....	5.20
300-amp. D. P. S. T.....	8.00
30-amp. 3 P. S. T.....	1.80
60-amp. 3 P. S. T.....	2.68
100-amp. 3 P. S. T.....	5.08
200-amp. 3 P. S. T.....	7.80
300-amp. 3 P. S. T.....	12.00
Low Grade:	List
30-amp. S. P. S. T.....	0.42
60-amp. S. P. S. T.....	0.74
100-amp. S. P. S. T.....	1.50
200-amp. S. P. S. T.....	2.70
30-amp. D. P. S. T.....	0.68
60-amp. D. P. S. T.....	1.22
100-amp. D. P. S. T.....	2.50
200-amp. D. P. S. T.....	4.50
30-amp. 3 P. S. T.....	1.02
60-amp. 3 P. S. T.....	1.84
100-amp. 3 P. S. T.....	3.76
200-amp. 3 P. S. T.....	6.76

DISCOUNT—NEW YORK

Less than \$10 list.....	5% to +5%
\$10 to \$25 list.....	11% to 16%
\$25 to \$50 list.....	14% to 24%

DISCOUNT—CHICAGO

Less than \$10 list.....	+5% to 5%
\$10 to \$25 list.....	11% to 16%
\$25 to \$50 list.....	14% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole.....	250	\$0.28
5-amp. single-pole, ind.....	250	.32
10-amp. single-pole.....	100	.48
10-amp. single-pole, ind.....	100	.54
5-amp., three-point.....	100	.66
10-amp., three-point.....	50	.76
10-amp., 250-volt, D. P....	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole.....	100	\$0.45
10-amp. three-way.....	50	.70
10-amp. double-pole.....	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	Net list
1/5 to std. pkg.....	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	List to—20%
1/5 to std. pkg.....	15% to list
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

	Union and Similar	List, Each
No. 155.....		\$0.34
No. 160.....		.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list	23% to list	....
\$2.00 to \$10.00	23% to 20%	....
\$10.00 to \$50.00	23% to 30%	....

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list.....	25% to 40%	20% to 30%
\$2.00 to \$10.00	25% to 50%	15% to 40%
\$10.00 to \$50.00	25% to 64%	25% to 52%

TOASTERS, UPRIGHT

NEW YORK

Net price	\$3.10 to \$3.50
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CHICAGO

Net price	\$2.80 to \$3.50
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WIRE, ANNUNCIATOR

DISCOUNT—NEW YORK

No. 18, less than full spools.....	52%
No. 18, full spools	48%

CHICAGO

	Per Lb. Net
No. 18, less than full spools	\$0.565 to \$0.6885
No. 18, full spools.....	0.495 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No. 14	\$15.00-18.00	\$12.00-14.50	\$11.50-12.50
12	21.06-27.05	18.96-22.85	18.01-20.95
10	29.60-39.27	26.64-33.66	25.31
8	42.40-51.44	38.16-48.42	36.25
6	72.19-89.57	64.98-76.80	61.73

CHICAGO

	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No. 14	\$18.00	\$16.00	\$14.00
12	25.92-29.89	21.96-25.62	19.44-23.48
10	36.48-42.28	30.84-35.58	27.36-33.22
8	43.80-60.13	40.15-51.54	35.77-47.25
6	69.24-82.72	63.47-75.73	56.55-61.20

WIRE, WEATHER-PROOF

Solid-Conductor, Triple-Braid, Sizes 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.....	\$40.25 to \$45.00
25 to 50 lb.....	39.25 to 42.00
50 to 100 lb.....	\$38.00

CHICAGO

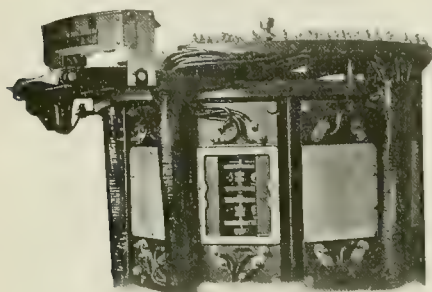
	Per 100 Lb. Net
Less than 25 lb.....	\$42.35 to \$45.50
25 to 50 lb.....	41.35 to 44.50
50 to 100 lb.....	40.35 to 43.50

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Largest Graphic Meter in the World

A 250,000-kw. totalizing graphic meter has been built by the Esterline Company of Indianapolis, Ind., and installed in the Keokuk plant of the Mississippi River Power Company. To



ONE SECTION OF A 250,000-KW. TOTALIZING GRAPHIC METER

meter the output of the thirty three-phase generators used in this plant required the use of thirty polyphase meter elements, each made up of two single-phase units. In carrying out the design of this instrument the desirability of using the same general design in other instruments was borne in mind, with the result that the supporting frame was made up of three sections, each carrying ten polyphase meter elements, thereby making it possible to construct a similar instrument of ten elements or any multiple of ten up to fifty. The instrument is designed so as to be self-contained, without the use of an external case, and is arranged so as to enable the removal and calibration of any individual meter element without putting the instrument out of operation.

The induction type of meter element was adopted, after having devised an element capable of being calibrated mechanically for torque without affecting the correction for power factor. The moving element consists of six aluminum vanes, all mounted on a single staff, supported in such a manner as completely to eliminate friction. The use of this type of element entirely eliminated moving connections or contacts and made possible a high ratio of torque to pen friction.

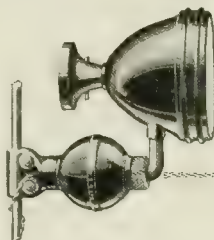
All connections are carried to the top of the instrument to a circular terminal board carrying 240 binding posts, four being used for each single-phase meter element. The actual width of chart is 12.5 in. (31.8 cm.). The charts used are printed in twelve-hour sections and fed at the rate of 3 in. (7.6 cm.) per hour over two rollers, one of which carries pins for driving the paper and is rotated by means of a solenoid-oper-

ated ratchet connected in the electric clock system of the plant. The indicating scale which faces the system operator's desk is illuminated and graduated to the same range as the chart.

With an instrument of this type it is possible to totalize the output of a station of any capacity or a number of stations or systems, regardless of differences in frequencies, voltage and whether or not they are in synchronism, and instruments of the same type can be built for any number of circuits from five to fifty.

A Three-Service Lamp for Autos

An electric automobile lamp which may be used as a spotlight, trouble lamp or floodlamp for camps and picnics is being made by the Anderson Electric Specialty Company of Chicago, Ill. The lamp and bracket are finished in black enamel. A 21-cp. nitrogen-filled tungsten lamp is used in



A CORD REEL MAKES THIS LAMP A FLEXIBLE TROUBLE LAMP

connection with a silvered parabolic reflector. An adjustable cord reel which operates like a curtain roller is located in the ball casing just back of the lamp. Unscrewing the knurled nut permits the lamp to be withdrawn and used as a portable. Control is afforded by a positive "on and off" switch mounted at the back of the lamp.

Universal-Type Sewing Machine Motor

The Pittsburgh Electric Specialties Company of Pittsburgh, Pa., has placed on the market a universal-type sewing-machine motor of simple design. It fits any make or style of machine and is attached without brackets, pulleys, screws or clamp. All that is necessary is to place it in position so that its pulley engages the wheel of the machine and it is ready for work. It is so balanced that it remains in position without being fastened. The speed is regulated and the motor started and stopped by a foot control on the floor.

Elevator Brake Magnet

An elevator brake magnet, designed for use with the parts regularly furnished by the elevator builder and which may be used for elevator motors operating on 220, 440 and 550-volt, 25-cycle to 60-cycle, two-phase and three-phase circuits, is shown in the accompanying illustration. It is installed by mounting it directly over the brake wheel, the base being bolted against the machined gear case.

The operation of the magnet is as follows: When no current is flowing through the motor the brakes are set, being held by a spring. When the motor is started a portion of the current passes through the shunt magnet coils, energizing them and pulling down the brake armature. The travel of this armature, which is about $\frac{1}{4}$ in. (6.4 mm.) at the point furthest from the bearing, gives a horizontal motion of $\frac{1}{16}$ in. (1.6 mm.) to each of the lower ends of the bell cranks, compressing the springs and releasing the brake. When the energy supply is interrupted the armature is released and the brake applied by the springs. The recoil of the magnet armature is taken up by buffer springs, which may be adjusted to the proper compression. The pull of the magnet is 150 lb. (68 kg.) on the lower



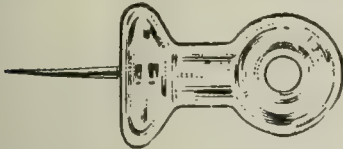
MAGNET MOUNTED DIRECTLY OVER BRAKE WHEEL

ends of each of the bell cranks, making a total of 300 lb. (136 kg.) compression available.

The magnet which is described above is a product of the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa.

Glass Eyelets for Temporary Wiring

Glass push pins provided with an eyelet for use in temporary low-voltage wiring are being made by the Moore



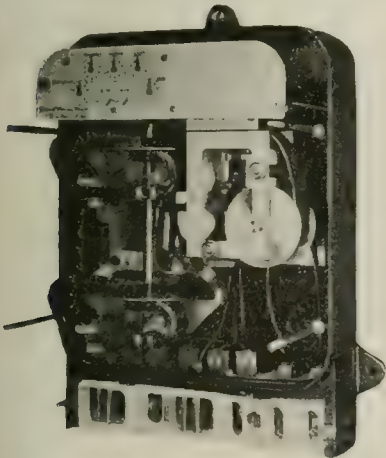
GLASS EYELET FOR LOW-VOLTAGE WIRING

Push Pin Company of Wayne Junction, Philadelphia, Pa. The pins are easily attached to woodwork or walls, and it is pointed out by the maker that they are particularly useful for amateur battery work where small wires are to be run about the house.

Printing Watt-hour Meter That Gives Peaks

An effective method of checking peak loads has been devised by the British Westinghouse Electric & Manufacturing Company, Ltd., Manchester, England. This firm makes several types of maximum-demand meters and has recently developed a printing-type meter equipped with a chart whereon are printed the total units of energy consumed over predetermined periods. The time at which the "peak" loads occur is also recorded.

As distinct from the usual forms of the maximum-demand meter, there is no periodical resetting, the total units registering upon an ordinary dial, another set of wheels being engaged so as to operate the printing mechanism. This part of the meter has three cyclometer dials with specially raised figures, a corresponding number of plungers, actuated by an electromagnet, serving to make the impressions. In consequence of this arrangement the chart is im-



METER FOR CHECKING PEAK LOADS

printed at intervals for which the device has been set.

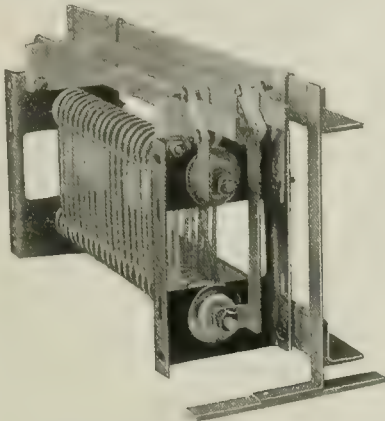
Each roll or chart is controlled by a time switch and will last from ten to twenty days, depending upon the time intervals. The peak loads can be obtained by finding the difference between

consecutive readings and multiplying by the number of imprints made per hour. The time intervals are standardized at fifteen minutes to two hours, but other settings can be obtained if required. A simple spool mechanism permits rapid changing of the charts, obviating interruption.

Industrial Oven Heater

Oven heaters designed especially for use in enameling or japanning ovens, but which may be used in a large variety of applications where ovens are employed for a baking or drying process, have been developed by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa.

The heating element consists of a ribbon wound on a number of fire-clay bushings assembled on two steel tie rods between two pressed-steel end plates. The ends of the ribbon are secured to drop-forged steel terminals which are clamped to the steel tie rods,



HEATER FOR USE IN JAPANING OVEN

the rods thereby becoming the terminals for the heaters. These rods are insulated from the end frames through which they pass, and the ends are threaded for bolting on the connectors.

Cold-rolled steel busbars are recommended and may be mounted directly above the heater on insulators bolted directly to the end frames. Hooks are used for hanging the heaters on to the usual supporting steel work, which may be flat iron, angle or channel iron or pipe work. Protecting screens may be attached directly to the end plates.

Renewable Fuse with Telescoping Element

Cartridge fuses with renewable elements that telescope into fiber shells are being made by the Arrow Fuse & Manufacturing Company of Milwaukee, Wis. The casing, the manufacturer claims, will last indefinitely and carries bolted contacts. A fire-retarding powder filler is used which, besides eliminating noise from explosion, is designed to prevent blackening of the contacts. The renewal operation involves the loosening of only three screws. The design of the shells and elements is such that only the proper cartridge can be used in connection with a fuse element.

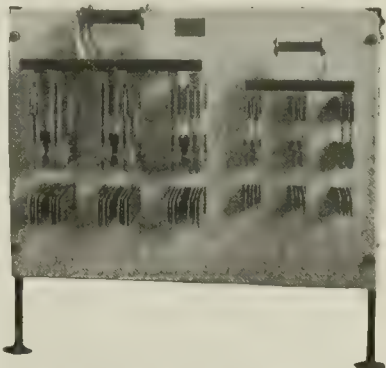
Electric Warmer for Fudge Sauce

An electric warming device designed for preparing and serving hot fudge sauce at soda fountains and candy stores has been developed by Landers, Frary & Clark of New Britain, Conn. Two heats are provided, one with 420 watts demand for quick work and one with 55 watts demand to maintain a proper serving temperature throughout the day. The appliance is made in 3-pint and 6-pint (1.4-l. and 2.8-l.) sizes and is equipped with a patented safety fuse plug for protection against possible injury in case the water pan is allowed to boil dry.

Split-Lever Starting Switch

The General Electric Company of Schenectady, N. Y., has devised a method of reducing the effort necessary to operate large lever switches used for starting large synchronous converters from the alternating-current side in conjunction with auto-transformers. To illustrate the switch arrangement by which this result was achieved, reference will be made to the two accompanying triple-pole switches for starting a six-phase converter. The switch on the left consists of two switches placed side by side, so as to serve as a single switch when thrown into the lower position. There are two cross-bars with separate handles. One-half the blades forming each pole are fastened to one of the cross-bars, while the other half are attached to the other cross-bar.

When used to start a synchronous converter the blades are temporarily thrown into the upper contacts, which are connected to the two-thirds voltage. These contacts are arranged to engage with only one set of blades—those which are attached to the outer cross-bar, or, in other words, those that would be moved first in throwing the switch into the lower position. This portion of the switch, comprising half the blade area, carries the current



TRIPLE-POLE LEVER SWITCHES FOR STARTING SIX-PHASE CONVERTER

until the remaining half of the switch can be thrown to the lower position. Switches of this type have been built up to 5000 amp. rating. They are easily operated and avoid the alternative, which is the installation of large solenoid-operated circuit breakers.

Trade Publications

BELLS.—Edwards & Company, Inc., 140th and Exterior Streets, New York City, is distributing a leaflet descriptive of its iron box bells and buzzers.

PHOTOGRAPHY.—Bulletin No. 78 of the Cooper Hewitt Electric Company, Hoboken, N. J., is a complete catalog of electric lamps and accessories for photographic processes.

MAGNETOS AND LIGHTING GENERATORS.—The Norma Company of America, New York City, is distributing folders relative to ball bearings in magnetos and lighting generators.

SIGNAL SYSTEM.—The Bryant Electric Company, Bridgeport, Conn., has a book on silent-call signal systems for hospitals. This describes the apparatus and illustrates its uses, wiring diagrams being given.

ELECTRIC HOISTS.—Bulletin No. 48-923, descriptive of electric hoists for use from 1 ton to 6 tons, has been prepared by the Sprague Electric Works of the General Electric Company, New York City.

STORAGE BATTERIES.—The Titan Storage Battery Company, Newark, N. J., has issued a book on storage batteries. Storage-battery parts are described and the elementary theory and performance are discussed.

REFLECTORS.—X-ray reflectors for direct, store-window, showcase and flood lighting are illustrated and described in catalog No. 20, recently prepared by the National X-Ray Reflector Company of Chicago and New York.

METERS.—Bulletin No. 46 of the Sangamo Electric Company, Springfield, Ill., tells of the construction and performance of alternating-current watt-hour meters. Price lists and table of train ratios and disk constants are given.

LOW-VOLTAGE TRANSFORMERS.—The Thordarson Electric Manufacturing Company, 501 South Jefferson Street, Chicago, has prepared leaflet No. 70-A, descriptive of its transformers, jump spark coils, make-and-break coils and low-voltage transformers for side lighting and special work. This leaflet also describes this company's wireless transformers.

ELECTRICAL APPARATUS.—The Wagner Electric Manufacturing Company of St. Louis is distributing a booklet in which is reviewed the history of the foremost of those who have made the present age of electricity possible. This booklet also brings to the reader's attention some of the results of the pioneer work which this company has done and its contributions to the art.

MANUAL OF SALES HELPS.—The Western Electric Company of New York City is distributing a manual of samples and reproductions of its complete line of free selling helps, designed for the use of the sellers of electrical appliances. These selling helps are typical of Western Electric educational publicity, illustrating a policy that is different from the advertising of most manufacturers and unique among jobbers. In this publicity the main theme is to sell the idea "Do it electrically." These helps include "Sewing Machines," "A Complete Local Advertising Campaign," "New Electric Iron," "Washing and Wringing Machines," "Fans," "Vacuum Cleaners," "Ranges," "Dish Washers," "Vibrators," "Sewing Machine Motors and Attachments," and "Heating Pads." Newspaper printing plates, lantern slides, folders, display cards, billheads, stickers, window displays and magazine advertisements are shown. A copy of this manual may be had upon request.

MAGNETIC SEPARATOR PULLEYS used to remove magnetic content from non-magnetic bulk material and to protect grinding, crushing and pulverizing machinery are described in booklet S, a new sixteen-page pamphlet just published by the Cutler-Hammer Manufacturing Company of Milwaukee. This booklet lists thirty-five distinct industries where the pulleys are now in use and describes the functions of the pulleys in each. In cement mills, coal mines, coconut-butter factories, cake works, feed plants, fertilizer foundries, light and power companies, linoleum factories, paper mills, pulp mills, railroad shops, railroad systems, rubber-reclamation plants and smelter copper companies the manufacturer states that the pulleys are used principally to protect grinding, crushing and pulverizing machinery from iron and steel pieces which might damage

it. On the other hand, it is stated that aluminum casting plants, automobile parts plants, bearing manufacturers, blast furnaces, brass foundries, brass mills, city refuse disposal plants, fiber plants, fire-clay and porcelain plants, glass products plants, gold mines, grease-manufacturing plants, gypsum mills, starch-refining plants, steel plants, sugar refineries, tea and spice importing houses and terra-cotta plants use C-H magnetic separator pulleys in refining their products through the removal of iron and steel foreign material. The booklet also contains excerpts from letters from twenty-three users of the pulleys engaged in some of the industries mentioned above. Illustrations showing actual installations in various industries are included.

Trade Notes

FRANK LEWIS BIGELOW, president of the Bigelow Company, New Haven, Conn., died on June 20 in the fifty-fifth year of his age.

S. KAHN, 1751 West Thirty-seventh Street, Chicago, advises that the business of K. McLennan & Company, manufacturer of Gale's commutator compound, was turned over to him on Nov. 1 last.

THE ESTERLINE COMPANY of Indianapolis, Ind., has appointed V. W. Shear & Company of Cleveland and Akron, Ohio, district sales agents for graphic recording meters in the northern Ohio territory.

JOSEPH V. KUNZE, vice-president of the Pelton Water Wheel Company and manager of its Atlantic department during the last twenty-four years, died at his home in Brooklyn, N. Y., on June 27, after a brief illness.

THE AUTOMATIC ELECTRIC WASH-ER COMPANY, Newton, Iowa, announces that it has completed and is now occupying its new factory. The company has gone to considerable expense to install efficient and labor-saving machinery in its new plant.

THE DRIVER-HARRIS COMPANY, Harrison, N. J., announces that all departments were shut down for one week beginning June 30. This action was taken to provide for necessary repairs in equipment and to give employees an opportunity to recuperate after a long, hard drive. During the week the plant was shut down a skeleton organization only was maintained by the company.

THE CUBAN MARKET.—A report on the market for construction materials and machinery in Cuba has been written by the Bureau of Foreign and Domestic Commerce for the firms that are interested in this market and want to know how to go about getting business there. Copies may be procured from the Bureau of Foreign and Domestic Commerce, Washington, D. C., for a nominal sum.

THE SHEPHERD-RUST COMPANY of Wilkes-Barre, Pa., recently formed for general electrical construction work, including the manufacture of electrical fixtures, etc., with a capital stock of \$75,000, will take over the business of Shepherd & Rust, which was a general electrical construction and jobbing house for more than twenty-one years. George Shepherd and Harold N. Rust, the principal incorporators, will direct the policy of the new corporation.

THE INDUSTRIAL ELECTRIC FURNACE COMPANY, organized under the laws of the State of Indiana, has acquired the business of the Snyder Electric Furnace Company and the Snyder patents and designs of electric furnaces and processes. The directors of the new company are Charles B. Sommers, Stoughton A. Fletcher and Charles B. Fletcher of Indianapolis, and F. Von Schlegell and F. T. Snyder of Chicago. The business organization is new, and the company will start with a large engineering force. It will take up the manufacture of electric furnaces for steel work and will enlarge the plant at Clearing, Ill., both for electro-metallurgical developments and for the commercial production of electric-furnace products. While no definite announcement of furnace types has yet been made, the company has let it be known that it will soon be in the market with an electric-furnace unit which will combine the desirable features of a three-phase electrical load and the further metallurgical advantages of a single electrode furnace. Mr. Snyder, who will be interested in and associated with the new company as engineer and metallurgist, has had many years of experience in the electric-furnace field. The executive officers of the company will be F. Von Schlegell and Charles B. Fletcher. The offices of the new company will be at 53 West Jackson Boulevard, Chicago.

New Incorporations

THE BRADY TOWNSHIP ELECTRIC COMPANY of Scranton, Pa., has been incorporated with a capital stock of \$5,000. John P. Rawson is treasurer.

THE BANKS TOWNSHIP ELECTRIC COMPANY of Scranton, Pa., has been chartered with a capital stock of \$5,000. John P. Rawson is treasurer.

THE HEREFORD TOWNSHIP ELECTRIC COMPANY of Wyomissing, Pa., has been chartered with a capital stock of \$5,000. A. L. Hart is treasurer.

THE MILLER LIGHT, HEAT & POWER COMPANY of Philadelphia, Pa., has been incorporated with a capital stock of \$5,000. John E. Zimmerman is treasurer.

THE ONEIDA LIGHT, HEAT & POWER COMPANY of Philadelphia, Pa., has been chartered with a capital stock of \$5,000. John E. Zimmerman is treasurer.

THE PERRY TOWNSHIP ELECTRIC COMPANY of Foxburg, Pa., has been incorporated with a capital stock of \$5,000. C. M. Hart is one of the incorporators.

THE NEW SEBREE LIGHT & POWER COMPANY of Sebree, Ohio, has been chartered with a capital stock of \$8,100 by Henry Powell, J. J. Korb and D. M. McMullen.

THE PROFILE FALLS POWER COMPANY of Portland, Me., has been chartered with a capital stock of \$200,000. Sherman I. Gould is president and Charles H. Tolman is treasurer and clerk.

THE MERRIMACK POWER COMPANY of Portland, Me., has been incorporated with a capital stock of \$200,000. The directors are: Sherman I. Gould, president; R. D. Little of Cape Elizabeth, and Embert L. Jones of Gorham.

THE CENTRAL BATTERY CORPORATION of New York, N. Y., has been incorporated with a capital stock of \$600,000 by H. S. Johannsen, P. Platou and J. B. Wardwell. The company proposes to manufacture electric batteries.

THE MET-STO-BAT METALLIC STORAGE BATTERY COMPANY of St. Louis, Mo., has been incorporated by A. I. Jacob, John K. Sterling and others. The company is capitalized at \$50,000 and proposes to manufacture storage batteries.

THE TRELECTRIC MACHINERY COMPANY of Cleveland, Ohio, has been organized by William T. Tregonning, J. A. Boyden, H. N. Pettibone and others. The company is capitalized at \$25,000 and proposes to manufacture electrical appliances.

THE PETERSBURG (Mich.) ELECTRIC LIGHT & POWER COMPANY has been incorporated to generate and distribute electricity for lamps and motors in Petersburg. The incorporators are: William Schroeder, W. L. McCarron and G. Guggenbuhler.

THE KEOUGH AUTOMOBILE DIRECTION INDUCTOR COMPANY of Mansfield, Ohio, has been chartered with a capital stock of \$15,000 by Z. Keough and others. The company proposes to establish a plant to manufacture an electrically operated device.

THE PRIMO LIGHT & MANUFACTURING COMPANY of St. Louis, Mo., has been incorporated with a capital stock of \$50,000 by Henry C. Finck, Leo J. Sayer and Henry H. Oberschelp. The company proposes to manufacture heating, lighting and power devices.

THE FAYETTEVILLE (TENN.) ELECTRIC POWER & LIGHT COMPANY has been incorporated by H. Knox Bryson, W. J. Bunn, William M. Smith, Hugh D. Smith and J. A. Moores. The company is capitalized at \$60,000 and proposes to generate and distribute electricity for lamps and motors.

THE LITTLE GIANT HEATING & LIGHTING COMPANY of Los Angeles, Cal., has been chartered with a capital stock of \$100,000 to manufacture heating and lighting systems. The incorporators are: A. L. Davidson, 712 H. W. Hellman Building; D. S. Collins, 4942 Lynn Street, and S. V. Halstead, 629 South Flower Street, Los Angeles.

THE CONEWAGO TOWNSHIP ELECTRIC COMPANY, the Glade Township Electric Company, the Meadow Township Electric Company and the Pleasant Township Electric Company have been granted charters to operate in Crawford County. Each company is capitalized at \$5,000. The headquarters of the companies will be located at Scranton. John P. Rawson is treasurer.

New England States

BANGOR, ME.—The Bangor Railway & Electric Company is planning to extend its transmission line from Somerville to Southwest Harbor, a distance of 12 miles. The company will also erect a line from Milford to Lincoln, a distance of 33 miles.

PORTSMOUTH, N. H.—Improvements involving an expenditure of over \$200,000 will be made to the electric-light, power and heating plant at the Portsmouth navy yard. New equipment and other apparatus will be installed.

BOSTON, MASS.—Bids will be received by the board of trustees of the Consumers' Hospital Department, 1001 City Hall Annex, Boston, until July 23, for furnishing material and installing complete electric wiring, etc., for Ward O, on hospital grounds, River Street, Mattapan, Boston. Proposal blanks may be obtained at the office of Hollis, French & Allan Hubbard, 88 Pearl Street, Boston.

BROCKTON, MASS.—Bids will be received by the trustees of the Brockton Hospital, Brockton, until July 13 for installing and completing electric wiring in the new hospital building at the hospital grounds, Centre Street. Plans and form of proposal may be obtained at the office of Wells & Dana, architects, 29 Central Street, Boston, Mass., upon deposit of \$15. Loring B. Packard, M. D., is superintendent.

LOWELL, MASS.—The Lowell Electric Light Corporation has applied for permission to lay conduits in Thorndyke and Appleton Streets.

SALEM, MASS.—The Salem Electric Light Company is planning to erect a fireproof building in Peabody Street, to cost \$40,000, to be used for a testing department, stock rooms and garage.

SHELBURNE FALLS, MASS.—According to specifications laid before the State Board of Gas and Electric Light Commissioners the New England Power Company contemplates the construction of a hydro-electric power plant on the Deerfield River at Readsboro, Vt., involving an expenditure of about \$7,000,000. The proposed work will include the construction of an earthen dam, nearly 200 ft. high, which will create a storage basin covering 3000 acres of land. From this dam a tunnel is to be bored through the mountain a distance of 14,000 ft. to a point known as Davis Bridge, where a power house is to be erected, equipped to generate 36,000 hp. The proposed plant will supply additional energy to manufacturing plants in Worcester, Hampshire, Hampden and Bristol Counties.

SPRINGFIELD, MASS.—George W. Atkinson of Washington, D. C., has been appointed electrical engineer at the United States Army at Springfield. He will have charge of the installation of a complete new power plant for the Hill shops, for which Congress recently appropriated \$90,000.

NEWPORT, R. I.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 30, for construction of primer filling house, including electrical work and electric elevator, at the naval torpedo station, Narragansett Bay, Newport, R. I. Specifications, etc., may be obtained on application to the above bureau or to the commandant of the naval station named.

NEW HAVEN, CONN.—Bids will soon be submitted for the large power and heating plant for the Yale University to be erected on Ashmun Street to furnish power for the entire university, grounds and buildings. The tunnel system now being built by the Sperry Engineering Company will lead to the proposed plant.

NEW HAVEN, CONN.—Application has been made to the Public Utilities Commission by the Rocky River Power Company, the Housatonic Power Company of New Haven, the United Electric Light & Water Company of Waterbury and the Seymour (Conn.) Electric Light Company for permission to consolidate the above companies under the name of the Rocky River Power Company. The Rocky River company is to pay \$6,000,000 for the holdings of the other three companies. The new company, it is understood, proposes to construct additional hydroelectric plants on the Housatonic River and a large steam generating plant at some point at tidewater to insure uninterrupted service.

Middle Atlantic States

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company has petitioned the Public Service Commission for permission to issue \$407,000 in bonds and \$174,100 in capital stock, the proceeds to be used for expansion to the service department, line extension, equipment, etc.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

BROOKLYN, N. Y.—Plans have been filed by the New York Telephone Company for a three-story telephone exchange and office building to be erected at Liberty Avenue and Milford Street, to cost about \$125,000.

BROOKLYN, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, N. Y., until July 25, for construction work and refrigeration equipment for storehouse and cold-storage building at the Brooklyn State Hospital, Brooklyn. Drawings and specifications, Nos. 2619 and 2754, may be consulted at the Brooklyn State Hospital, the New York office of the Department of Architecture, room 1224 Woolworth Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is State architect.

JORDAN, N. Y.—The capital stock of the Jordan Electric Light & Power Company has been increased from \$10,000 to \$25,000, the proceeds to be used for extensions and improvements.

LOCKPORT, N. Y.—The United Paper Board Company of Lockport is contemplating the construction of a power house, 100 ft. by 100 ft., one story. Sidney Mitchell, 171 Madison Avenue, New York City, is president.

NEW YORK, N. Y.—J. T. Butler, Room 714, 38 Park Row, New York City, is reported to be in the market for mining equipment and electric apparatus, including four electric cutters, a 500-hp. compound engine, two 300-kw., 250-volt, direct-current generators; marble switchboard complete; steam and water piping at power house; waterworks system for miners' houses, etc.; two electric 15-ton haulage motors; four electric motors, 50 hp. each; equipping outside of mine with electricity; wiring and 1000 incandescent lamps; portable sawmill and machinery for same, four sets of drills, tools, general equipment, etc.

POUGHKEEPSIE, N. Y.—The Central Hudson Gas & Electric Company has purchased the old carpet mill, the mill houses and water rights at Rifton.

RICHMOND, N. Y.—The Staten Island Shipbuilding Company has taken out a permit for the erection of a brick power house, 40 ft. by 80 ft., to be erected on Richmond Terrace, near Andros Avenue, at a cost of about \$16,500. Lockwood, Greene & Company of Boston, Mass., are architects.

SYRACUSE, N. Y.—A committee has been appointed by John R. Clancy, president of the Chamber of Commerce, to look into the feasibility of establishing a municipal electric-lighting plant to furnish electricity for lighting the streets and public buildings. The contract with the Syracuse Lighting Company expires in July, 1918.

SYRACUSE, N. Y.—Plans are being prepared by Captains George O. Hubbard and David Caldwell, quartermaster corps, in charge of camp construction, for the installation of an electric-lighting system at the open camp on the Van Vleck Road. The cost of the work, including extension of electric transmission lines, is estimated at about \$20,000. The cost of extending the main power lines of the Syracuse Lighting Company is placed at about \$1,700.

UTICA, N. Y.—The Utica Gas & Electric Company, it is reported, has awarded contract for the erection of a boiler house on Washington Street.

BAYONNE, N. J.—The Public Service Electric Company has applied for permission to construct a new underground conduit system from Twenty-second Street to the plant of the National Sulphur Company at Constable Hook to supply energy to operate the plant of the latter company there.

HIGHTSTOWN, N. J.—The Public Utility Commissioners have granted the Electric Light & Power Company of Hightstown permission to issue \$35,000 in bonds for extension and betterments to its system.

HOPEWELL, N. J.—The Board of Public Utility Commissioners has granted the Eureka Power Company, a subsidiary of the New Jersey & Pennsylvania Traction Company of Trenton, permission to erect a new line on the River Road from Hopewell-Ewing Township boundary to Hunterdon County, and from Washington Crossing to Titusville and Pennington.

NEWARK, N. J.—The City Council has authorized the advertising for bids for the installation of an improved lighting system in Center Market.

NEWARK, N. J.—The Foundation Company of New York has entered into an agreement with the Public Service Electric Company for energy to operate its new shipbuilding works on the Newark Meadows. A transmission line will be erected to the works.

PERTH AMBOY, N. J.—Bonds to the amount of \$50,000 have been sold. The proceeds are to be used for installation of the proposed commercial distribution system for the municipal power plant. Runyon & Carey, 843 Broad Street, Newark, are engineers.

STRATFORD, N. J.—Extensions and improvements to the street-lighting system, including reconstruction in many sections, are under consideration by the City Commissioners in connection with a five-year light contract to be awarded.

JOHNSTOWN, PA.—The Citizens' Light, Heat & Power Company is contemplating the installation of an ornamental street-lighting system, maintained by underground wires, in the business district.

LANCASTER, PA.—Plans are being prepared for a new power house for the Lancaster General Hospital. The heating system will be completely overhauled. A 100-ft. smokestack will be erected in connection with the new plant.

MAHANAOY CITY, PA.—The Schuylkill Gas & Electric Company has entered into a contract with the P. & R. C. & I. Company to furnish energy for the North Mahanoy and Draper collieries.

MIDDLETOWN, PA.—The installation of an ornamental lighting system in the public square at the junction of Union and Main Streets, is under consideration.

PHILADELPHIA, PA.—The Philadelphia Rubber Works is considering erecting a transformer station at its factory on Reed Street.

PHILADELPHIA, PA.—F. A. Poth & Sons are contemplating the construction of a new boiler plant, 44 ft. by 50 ft., at their factory at Thirty-first and Jefferson Streets.

PHILADELPHIA, PA.—The Electric Storage Battery Company, Nineteenth Street and Allegheny Avenue, Philadelphia, is planning to erect a two-story addition to its plant.

PHILADELPHIA, PA.—To increase the output of the city water plant, new impeller wheels will be installed at the Torresdale station. The Bureau of Water has charge of the work.

PHILADELPHIA, PA.—The City Council has authorized the construction of a new power plant at Pine and Thirty-fourth Streets for municipal service. Plans are being prepared by Philip H. Johnson, architect.

PHILADELPHIA, PA.—Contract has been awarded by the Philadelphia Drying Machine Company, Westmoreland Avenue and Stokley Street, Philadelphia, for the construction of a one-story shop and addition to power plant, to cost about \$20,000.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 27, for the construction of three one and two-story brick and reinforced concrete shop additions, including electric work, heating, etc., at the Frankford Arsenal, Philadelphia.

PITTSBURGH, PA.—Plans have been filed by the National Biscuit Company for the erection of a new baking plant at Penn Avenue and Lambert Street, to cost about \$600,000. The construction of a power plant, to cost about \$25,000, is included in the project.

WILMINGTON, DEL.—The Diamond State Telephone Company is planning to erect a new line from Cape Delaware to Cape Charles, Va., and also for the installation of new cable lines at New Castle to replace the present single-strand lines. Application has been made by the company to the Council for permission to do the work.

BALTIMORE, MD.—The contract for electrical work and mechanical equipment at School No. 47 has been awarded to Riggs, Distler & Stringer, 23 Light Street, Baltimore, at \$41,724.

CECILTON, MD.—A company has been organized to construct and operate an electric-light plant in Cecilton. Contract, it is understood, has been awarded for construction of plant. The officers of the company are: William H. Alderson, president; William H. Brown, secretary, and E. S. Short, treasurer.

TOWSON, MD.—The Black & Decker Manufacturing Company contemplates the erection of a power house at its new works to be built at Towson for manufacturing air compressors, electric drills, etc. R. C. Thomas is chief engineer.

BURNSVILLE, W. VA.—The Pittsburgh & West Virginia Oil Company is planning to install new engines, boilers and other operating machinery at its different pumping stations.

CHARLESTON, W. VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 16, for construction of four buildings for machine shop, foundry and forge shop, heat-treatment plant and lavatory and locker rooms, including electric work, heating, etc., at the United States naval projectile plant at Charleston. Specifications No. 2454 and drawings can be obtained on application to the above bureau.

FAIRMONT, W. VA.—Surveys have been made and rights of way secured by the Monongahela Valley Traction Company for the erection of 30 miles of electric transmission lines to furnish energy to various coal mines. A line (20 miles long) will extend from Ocean Mine, near Clarksburg, via Bridgeport, Rosemont, Flemington, Astor and to Galloway, to supply the Simpson Creek Coal Company and other companies operating in that section; also a line from Riversville toward Morgantown to supply the Lehigh mine operated by the Jamison Coal & Coke Company and the mines of the South Pittsburgh Coal Company and the Antler Coal Company, 10 miles long. F. A. Webster is superintendent of construction.

PETERSBURG, VA.—Work will begin at once by the Petersburg & Wheeling Railway Company to double-track its railway to the camp site at Lakemont.

WASHINGTON, D. C.—The War Department is planning for the immediate installation of an electric-lighting system at the new military camp at Annapolis Junction.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 23, for two coal-handling plants to be installed at the navy yards at Philadelphia, Pa., and Norfolk, Va.

WASHINGTON, D. C.—The Public Utilities Commission has instructed the Potomac Electric Company to extend its conduit system from its present terminus at the intersection of Champlain Avenue and Kalorama Road northward to connect with the existing conduits on Champlain Avenue, south of Euclid Street.

North Central States

WAHJAMEGA, MICH.—Bids will be received by the Michigan Farm Colony for Epileptics (a State institution), Wahjamega, for construction of three buildings as follows: (1) Cottage No. 6 for inmates; (2) addition to present power house and laundry building; (3) a combination store, bakery and refrigerator building. Plans and specifications may be obtained on application to R. L. Dixon, medical superintendent, Wahjamega, and at the office of E. E. Dunlap, architect, 708-709 Hammond Building, Detroit, Mich.

CAMDEN, OHIO.—The local electric-light plant, it is reported, has been purchased by S. P. Hall and others of Angola, Ind.

CLEVELAND, OHIO.—A permit has been taken out by the American Steel & Wire Company for the construction of a coal storage and coal-handling plant and a mill building.

COLUMBUS, OHIO.—The City Council has passed an emergency ordinance authorizing an issue of \$65,000 in bonds for the purpose of rehabilitating the entire street-lighting system. Work will begin on replacing the arc lamps now in use with nitrogen lamps as soon as funds are available.

COLUMBUS, OHIO.—The supplemental estimate prepared by Herman Gamper, city engineer, states that only 700 additional lamps would be required to take care of the city needs instead of 1675 additional lamps recommended in the former report. To take care of the present lighting system 29 circuits are in service and with the new system, including the additional 700 lamps, but 23 circuits would be required. It is proposed to replace the arc lamps now in use with nitrogen lamps. The cost is estimated at \$65,000.

EAST LIVERPOOL, OHIO.—The City Council is considering a plan, recommended by the Chamber of Commerce, for lighting the streets of the business section of the city.

MASSILLON, OHIO.—The Massillon Electric & Gas Company has closed a contract with the Central Steel Company of Massillon for 14,000 kw. The contract calls for delivery of 6000 kw. by Aug. 1 and the remaining 8000 kw. by Jan. 1, 1918. Other

contracts have been made for 4000 kw. additional in the next six months. The company is installing an additional 4500-kw. unit at its plant.

MAYNARD, OHIO.—An underground substation is being installed at the Lydia Mine of the Pursglove-Maher Coal Company. Energy to operate the plant will be supplied by the Sunnyside Electric Company.

NEWARK, OHIO.—Work has begun on the erection of the addition to the local power station of the Ohio Light & Power Company on East Street, which will more than double the present output of the plant. A new 12,500-kw. turbo-generator and 2500 hp. in boilers will be installed. The plans provide for a new smokestack, the installation of a traveling crane, equipping boilers with automatic stokers and the boiler room with coal bunkers. The company is now erecting a transmission line between Newark and Tiffin, a distance of more than 100 miles. The line is completed to Shelby.

REPUBLIC, OHIO.—The Village Council has awarded the contract for erecting 4 miles of electric transmission line from the Tiffin-Shelby line of the Ohio Light & Power Company to Republic and wiring the village for street lamps to Charles L. Zahm of Detroit, Mich., for \$10,560.

ST. PARIS, OHIO.—A special election will soon be held to submit to the voters the proposal to sell the municipal electric-light and power plant to the Dayton Power & Light Company.

YOUNGSTOWN, OHIO.—The Cleveland & Mahoning Valley Traction Company is contemplating constructing a new interurban railway from Warren to Midland, the new industrial town being built by the Carnegie Steel Company. Right of way for the extension has been secured.

NEWPORT, KY.—The local electric plant of the Union Light, Heat & Power Company was recently damaged by fire, causing a loss of about \$25,000.

PADUCAH, KY.—Improvements to the municipal electric-light plant are under consideration by the City Commission, which will include the installation of two 300-kw. generators and other apparatus, to cost about \$52,000.

WHITESBURG, KY.—The Caudill Coal Company is preparing for extensive operations on its local coal properties, and will install electrically operated machinery. The cost of the proposed plant is estimated at \$35,000. L. W. Fields is general manager.

GARRETT, IND.—The Baltimore & Ohio Railroad Company, it is reported, is contemplating the construction of a one-story power house, 71 ft. by 80 ft., in Garrett.

MUNCIE, IND.—The Muncie Electric Light Company is planning to install the new ornamental lighting system provided for in the new franchise recently granted the company.

CHICAGO, ILL.—The Union Electrical Engineering Company has submitted a proposal to the City Council offering to furnish electricity and gas to the city of Chicago at reduced rates. W. R. Furthman is secretary.

CHICAGO, ILL.—Plans have been prepared for Armour & Company for the erection of a two-story reinforced mechanical shop, 110 ft. by 304 ft., on West Thirty-ninth Street and Packers' Avenue, to cost about \$70,000.

CHICAGO, ILL.—Land has been purchased by the Chicago Short Line Railway Company, which serves the Iroquois Iron Company, the Mark Manufacturing Company and other industries in the Calumet district of Chicago, upon which it proposes to erect a round-house and coal pocket.

LEWISTOWN, ILL.—The Lewistown Electric Company, it is reported, is making improvements to its plant.

OTTAWA, ILL.—Work will begin at once by the Northern Illinois Light & Traction Company on improvements to its local street railway and lighting system, involving an expenditure of about \$80,000.

BELOIT, WIS.—The City Council has authorized the street lighting committee to complete plans for the improved lighting system. The committee was also instructed to consider the lighting requirements with a view of making changes in the system as applied to the outside districts in the city. The removing of overhead wires in the business section of the city is also under consideration.

BLOOMER, WIS.—The property of the Bloomer Electric Light & Power Company, including the local power plant and electric transmission line between Bloomer and Chippewa Falls, has been purchased by the Wisconsin-Minnesota Light & Power Company of Eau Claire.

STANLEY, WIS.—The Wisconsin-Minnesota Light & Power Company is erecting an electric transmission line between Chippewa Falls and Stanley.

GILBERT, MINN.—The Mesaba Railway Company of Virginia is contemplating replacing its wooden poles with steel poles in Gilbert. Peter Cosgrove is superintendent of the water and light commission.

MANKATO, MINN.—The Commonwealth Utilities Company of Mankato, Minn., has petitioned the Board of Railroad Commissioners of the State of Iowa for a franchise to erect transmission lines on certain roads and highways in Kossuth and Winnebago Counties, Iowa, to supply electricity for lamps and motors for a period of 25 years.

ROCHESTER, MINN.—Work has started on the construction of the dam in connection with the municipal hydroelectric plant 12 miles north of Rochester, on the Zumbro River, for the city of Rochester. The plan will cost about \$650,000 and when completed will generate sufficient power to supply Rochester and several of the surrounding villages.

CEDAR RAPIDS, IOWA.—The Iowa Falls Electric Company of Cedar Rapids has been granted permission by the State Railroad Commission of Iowa to erect and operate electric transmission lines on certain roads and highways in Hamilton and Worth Counties for a period of 25 years.

DES MOINES, IOWA.—Property has been purchased by the Des Moines City Railway Company south of South Park on which it will erect a substation to furnish power for the South Side line. Equipment for the station has been purchased.

SIOUX CITY, IOWA.—In order to economize in coal and copper, and to provide for an increasing demand for electrical service, the Sioux City Service Company will make extensive improvements at once to its power plant and distributing system. Fred A. Krehbiel and Edward N. Lake of the Krehbiel Company of Chicago, Ill., have co-operated with the company's engineers in making detailed tests and re-

WATERLOO, IOWA.—The Cedar Valley Electric Company of Waterloo has applied to the Board of Railroad Commissioners of the State of Iowa for permission to erect electric transmission lines on certain roads and highways in Franklin County for the distribution of electricity for lamps and motors for a period of 25 years.

ST. LOUIS, MO.—The Spring Wheel Company, 730 Trendley Avenue, St. Louis, is reported to be in the market for electric motors, boilers, presses, etc.

ST. LOUIS, MO.—The Selden-Breck Construction Company of St. Louis, which has the general contract for construction of the University Club Building, to cost about \$525,000, has awarded sub-contract for electric wiring to the William A. Corrao Electric Company of St. Louis.

AVOCA, NEB.—At an election held recently warrants to the amount of \$5,000 were voted for establishing an electric-lighting system. The cost of the system is estimated at between \$6,000 and \$7,000.

GREELEY, NEB.—An election will soon be held to vote on the proposal of issuing \$13,000 in bonds to establish a municipal lighting and heating plant.

INDIANOLA, NEB.—The date for awarding contracts for construction of the proposed electric plant has been postponed by the City Council. The cost of the plant is estimated at \$12,000. Grant & Fulton, Bankers' Life Building, Lincoln, are engineers.

PENDER, NEB.—Plans are being considered for rebuilding the municipal electric-light plant, at a cost of about \$12,000.

PETERSBURG, NEB.—The Nebraska Gas & Electric Company of Norfolk, Neb., has been granted a franchise to supply electricity in Petersburg.

CLEARWATER, KAN.—Plans are being prepared by W. B. Rollins & Company, Railway Exchange, Kansas City, engineers, for improvements to the municipal waterworks system, to cost about \$8,000. The proposed work will include generator, oil engine and pump.

GRENOLA, KAN.—The City Council has engaged W. B. Rollins, Railway Exchange, Kansas City, Mo., to prepare plans and supervise the proposed improvements to the electric-lighting system, to cost about \$15,000. An election will soon be called to vote on bond issue.

HAYS, KAN.—Plans have been completed and approved for improvements to the municipal electric-light plant and waterworks system, to cost about \$50,000. Bids, it is understood, will soon be asked for the work. E. T. Archer & Company, New England Building, Kansas City, Mo., are engineers.

LA CROSSE, KAN.—Contracts have been awarded for improvements to the municipal electric-lighting plant and waterworks system. Contract for pumping equipment not yet awarded. W. B. Rollins & Com-

pany, Railway Exchange, Kansas City, Mo., are engineers.

LENORA, KAN.—An election will soon be called to vote on the proposal to issue \$10,000 in bonds for the installation of a new electric-lighting system.

MANHATTAN, KAN.—The Manhattan City & Interurban Railway is contemplating the purchase of a new or second-hand 200-kw. or 300-kw. rotary converter.

Southern States

RALEIGH, N. C.—The Carolina Power & Light Company is erecting a high-tension electric transmission line from its hydroelectric plant at Waters, S. C., to Laurinburg, where it will connect with the Yadkin River power system.

SPENCER, N. C.—The new car repair shops of the Southern Railway, now being completed, will be equipped for electrical operation.

WARSAW, N. C.—The City Council has approved a bond issue of \$15,000 for the installation of an electric-lighting system.

ATLANTA, GA.—Arrangements have been made for the use of electric service from the Georgia Railway & Power Company at the United States Penitentiary.

ATLANTA, GA.—The Pratt Engineering Company is reported to be in the market for one 100-kw., 220-volt, two-wire compound direct-current generator; one three-phase, 60-cycle, 550-volt, squirrel-cage, alternating-current motor-generator set; two 150-cu. ft. air compressors with 550-volt, alternating-current motors, directly connected; one cupola blower; also miscellaneous motor-driven pumps. Joel Hurt, Jr., of Atlanta is president.

BARTOW, GA.—The Southern Leasing Corporation has contracted with the Georgia Railway & Power Company of Atlanta for energy to operate motors in connection with log washers and pumps at its Barytes mines.

CARTERSVILLE, GA.—The Thompson-Weinman Company, which owns and operates extensive barytes mines in this section, is in the market for one 150-hp., 2300-volt, three-phase, 60-cycle, 1800 r.p.m. squirrel-cage induction motor for direct connection to a centrifugal pump. Electricity will be secured from the Georgia Railway & Power Company.

LINDALE, GA.—Plans are being considered for the erection of a new dye house at the Massachusetts Mills. About 150 hp. in motors will be used. Contract for energy has been signed with the Georgia Railway & Power Company.

NEW HOLLAND, GA.—Arrangements are being made for equipping the plants of the Paeolet Manufacturing Company and the Gainesville Cotton Mills for electrical operation. Contracts have been placed for 506 electric motors of approximately 6000 hp. with the General Electric Company. Contract for wiring has not been awarded. J. E. Sirrine of Greenville, S. C., is engineer. B. M. Stallworth is manager of the cotton mills.

PELLSMERE, FLA.—Bonds to the amount of \$20,000 have been voted to purchase the local electric and ice plants to be owned and operated by the municipality.

KEY WEST, FLA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 23, for construction of two officers' quarters, including electric-lighting systems, etc., at the distant control naval radio station, Key West. Specifications (No. 2422) can be obtained on application to the above bureau or to the commandant of the naval station named.

LIVE OAK, FLA.—The Econpena Lumber Company, it is reported, contemplates installing an electric-light plant for lumber mill.

CHARLESTON, TENN.—Equipment for an 1800-hp. hydroelectric plant, it is reported, will be purchased by John N. Adams, engineer.

CHATTANOOGA, TENN.—The Southern Ferro-Alloys Company has begun work on remodeling the old plant of the Southern Steel Works, which is to be equipped to manufacture ferro-silicon. Later on it is proposed to manufacture ferro-chromium and ferro-molybdenum; also alloys used in the manufacture of high-grade steel. Orders have been placed for three electric furnaces. The company has contracted with the Tennessee Power Company of Chattanooga for energy from the Hale's Bar plant to operate its works. P. J. Kruesi is president of the steel works.

WILDER, TENN.—The Albert Amusement Company is contemplating the construction of an electric plant to supply electricity for lamps and motors in Wilder.

LAMBERT, MISS.—Contract, it is understood, has been awarded for the construction of the proposed municipal electric-light plant, for which bonds to the amount of \$12,000 have been voted.

PINE BLUFF, ARK.—The installation of a new ornamental lighting system in the business district is under consideration by the City Council. It is proposed to replace the cluster-lighting system with single lamps. The Pine Bluff Company has the contract for street lighting.

SPRINGDALE, ARK.—The plant and holdings of the Springdale Light & Power Company have been purchased by the Middle West Gas & Electric Company. The new company proposes to erect an electric plant and supply electricity in Springdale, Fayetteville and to the Rogers plant at Fayette. The cost of the plant and transmission lines is estimated at about \$75,000.

KENTWOOD, LA.—C. A. Kent, owner of the Kentwood creamery, is reported to be in the market for equipment for a cold-storage plant, ice-making machinery, etc.

BARTLESVILLE, OKLA.—Plans have been completed for construction of a Masonic Temple and office building for the Masonic Building Association, to cost about \$275,000. Messrs. McGregor & Everman, superintendents of the association, will have charge of construction of buildings. Bids are now being asked on materials and sub-contracts, including general contract, steam heating, electric wiring, electric passenger elevator, ornamental sidewalk lamps, etc. J. H. Felt & Company, 800 Grand Avenue Temple, Kansas City, Mo., are architects.

ROCKY, OKLA.—An election will soon be called to submit the proposal to issue \$15,000 in bonds for the construction of a water-works system and \$5,000 for an electric-light plant.

EL PASO, TEX.—The El Paso Electric Railway Company has petitioned the City Council for a franchise to build a branch line from Hague Street, out Campbell Street to Kern Place.

SAN ANTONIO, TEX.—The San Antonio Traction Company and the Gas & Electric Company are to be consolidated under the name of the San Antonio Electric Company. The capital stock is placed at \$4,700,000. The company is planning to build an electric railway between San Antonio and Austin, a distance of 82 miles.

STOCKDALE, TEX.—A movement has been started to establish an electric-light plant in Stockdale.

Pacific and Mountain States

ANACORTES, WASH.—The local fish cannery of the Great Northern Packing Company has been purchased by the International Packers of Seattle. The new owners contemplate the construction of an electric plant to supply electricity for lighting and power purposes at the works. A. H. Seeley is superintendent.

BREMERTON, WASH.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 23, for construction of caisson gate for shipbuilding dock, including electric wiring, motors and other electrical apparatus, at the Navy Yard, Puget Sound, Wash. Specification (No. 2459) may be obtained on application to the above bureau or to the commandant of the navy yard named.

HOQUIAM, WASH.—The City Commission is considering a proposal submitted by Mayor McKee to lease the local distributing system of the Gray's Harbor Railway & Light Company for a period of five years. Bids were recently called for street-lighting and only the gas company submitted a bid.

NORTH YAKIMA, WASH.—The Pacific Power & Light Company has authorized the erection of two additional 6600-volt circuits from the North Yakima substation, one to Selah and the other to Oldtown. Orders have been placed for three 250-kva., 6600/2300-volt transformers.

FORT ANGELES, WASH.—A special election has been called for July 20 to authorize a bond issue of \$30,000 to retire outstanding warrants and to provide for extensions and improvements. Bonds in this amount were voted last year, but owing to an alleged technical irregularity were not sold.

SEATTLE, WASH.—The Board of Public Works has extended the date for receiving bids for the construction of a municipal hydroelectric plant from July 20 to Aug. 3. The date was changed at the request of the Allis-Chalmers Company.

SEATTLE, WASH.—The Hebb power site on the White River, owned by the Mountain Development Company, of which P. H. Hebb is president, has been purchased by the Western Washington Power Company,

a subsidiary of the Puget Sound Traction, Light & Power Company, for about \$1,000,000.

TACOMA, WASH.—A portable power station, including complete equipment of dynamos, etc., will be installed immediately by the Tacoma Railway & Power Company to increase the power service on the American Lake street car line. The station will be mounted on a flat car.

BEND, ORE.—A complete new lighting system will be installed in the mills, yards and buildings of the Gardner-Wilkinson Lumber Company.

COQUILLE, ORE.—Plans have been approved by the Chicago office for the rebuilding of the transmission line of the Oregon Power Company between Coquille and Myrtle Point, a distance of about 9 miles. The company is also to erect a new line between Coquille and Marshfield this summer. The Oregon Power Company is operated by H. M. Byllesby & Company of Chicago, Ill.

HERMOSA BEACH, CAL.—A campaign has been started by the Chamber of Commerce for the installation of an ornamental street-lighting system.

LOS ANGELES, CAL.—The City Council has approved the decision of the Public Service Commission to extend the temporary operating agreement with the Edison Electric and the Pacific Light & Power Companies for two years from July 1, 1917.

LOS ANGELES, CAL.—Negotiations are under way for the sale of surplus power generated by the aqueduct plant. It is proposed to sell about 13,500 hp., of which 8000 hp. is to be purchased by the Southern California Power Company and the remainder by the city of Pasadena.

TORRANCE, CAL.—The Pacific Electric Railway Company, it is reported, will alter and enlarge the plans for the construction of its shops at Torrance to provide for a plant for building new cars.

BOVILL, IDAHO.—Bonds to the amount of \$5,000 have been voted for the installation of a municipal electric-light plant in Bovill.

KELLOGG, IDAHO.—The Bunker Hill & Sullivan Mining & Concentrating Company, it is reported, will soon begin the construction of an electrolytic zinc plant at Kellogg. The proposed plant will have an initial capacity of 30 tons per day.

FOCATELLO, IDAHO.—The Burns lighting proposition which has been under consideration for some time has been rejected by the City Council upon recommendation of the highway and light committee, which had investigated the matter and did not think it feasible. The Council has contracted with the Idaho Power Company for lighting the streets of the city for a period of ten years.

RICHFIELD, UTAH.—The State Department has issued a certificate of convenience and necessity to the Southern Utah Power Company, giving the company permission to install a 100-hp. engine on Panguitch Creek and an electric distributing system in Panguitch; an electric transmission line from Beaver Station to Marysvale; a transmission line from Sevier to Marysvale; a distributing system in Marysvale and a transmission line to the Deer Trail mine to carry 300 hp. The company also asks for permission to build a 2500-hp. plant below the works at Beaver. Extensions to Milford and Newhouse and into the Lincoln mining district are also planned.

PHOENIX, ARIZ.—The State Corporation Commission has granted the Pacific Gas & Electric Company permission to issue \$555,000 in bonds, the proceeds of which are to be used for extensions of its street railway system, enlarging its electric power plant and other improvements.

YUMA, ARIZ.—The Arizona-Mexico Land Company is contemplating the installation of a 3000-hp. pumping plant near Yuma, to pump water from the Colorado River to irrigate a tract of about 17,000 acres.

BUTTE, MONT.—Surveys are being made by the Montana Power Company for the construction of an electric railway and electric transmission line from Twin Bridges to the Bielenberg-Higgins and Lake Shore mines, a distance of 14 miles. The proposed railway will be built under the supervision of the Montana Power Company, but will be owned by the proprietors of the mines. The high-tension line will carry about 49,000 volts, to be stepped down to 2000 volts at the Higgins mines and from there transmitted to the Lake Shore mines. The cost of the railway is estimated at about \$26,000.

TONOPAH, NEV.—Work has begun on the large auxiliary power plant in Nye County which will supply electricity for the Great Western and the Tonopah Bonanza mines.

Canada

OLDS, ALTA.—The by-law providing for the installation of an electric-lighting system has been approved by the ratepayers.

EHOLT, B. C.—The S. K. Power Company is contemplating the construction of a large substation at the Emma mine near Eholt.

FERNIE, B. C.—The Coal Creek Mining Company is reported to be considering the construction of an electric-lighting system in the Coal Creek mine.

KASLO, B. C.—The City Council is considering a proposal to heat the city hall and municipal building with electricity this coming winter.

NEW WESTMINSTER, B. C.—Plans

have been completed by the Dominion Products Company for the erection of an addition, 115 ft. by 150 ft., to its local plant. New equipment, including fans and motors, four mechanical stokers and appurtenances and three high-pressure boilers, 18 ft. by 72 in., will be installed.

DRAYTON, ONT.—The ratepayers have approved a by-law appropriating \$9,500 for the installation of hydroelectric power.

Record of Electrical Patents

Notes on United States Patents issued on July 3, 1917

1,231,549. POST-TYPE ARC LAMP; Christian Aalborg and Samuel C. Hoey, Wilkinsburg, Pa. App. filed April 3, 1914. Inclosed.

1,231,557. MOTOR-CONTROL SYSTEM; Howard L. Beach, Edgewood Park, Pa. App. filed Oct. 23, 1913. Employed in connection with elevators, planers and similar machines.

1,231,568. ELECTRIC CABLE; Le Roy Clark, Englewood, N. J. App. filed March 10, 1915. Thin metallic flexible sheath which incases the conductor, providing a smooth exterior surface to which the coating of insulation is applied.

1,231,584. ELECTRICAL APPARATUS; Ralph E. Ferris, Swissvale, Pa. App. filed Dec. 31, 1913. Means for obviating the use of a shunt coil to prevent excessive speed in dynamotors or other compound-wound dynamo-electric machines.

1,231,587. SHIELDING SYSTEM FOR VAPOR CONVERTERS; Charles L. G. Fortescue, Pittsburgh, Pa. App. filed Aug. 9, 1915. Minimizes short-circuiting and reverse arcing.

1,231,588. MAGNETIC MATERIAL; Louis T. Frederick and Leon McCulloch, Wilkinsburg, Pa. App. filed Jan. 7, 1914. Material to be formed into wedges for use in the slots of dynamo-electric machines.

1,231,599. MOTOR-CONTROL SYSTEM; Edward A. Hanff, Wilkinsburg, Pa. App. filed Aug. 7, 1914. Means for insuring the establishment of initial starting conditions in motor circuits before they can be closed, after having been opened because of abnormal circuit conditions.

1,231,613. SYSTEM OF PUMP CONTROL; Henry D. James, Wilkinsburg, Pa. App. filed May 11, 1914. Improvement.

1,231,614. MOTOR-CONTROL SYSTEM; William R. Johnston, Wilkinsburg, Pa. App. filed Sept. 4, 1913. Adapted to be employed in connection with oil-well-drilling rigs and similar machines.

1,231,620. VENTILATING APPARATUS; Jan. A. Kuyser, Edgewood, Pa. App. filed March 3, 1914. Adapted for use in connection with dynamo-electric machines such as large turbo-generators and the like.

1,231,628. POTENTIAL REGULATOR; Edwin Lehr, Pittsburgh, Pa. App. filed May 3, 1915. Improvement.

1,231,648. TRANSFORMER; Emerson G. Reed, Wilkinsburg, Pa. App. filed Nov. 28, 1913. Simple and effective means for holding together the plates or laminas of which the core structure is composed.

1,231,652. SYNCHRONOUS DYNAMO-ELECTRIC MACHINE AND METHOD OF STARTING THEREFOR; Emanuel Rosenberg, Ashbourne, Dowdon, England. App. filed April 25, 1914. Improvement.

1,231,658. CONTROL SYSTEM; Karl A. Simmon and Arthur J. Hall, Wilkinsburg, Pa. App. filed April 6, 1914. Special reference to alternating-current control systems embodying induction motors.

1,231,659. ELECTRICAL PROTECTIVE DEVICE; Benjamin H. Smith, Turtle Creek, Pa. App. filed May 4, 1916. Improvement.

1,231,666. REGULATING CONTROLLER FOR ELECTRIC MOTORS; Harve R. Stuart, Springfield, Ohio. App. filed July 17, 1912. Improvement.

1,231,667. INCANDESCENT LAMP; Howard A. Styring, Middletown, Ohio. App. filed Jan. 21, 1916. Head of the lamp upon which the bulb is carried is provided with a plurality of conducting portions which are so formed as to allow only a limited number thereof to engage the contacts carried by the electric socket.

1,231,708. BATTERY TESTER; Emerson L. Clark, Lakewood, Ohio. App. filed March 9, 1915. Improvement.

1,231,714. STARTING DEVICE FOR MULTIPHASE MOTORS; Henry H. Cutler, Milwaukee, Wis. App. filed Nov. 2, 1916. Provides means for removing resistance from the motor circuit in such a manner that the motor will gradually increase in speed without undue strain upon the motor or power circuit.

1,231,749. ELECTRICALLY HEATED INSTRUMENT; Frank Kuhn, Detroit, Mich. App. filed Aug. 30, 1915. Increase in efficiency in the distribution of the heat from the resistor to the work surface.

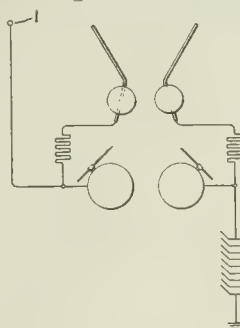
1,231,750. LUMINOUS ELECTRIC HEATER; Frank Kuhn and Frank E. Shailor, Detroit, Mich. App. filed Sept. 9, 1915. Heat is distributed from a plurality of luminous points.

1,231,758. UNIVERSAL LAMP BASE; Louis O. Lieber, Los Angeles, Cal. App. filed Dec. 27, 1915. May be put together or released by a comparatively small movement.

1,231,760. UNIVERSAL RECEPTACLE; Louis O. Lieber, Los Angeles, Cal. App. filed Feb. 23, 1916. Improvements.

1,231,762. SWITCH FOR ELECTRIC SIGNS; John E. Long, Hot Springs, Mont. App. filed Aug. 18, 1916. Provides pneumatically controlled switches which will enable the user to operate the sign without requiring an attendant to insure the smooth running of the apparatus.

1,231,804. WIRE CLAMP; Harry C. Staton, Burlington, Iowa. App. filed Nov. 27, 1916. Means whereby a contact may be formed between two insulated wires without having to remove the insulation.



1,232,467—Spark Gap

1,231,819. ELECTRIC LAMP SOCKET; David A. Walling, Merryville, La. App. filed Jan. 29, 1917. Provides diametrically oppositely disposed electrical conductors carried by the porcelain core and provided with a contact ring spirally arranged.

1,231,821. VARIABLE ELECTRIC SIGN; Herman F. Walton, South Bend, Ind. App. filed Dec. 31, 1914. Means for producing any desired form of display writing on the electric signboard.

1,231,829. PROCESS FOR ELECTROLYTICALLY PRECIPITATING METALS; George C. Westby, Ludwig, Nev. App. filed March 21, 1916. Improvements.

1,231,844. BRUSH-LIFTING DEVICE; Arthur J. Brown, Milwaukee, Wis. App. filed Aug. 3, 1914. Current-conducting element between the brushes and the brush holder or cross-connecting ring is utilized as a portion of the brush-lifting mechanism.

1,231,848. ELECTRIC-LIGHT SUPPORT; Giuseppe A. Centolella, Clinton, N. Y. App. filed May 23, 1916. Upon the arm of a sewing machine.

1,231,875. MAGNETIC CHOKING DEVICE; Hiram H. Gifford and William Gifford, Traverse City, Mich. App. filed June 10, 1916. Gives the lightning arrester sufficient opportunity to act before the high-frequency current can pass the choking device.

1,231,882. CLUSTER TOP FOR ELECTRIC LAMPS; Edmund J. Y. Hammett, Philadelphia, Pa. App. filed Nov. 7, 1916.

"Period" reproduction, floor and table electric lamps.

1,231,883. APPARATUS FOR ELECTRICAL STERILIZATION OF FOOD; Jacob Hanssen, Christiania, Norway. App. filed Oct. 7, 1916. Improvements.

1,231,895. APPARATUS FOR REGULATING THE TEMPERATURE OF SUPERHEATED STEAM; David S. Jacobus, Jersey City, N. J. App. filed June 11, 1915. Improvements.

1,231,953. ELECTRIC POWER SYSTEM; Harry M. Shedd, Elizabeth, N. J. App. filed March 11, 1916. Improvement.

1,231,955. ELECTROLYTIC CELL STRUCTURE; Henry B. Slater, Riverside, Cal. App. filed March 21, 1914. Provides a combined anode and diaphragm for an electrolytic cell, the diaphragm being readily removable for cleansing and replacement.

1,231,992. ELECTRICAL SWITCH; Oscar R. Blumberg and Bryson D. Horton, Detroit, Mich. App. filed June 2, 1914. Designed primarily for service as a three-phase motor starter.

1,232,012. INDUCTION MOTOR; Adolphus M. Dudley, Pittsburgh, Pa. App. filed Oct. 3, 1913. Squirrel-cage type.

1,232,055. MECHANISM FOR CONVERTING MOTION; James B. Lee, Savannah, Ga. App. filed Nov. 20, 1916. Means for converting reciprocatory motion into a rocking or oscillating motion.

1,232,106. SET AND RELEASE DEVICE FOR CIRCUIT BREAKERS AND OTHER MECHANISM; Oscar F. Shepard, Jr., Cincinnati, Ohio. App. filed Dec. 18, 1911. Improvement.

1,232,209. SYNCHRONOUS MOTOR; Arthur R. Bullock, Cleveland, Ohio. App. filed Oct. 19, 1912. To eliminate the hunting action.

1,232,253. ELECTRICAL APPARATUS; Alvarado L. R. Ellis, Lynn, Mass. App. filed July 8, 1915. For electrical instruments having two or more coils or windings adapted to be connected in series or parallel, or series-parallel, for varying the effect or range of the apparatus or instrument.

1,232,278. INSULATOR; Walter T. Goodard, Hamilton, Ontario, Canada. App. filed April 4, 1916. Strain.

1,232,372. CONTROLLING APPARATUS FOR ELECTRICAL MOTORS; Harley C. Mosley, Portsmouth, Ohio. App. filed Dec. 30, 1915. Improvements.

1,232,354. INSULATOR; John E. Mair, Pittsburgh, Pa. App. filed Nov. 28, 1916. Knob.

1,232,362. ELECTRIC FURNACE; Claude G. Miner, Berkeley, Cal. App. filed Feb. 17, 1917. For laboratory and scientific work on a small scale.

1,232,412. SWITCH AND FUSE CONSTRUCTION; Hermon L. Van Valkenburg, Edgewater Park, N. J. App. filed April 21, 1913. For use in connection with electric distributing systems such as are employed in the interior wiring of buildings.

1,232,450. RESISTANCE ELEMENT; Joseph A. Misland, Bayonne, N. J. App. filed Sept. 9, 1916. Resistance wire is preferably in the form of a spiral coil suitably supported by an inner insulating support throughout its entire length when contracted and throughout most of its length when extended.

1,232,451. ELECTRIC REGULATING DEVICE; Joseph A. Misland, Bayonne, N. J. App. filed Sept. 9, 1916. Provides improved means of support for the extensible coil and, if desired, an improved form of cross-section of wire for the purpose.

1,232,453. ANNUNCIATOR; Albert Sullwold, Grove, Okla. App. filed Oct. 4, 1915. Operation is under thermostatic control.

1,232,456. RELAY; William L. Bliss, Brooklyn, N. Y. App. filed Dec. 26, 1908. Provides a fluid-pressure responsive device for actuating certain instrumentalities and electromagnetically operated means for regulating the pressure upon said fluid-pressure responsive device.

1,232,467. SPARK GAP; Frank W. Peek, Jr., Schenectady, N. Y. App. filed Aug. 19, 1915. Relates to lightning arresters of the type having a spark gap for relieving transmission lines and other conductors of transient voltages and similar abnormal conditions.

Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, JULY 21, 1917

No. 3

The Reform of Rates

THE time has come when central stations can no longer afford to continue service at present or reduced prices in face of the immense increase in the cost of the fuel, material and labor that go to make up and distribute their product. Year after year the tendency in the price of electrical energy has been steadily downward in face of rapid increases in the price of every other human necessity. With cheerful optimism the supply companies have trusted to skill, increased efficiency of operation and the natural growth of the business to compensate for the extra costs that have gradually been piled upon them. The conditions brought about by the war have now banished illusions, and it is needful to look the grim facts in the face. Within the last two or three years all material of electrical construction and operation has increased immensely in price. Finally coal, the raw material of much of the central station output, has risen to figures never imagined by those in the business as likely to be reached during the lifetime of the present generation.

It had been realized that at some time in the far distant future the coal supply must necessarily be shortened by the continual inroads upon it, and that fuel prices might become almost prohibitive. That time is forced prematurely upon us by the world war, so that this, with the other items of cost, in most cases is practically doubled. Until very recently electric supply companies have held hard and hoped for better things. But to-day there is no chance for disguising the seriousness of the situation. As the business has grown, large consumers have been taken on in great numbers at rates only moderately remunerative at the old prices for coal. To-day the profit in such business is virtually wiped out, or even converted into a loss, and the time is ripe for a general upward movement of rates to meet actual increase in expenses forced upon the producer. Those who have studied our columns in the last few weeks realize how general has been the necessity and in how many places the need of increased prices has spontaneously been felt. Scores of stations have adopted coal clauses in their power contracts, raising or diminishing the price to the consumer on a sliding scale. In fewer instances the same process has been applied to the lighting rates, which in many cases have been very low for the large consumer.

It is difficult to estimate by general average the increase in actual cost of production in electrical energy due to the rise in coal. Half a cent per kilowatt-hour is probably an underestimate, while a cent per kilowatt-hour frequently would not cover the rise in the actual

cost of distributed energy. The disastrous feature of this change is its effect on the large blocks of energy sold at low figures to big industries. The rate which represented a small but steady profit three years ago may very readily mean actual loss to-day. It is chiefly to meet the requirements of such cases that the coal clause has been adopted. If, however, the electrical industry is to prosper in the face of present conditions, there must be a frank and open readjustment of prices to take account of all the increases of cost. Serious as these are now, they are likely to be worse in the near future. Just how an increased schedule can best be worked out is not easy to say. The coal clause helps in putting the burden of extra cost where it belongs, but it does not help enough. When every single item that goes into the cost of public service has increased in price, some account must be taken of things other than fuel. Adverse conditions evidently strike hydroelectric plants as well as those operated by steam, for the costs of labor and material are up, and every hour in which auxiliary plants have to be used becomes a serious burden, especially since these plants are often in places where the cost of transporting fuel, always high, has still further risen.

It is interesting to note that private and municipal plants alike have felt the sting of necessity and have been obliged to call for an increase of rates. But for one plant which as yet has taken this step scores are struggling on against almost prohibitive costs and trying to hold their own. They have stood by the public to the limit of their ability while every other one of the concerns that serve the public with necessities has unloaded its burden and too often made necessity an excuse for extortion. The public service commissions are rightfully jealous of the public interests, but we believe that they are far too fair-minded to expect the producers of electrical energy to face financial disaster in the endeavor to maintain the low level of the prices of the past. Any company that comes before them with the expectation of giving and getting a square deal will now meet with at least an open mind on the part of the guardians of the public.

In order that proper prices may be secured, a concerted effort should be made to work out an equitable basis for the necessary increase. It is now being done in a rather haphazard way, chiefly by means of a coal clause which sooner or later is likely to produce bickering and recriminations unless dealt with in a perfectly systematic manner. And, aside from this, the service costs must be taken into account if any suitable and permanent basis for meeting new conditions is to be

worked out. The service costs probably represent on the whole a permanent increase, at least one which will hold for some years to come. The coal costs represent an increase in part permanent, depending on the general upward trend of prices, and in part temporary, owing to shifting costs of transportation, particularly by water. Any general plan for dealing fairly with the situation must therefore include a fixed and a variable factor. The criticism which we would make of the coal clauses now in use is that they are often somewhat too intricate. If reduced to a very simple sliding scale added to the necessary service charges, it ought to be possible to work out a logical system. Each station has its own coal cost per kilowatt-hour, which is on the average an ascertainable figure, on which to base the actual rise in cost of energy furnished for every shift in the price of fuel. The main point about working out a practical rate is not to attempt too complicated a sliding scale. It is high time that the electric supply companies of the country got together and settled upon a fair basis for increased rates which could be laid generally before the public service commissions, placing the cards squarely upon the table and asking as a matter of simple justice that the companies serving the public shall not be required to suffer in the performance of their duty. Unless a general move is made in this direction, many a company will get a staggering blow from which it will not recover for years to come. It is simply a case of fair play to those who recognize their duty in public service and have shown every disposition to live up to their obligations. There are many companies, some of them in large cities, to which the above is not applicable; but we speak for the industry in general, and particularly for those smaller companies whose position at the present time is very far from being an enviable one.

Comparison of Transformer Ratings

IT IS a well-known fact that the hotter a copper winding the more power it will dissipate for a given current strength, because the dissipation varies as I^2R , and therefore, for a fixed value of I , the heat liberated will vary directly with R , and this increases with the temperature. Consequently, an ordinary dynamo-electric machine tends to increase its temperature elevation, at constant output, as the ambient temperature is increased, although the relation is somewhat obscured by the effect of temperature on the iron losses.

If, however, the experiment is made on an oil-cooled transformer, the temperature elevation is found to depend but little upon the ambient temperature at constant output. It is true that at the higher ambient temperatures the dissipation in the windings of the transformer tends to increase under constant load; but the oil is also reduced in viscosity, so that the convection of heat through the oil from the windings to the outside shell and environment becomes more active, thereby tending to arrest the temperature elevation. This property of self-cooled oil transformers has only come into

recognition of recent years. The practical consequences are discussed this week by E. Hagenlocher in his article on another page.

Outdoor Substations

THE good points of the outdoor substations from the standpoint of operative reliability and economy we have often discussed in these columns. More and more of them are being installed, even for severe service in difficult climates, and the indications now are that for the ordinary work of transmission systems in most parts of the country the outdoor substation should be regarded as standard and the substation building as highly special. Indeed, where the work of the substation is not of such a character as to demand intricate switching or the regular work of an attendant, housing it in a permanent structure is seldom necessary.

The switching problem being the most difficult, the best general rule to follow is to use as few switches as are compatible with safely working the necessary service. It is important that the supply should be so arranged that the outgoing lines can be fed somehow in face of all ordinary service conditions. It is not important, generally, that provision should be made for putting any transformer upon any line at will or under some highly improbable circumstances. It should be remembered in this connection that low-tension switches, in the present sense of that word, are the high-tension switches of yesterday and must be treated with corresponding respect. For the primary lines the air-break type of switch has come into considerable use and, while not yet perfect, has simplicity in its favor. The oil switches for high tension are fortunately well worked out in the outdoor form, so that all requirements for the breaking of considerable current at high tension can be readily met. Stress, too, should be laid on the requirements of a simple and easily operated type of disconnecting switch for cutting loose the apparatus which is not carrying current. The simple forms which have been developed for indoor use require considerable modification when they are to be left out in the weather. Certainly they should never be used with switch hooks and other temporary rigging, which always runs some risk of getting mixed up in the high-tension circuit. Mr. Samuels shows in his article a practical operating gear for such switches which seems fully to meet the requirements of outdoor service.

Auxiliary apparatus like lightning arresters works as well out of doors as anywhere else, but no better. As a rule it has to be tried symptomatically with reference to the local conditions and requirements. Outdoor metering perhaps needs more development than any other branch of the game. It involves the convenient and safe installation of both meters and their potential transformers. The fewer the high-tension terminals in the equipment the better, and the main point in the installation is to combine proper precautions for safety with facility for reading the meters. It is an open question to what point of complication the outdoor substation can profitably be carried. If pushed to the ex-

tre, it may readily happen that the cost of apparatus and installation fit for use in the open, particularly as regards the smaller items of the outfit, may be so considerable that there would be actual simplification in housing the whole affair. - An intermediate condition, too, may be encountered in which it may be wise to house certain parts of the equipment while leaving the rest in the open air. However, the orderly way in which apparatus can be assembled, following the plan outlined by Mr. Samuels, is one which permits widely varied service on what one may call a unit system of construction.

What Is to Become of Our Teachers?

THE recent report of the Carnegie Foundation is a very interesting document. It will be remembered that Andrew Carnegie about ten years ago created a pension fund, under the administration of a board of trustees, for the benefit of college teachers in North America. The colleges included in the endowment were at first comparatively few. It became necessary to define and standardize the conditions under which the outside colleges might enter the fold of the endowment. After these standards had been fixed, a large number of the outside colleges found means for complying with them and applied for admission; so that to-day there are seventy-three accepted colleges, several of which are in Canada. The report shows that the great universities tend to grow, in the numbers of their teaching staffs, more rapidly than the small colleges, and already about half of the pensions administered are absorbed by ten of the largest institutions. It has also become manifest that the fifteen-million-dollar fund at present handled by the trustees will be hopelessly inadequate to provide pensions on the present scale for the retirement of all the teachers in all these colleges at the present rate of aggregation.

As the report intimates, about 50 per cent of all the college teachers, commencing their work as young instructors, die before sixty-five, the age of admitted retirement, and besides those who die young about 30 per cent resign before that age to take up other forms of employment; so that only about 20 per cent of the original entering class of teachers come up for pensions. These veterans, however, cling to their pensions with a tenacity worthy of Methuselah himself. The foundation, grieved by this longevity, has called a halt and

laid the threatening grievous deficit before all the constituent colleges, asking for suggestions. The report prints about fifty college replies. Some of the replies are vague; but, broadly speaking, they indicate a wide recognition that in future the pensions of the incoming teaching staffs must be placed upon some contributory basis, in which a certain share should be carried by the foundation and the remainder by compulsory deduction from salaries.

A great incidental advantage of the Carnegie Foundation is that it steadily tends to organize and weld the college teachers into a recognition of a purpose, a brotherhood, a duty and a responsibility shared in common. The advantage to North America and to the world of such an intellectual concept, rightly outlined, far outweighs the financial advantage of pensions distributed among the staffs. In a democracy like ours it is of the highest concern that the college teachers should be men of scholarly habits and of large ideals. To this end the vocation of teaching should be dignified, and made permanent on good behavior, but should not necessarily be made commercially attractive. A college teacher once attaining faculty rank should never be removed without the consent of his peers. His pension should be paid for out of his own salary, if not entirely, at least in part; because, in the last analysis, there is no way in which the cost of a definite pension system can be lifted from the shoulders of its consignees. Non-contributory pensions are mythical in the long run. Above all, the emolument of the college teacher must be appreciably less than that which the same intelligence, energy and enterprise would probably secure in competitive professional or business life, if the teachers are to be leaders in intellectual and scholarly pursuits. If the pay of college teachers should be recognized to be as great as or greater than that in the outside world of affairs, then the chairs of professors will cease to be filled by men who esteem learning and hard intellectual work above everything else in life, and the inspiration of the colleges will cease. The teacher must feel that by the sacrifice of a certain reasonable margin of extra emolument he receives in exchange the intangible advantages of intellectual fellowship and a leadership among those who consume the midnight kilowatt-hours for the acquisition of intellectual power and the uplift of the spiritual horizon. In recognition of this renunciation, the teacher's position, tenure of office and pension must be respected and safeguarded.

WITHIN the last two years industrial conditions have had many economic effects on central station operation. Load factors have been bettered, load curves changed, stations utilized to the limit of their capacity, etc. This alteration of previously existing conditions is commanding the attention of plant executives. One such change, namely, the effect on the station peak, will be discussed in the next issue of the *ELECTRICAL WORLD* by William N. Neibich. The author shows how the great increase in industrial load in Baltimore during recent years has

The Coming Issues

caused the disappearance of the evening peak and the appearance of forenoon and afternoon peaks. Another article will discuss the question of whether or not appliances should be given free to employees, especially those engaged in appliance sales. In the same issue will appear an article by Prof. C. E. Clewell on lighting in the textile and clothing industry. Among the subjects which will be discussed will be the effect of adjacent buildings, angle of incidence of sunlight on windows, and reflection coefficient of fabrics on artificial light requirements.

The Improvement of the Outdoor Substation

Suggestions for Changes in the Design and Arrangement of Apparatus Used in Unhoused Transformer and Switching Stations—Air-Break and Disconnecting Switches, Floodlighting, Etc.

BY M. M. SAMUELS

OUTDOOR substations have come to stay. Only in very special and extreme cases will it be necessary to consider housing of the high-tension apparatus. Many high-tension transformers and lightning arresters which are now sold for indoor purposes can be placed outdoors without making any change whatever in the apparatus, and the time is not very distant when the type of high-tension apparatus which requires housing will have disappeared altogether. Even outdoor generators are now being contemplated and are within the range of probability for the near future.

Notwithstanding the great progress made within very recent years in the design of outdoor apparatus and outdoor stations, there are still some drawbacks and difficulties which must be overcome before the outdoor station will take a final form. On the one hand, many engineers who are designing outdoor stations are slow in realizing that they must be designed as such and neither as parts of transmission lines nor as indoor stations with walls and roof omitted. On the other hand, the manufacturers of outdoor apparatus do not give enough consideration to suggestions made by station designers and operators. Thus it often happens that a piece of apparatus, though excellently worked out when considered by itself, will give considerable trouble when it becomes necessary to make it a part of a station having any degree of uniformity, especially when the apparatus must be operated or inspected. With these ideas in mind some suggestions for improvements will be given in this article, it being hoped that the discussion will elicit suggestions from other sources.

HOW TRANSFORMERS CAN BE MODIFIED

To eliminate the necessity of running cables from the switches to terminals inside the transformer housings, all transformer terminals should be adapted for connecting to a pipe or a bar, and external lugs should be provided for high-tension and low-tension connections. The terminals should be arranged on top of the transformer cover instead of in the bottom or side, since this arrangement will make the wiring simpler. Solid studs with threads on the outside should be cemented in the bushing, so that either a cable terminal or a flattened pipe or bar can be connected thereto.

Transformers rated at 200 kw. and more should be equipped with wheels, flat ones being best for small transformers and flanged wheels with standard gage for large ones. Terminals and wheels should be so arranged in relation to each other that the center lines of the terminals are at right angles to the center line of the track, this arrangement being the best in most cases. Since gages and thermometers are always placed near the top of transformer cases, reading them is a hazardous task as the operator is brought into very close proximity with the terminals emerging from the top of the case. For this reason thermometers, gages

and valves should be attached to the side of the case furthest from the high-tension terminals. In addition, a head guard might be attached to the transformer case as shown. Perhaps it will be possible to work out some sort of a periscopic arrangement (either permanent or portable) whereby thermometer and gage readings can be taken from the ground.

Great progress has been made recently in the construction of self-cooled outdoor transformers of large capacity, to the great satisfaction of station builders and operators. The increased use of such transformers will therefore make it necessary in the near future to develop a good, serviceable, distant-indicating temperature-measuring device.

SUGGESTIONS REGARDING OIL SWITCH TERMINALS AND HANDLES

Next in importance to the transformer for outdoor stations is the oil switch. There is very little to suggest for the improvement of high-tension oil switches

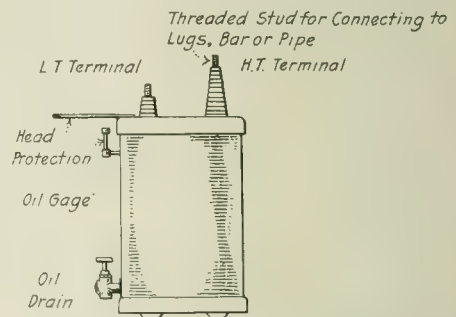


FIG. 1—METHOD OF EQUIPPING TRANSFORMER TO PROTECT OPERATOR AND FACILITATE CONNECTION

since all oil-switch manufacturers have within the last year or two redesigned their switches with due regard to outdoor station arrangements and requirements. The introduction of pipe and angle-iron framework mounting has eliminated the necessity of very high foundations, and the introduction of tank lifters makes it possible to inspect and repair switches without disconnecting any cables from them.

A little more attention should be given, however, to low-tension outdoor oil switches, which are generally for 2300-volt service. Many switches designed for this voltage do not fulfill outdoor station requirements, particularly as regards the terminals and operating handles, and are often the cause of awkward station wiring and operating troubles. What has been said with reference to transformer terminals is equally true for low-tension switches. Cable will very seldom be used in outdoor stations of any size, and all terminals should therefore be arranged so that a pipe or a bar can be connected to an external stud, which should always be on top of the oil-switch casting. Bushings in the bottom of the cover have, in the opinion of the writer, no advantage whatever, except perhaps that they permit a

small saving in the cost of the switch which will be offset by the increased cost of wiring. The operating mechanism or handle should be so constructed that its position will clearly indicate at the switch whether the switch is open or closed. This is especially important with remote-controlled switches and should be made a safety requirement by insurance companies and other

and other delicate parts should be eliminated as they are not suitable for outdoor use.

It may be said that the present tendency is to reject the use of switch hooks as entirely obsolete. They are too cumbersome, involve too great a hazard, and should be prohibited by the proper authorities. It is such a comparatively simple matter to arrange a suitable mechanism for operating a single or double set of disconnecting switches that individual switches and switch hooks should not have to be considered at all. A very simple arrangement is shown in Fig. 3. For the same reasons strain-type disconnecting switches may be considered an entirely unnecessary evil. For them can be substituted in each case vertically mounted or horizontally mounted switches operated in common from the ground. All disconnecting switches and air-break switch mechanisms should have locking devices. These types of switches should be rugged but not clumsy or unnecessarily heavy.

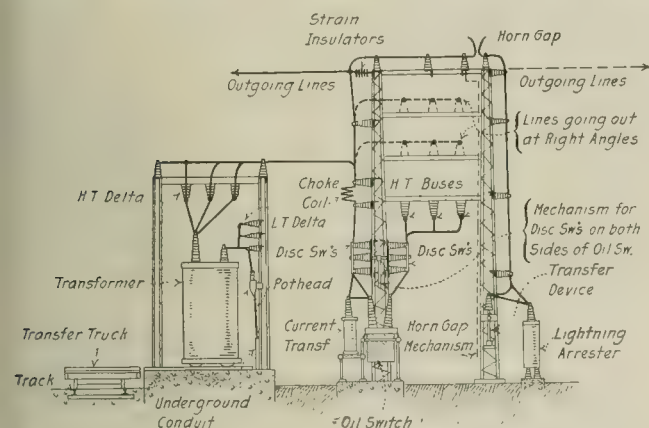


FIG. 2—ARRANGEMENT OF EQUIPMENT THAT SIMPLIFIES CONNECTIONS, PERMITS LINE EXTENSIONS IN ANY DIRECTION AND FACILITATES ADDITIONS

authorities. The handle should be so arranged that a remote-control attachment can be easily introduced, since it will often be necessary to mount the oil switch too high for an operator to reach the handle from the ground.

When solenoid-operated mechanisms are used, the waterproof housing should be so arranged that the solenoid and mechanism can be inspected without lifting heavy castings. The solenoid housing will generally be mounted on a concrete base, and since it has to be adjusted with respect to the mechanism it will not be possible to bring a conduit up through the concrete accurately enough to meet the inlet usually provided in the bottom of the solenoid housing. For this reason the inlet should be on the side of the housing.

AIR-BREAK SWITCHES AND DISCONNECTING SWITCHES

Considerable misunderstanding still exists as to the distinction between air-break switches and disconnecting switches, engineers often specifying air-break switches when they want disconnecting switches and vice versa. Manufacturers also frequently confuse the two. It must therefore be repeated that an air-break switch is equipped with arcing horns or other means which permit opening a circuit carrying a load or a charging current. A disconnecting switch serves only to disconnect a line, an oil switch, a transformer or other apparatus after the load or charging current has been broken by an oil switch or air-break switch. The air-break switch is still in its infancy and will have to pass through a period of considerable development in order to fulfill all the requirements expected of it.

Insulators subject to a bending moment or torsion often break and cause a great deal of trouble. Ice and sleet problems are still to be solved since the hoods usually employed to protect the contacts very often only serve as receptacles for ice and make operation of the switch more difficult instead of easier. Operating mechanisms should be so designed that one man of average strength can operate the switch without applying his whole weight thereto. Springs, long flexible leads

LIGHTNING ARRESTERS AND OTHER PROTECTIVE DEVICES

Discharge resistances which have proved successful on small arresters have been added as an auxiliary to electrolytic arresters. However, they burn out so frequently that improvements will have to be made before they are satisfactory in this service. The dry-type electrolytic arrester which has lately been put on the market promises to be a great improvement, although it has not been tried out long enough in outdoor service to permit any broad claims regarding its operation.

Horn gaps and operating mechanisms for transfer devices should be designed so that they can be remote from the tank, the ideal place for the horn gap being on top of the structure, as shown in Fig. 2. High-tension primary fuses should be avoided as much as possible, but when they have to be used they should be made easily accessible, so that they can be exchanged without danger to the operator.

Choke coils are often very flimsy, and a rigid construction should be insisted upon. The hour-glass type of choke coil, which was originally introduced for mechanical reasons and not for the purpose of increas-

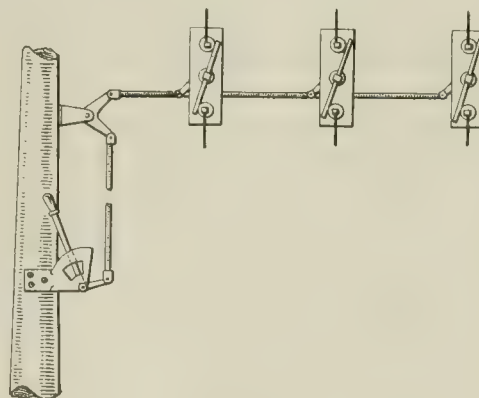


FIG. 3—SIMPLE ARRANGEMENT FOR OPERATING DISCONNECTING SWITCHES

ing the reactance (the reactance is increased somewhat, but only to a negligible degree), is often used as an excuse by amateur apparatus designers for choke coils which do not hold their shape even under normal conditions. The use of copper-clad wire and stiffeners will greatly contribute to the rigidity of choke coils. There is just as little reason for the existence of the strain-

type choke coil as there is for the strain-type disconnecting switch. Both should be eliminated.

METERING EQUIPMENT

Outdoor metering equipment should be considered as consisting of two separate elements—first, the outfit consisting of current and potential transformers and, second, the meters proper. The installation of current and potential transformers in one housing serves the purpose of minimizing high-tension terminals. The outfit looks very much like an oil switch, and the remarks made previously about oil switches, particularly concerning their terminals, hold good for this equipment. The terminals should be on top of the housing and should have external-threaded studs so that bars or pipes can be connected thereto. This statement applies to 2300-volt apparatus as well as to a very high-voltage equipment.

The meter proper should be in an entirely separate compartment and preferably somewhere on the outskirts of the station remote from high-tension apparatus. The reading of meters in outdoor stations is generally the duty of a meterman. He usually has no experience in handling high-tension wiring, and he should not be made to have anything to do with anything but secondary wiring. The placing of meters in one common housing with primary wiring, even if it be only 2300-volt, should not be permitted. When primary potential fuses are used a separate door should be provided in the housing of the current and potential transformers for the purpose of changing fuses only.

In a station containing a great number of meters a common housing should be provided for all the meters, and if the number of meters is large enough to warrant it this housing should be made of brick or concrete. In this case the meters can be back-connected, since both the front and back of the meter switchboard can be made accessible for inspection, testing and repairing of wiring. However, where only very few meters are used they can be housed in a sheet-metal box, but it should be remote from the high-tension wiring. There is no reason for placing the meter houses close to the current and potential transformer house since one or two secondary cables can be run between the two equipments in underground conduits.

With small meter equipments housed in metal boxes the meters should be front-connected and all the wiring should be on the front of the meter panel. It should not be necessary to move the meter panel bodily in order to inspect or repair any of the wiring. The suggestions made here in regard to metering equipments are based on the analysis of a great many complaints from operators and metermen, and it is hoped that improvements along this line will soon be forthcoming.

GENERAL ARRANGEMENT AND WIRING OF OUTDOOR STATIONS

Every outdoor station should be designed so that it can be extended in at least one direction. Therefore all circuits should be made as nearly alike as possible. By arranging the transformers on one side of the oil switches and the lightning arresters on the other side it will nearly always be possible to allow for growth. The structure should be arranged so that the lines can leave the station in any direction. Fig. 2 shows an ideal arrangement of an outdoor substation, and almost

any desired result may be obtained therewith. This arrangement is being used by the J. G. White Engineering Corporation at the outdoor station near the Palo Alto power house of the Eastern Pennsylvania Railways Company, Pottsville, Pa. It can be extended in the direction of the bus, which is the logical way, and it can also be duplicated on the other side of the track, by simply "reflecting" the arrangement on the other side of the center line of the transfer track.

Pin-type or post-type insulators with copper pipe for wiring should be the practice for outdoor stations. However, when pole-top apparatus such as air-break switches, is used, strain insulators will have to be resorted to. The steel work should not be designed like transmission-line towers, but should be made as compact and light as possible. Latticed poles used for this purpose will never require bases more than 24 in. (61 cm.) square if properly designed.

PROPER METHOD OF LIGHTING

While there is no doubt that floodlighting is the best way to illuminate properly an outdoor station, it must not be forgotten that floodlighting* will be out of the question in a great many cases. For instance, where projectors would have to be mounted so that they would cast a beam on nearby residences or along railroad tracks the residents might object, or the glare might endanger railroad traffic. In such cases other forms of lighting must be worked out.

EFFICIENT GENERATOR OF STATIC ELECTRICITY

Result Is Accomplished by the Intimate Contact and Separation of Liquid Conductor and Glass Plate

William H. Chapman of Portland, Maine, in patent No. 1,202,672, offers a remedy for preventing loss of electrical and mechanical efficiency in static electricity generators. The invention consists in bringing a solid body of insulating material into intimate contact with a conducting liquid such as mercury which will not adhere to its surface, and then separating the solid body from the liquid and collecting from the surface of the solid the charge generated thereon. The rotating disk is partially immersed in the mercury. The inventor has found that a glass plate 8 in. (20.3 cm.) in diameter making 80 r.p.m. and dipping into a mercury trough to a depth of 1½ in. (3.7 cm.), without induction plates, will develop a potential of 9000 volts on comb points, arranged to collect the charge at the top of the plate. The application of induction plates in proximity to the revolving plate at the point where it leaves the mercury raises the potential to 13,000 volts or more on the comb points and gives sparks ¾ in. (1.9 cm.) long. This is still further increased by covering the induction plates with a thin sheet of rubber or glass. In order to increase the quantity of electricity generated, a number of glass plates can be mounted on one shaft and separated by washers and all then dipped together into the one trough of mercury.

*Suggested by writer in the issue of the ELECTRICAL WORLD for Nov. 18, 1916, and application described in the issue for May 12, 1917.

Analysis of Design-Constant Curves

How the Design Constant for Synchronous Machines Is Affected by the Speed for Which They Are Designed—A Graphical Representation of This Relation

BY THEO. SCHOU
State University of Iowa

DESIGN of electrical apparatus is an art more than it is a science, since mathematical formulas are used chiefly for approximating purposes, the final result usually being altered according to the judgment of the designer to take advantage of past experience or meet certain construction requirements. However, it is possible to modify formulas so that they will incorporate some of the factors which are taken into account when individual judgment is applied to make the design practicable. Such an opportunity is presented in determining design constants, as these have been found to depend on the speed and the kva. rating for which the machine is designed. In what follows it is not the intention of the writer to attempt making routine work out of design, but it is the endeavor to point out how these constants differ for different-speed alternating-current generators. To illustrate this point the relation of the design constant to certain characteristics of synchronous machines will be pointed out and practical observations will be included which affect the constant.

DERIVATION OF THE DESIGN CONSTANT

The flux per pole in any electrical machine is:

$$\phi = \frac{e \times 10^8}{4 \times f_b \times f_w \times f_{ch} \times w \times \text{cycles}} \text{ c.g.s. lines}$$

where e = voltage per phase; f_b = form factor, depending on the field form; f_w = spread factor, depending on the number of phases and the number of slots per pole per phase; f_{ch} = chord factor, depending on the throw of the coil in the armature, and w = turns in series per phase (between brushes for direct-current machines).

This effective flux per pole is equal to the total maximum flux times the pole constant, C_p (where C_p depends upon the field form), divided by the number of poles, $2p$. By total maximum flux is meant the maximum flux density under the pole in the air gap times the total armature surface in square centimeters. Therefore

$$\begin{aligned} \phi \text{ per pole} &= \frac{\phi \text{ total} \times C_p}{2p} = \frac{e \times 10^8}{4 \times f_b \times f_w \times f_{ch} \times w \times \text{cycles}} \\ \text{Since cycles} &= \text{r.p.m.} \times p \div 60 \text{ and } w = 1/2 N, \text{ if } N = \text{effective conductors in series per phase, then by substituting:} \\ \phi \text{ total} &= \frac{e \times 2p \times 60 \times 10^8}{4 \times f_b \times f_w \times f_{ch} \times C_p \times N/2 \times \text{r.p.m.} \times p} \\ &= \frac{e \times 10^8 \times 60}{f_b \times f_w \times f_{ch} \times C_p \times \text{r.p.m.} \times N} \end{aligned}$$

If instead of phase voltage, e , terminal voltage, E is introduced, then

$$\phi \text{ total} = \frac{k_o \times E \times 10^8 \times 60}{k \times \text{r.p.m.} \times N}$$

where k_o depends upon the number of phases and the connection ($k_o = 1 \div \sqrt{3}$ for three-phase star-connected machines) and $k = f_b \times f_w \times f_{ch} \times C_p$.

In order to simplify this formula and also introduce

inches instead of centimeters, calculations may be made in Kapp lines, where one Kapp line per square inch equals 6000 c.g.s. lines. Then

$$\phi \text{ total} = \frac{k_o \times E \times 10^6}{k \times \text{r.p.m.} \times N}$$

If D_g is the armature bore and l is the length of the armature core (including vent ducts) of a rotating-field synchronous machine, and if a line of such machines of different kva. ratings and of various speeds is designed with the same flux density per square inch in the air gap, then

$$\frac{\phi \text{ total}}{\pi \times D_g \times l} = \text{constant} = k_1$$

Therefore

$$k_1 \times \pi \times D_g \times l = \frac{k_o \times E \times 10^6}{k \times \text{r.p.m.} \times N}$$

Since $E = \text{kva.} \div (I \times k_2)$, where I = current per terminal and k_2 = constant depending upon the number of phases, therefore

$$k_1 \times \pi \times D_g \times l = \frac{k_o \times \text{kva.} \times 10^6}{k \times k_2 \times I \times \text{r.p.m.} \times N}$$

If this line of machines is designed with the same current density per square inch of conductor, then I/q = a constant k_3 , where q = section of conductor in square inches. Substituting in the preceding equation:

$$k_1 \times \pi \times D_g \times l = \frac{k_o \times \text{kva.} \times 10^6}{k \times k_2 \times k_3 \times N \times q \times \text{r.p.m.}}$$

As the armature-slot depth does not vary much over the whole line of machines, $(N \times q)$ obviously is proportional to the circumference of the armature bore, or $\pi \times D_g$, or $N \times q = k_4 \times \pi \times D_g$.

Substituting:

$$D_g \times l = \frac{k_o \times \text{kva.} \times 10^6}{k \times k_1 \times k_2 \times k_3 \times k_4 \times \pi^2 \times D_g \times \text{r.p.m.}}$$

or

$$\frac{D_g^2 \times l \times \text{r.p.m.}}{\text{kva.}} = \frac{10^6}{1/k_o \times \Sigma k \times \pi^2}$$

For three-phase, star-connected machine:

$$\frac{D_g^2 \times l \times \text{r.p.m.}}{\text{kva.}} = \frac{10^6}{1.7 \times \Sigma k} = \text{constant.}$$

Therefore, if Σk would remain constant, assuming the same kva. rating, the same design constant would be obtained for various synchronous speeds. This is, however, not the case in practical manufacturing. For example, investigate Σk for two three-phase, star-connected machines of the same kva. rating, say 100 kva., one running at 100 r.p.m. and the other at 1200 r.p.m. The result would be approximately as shown by the following table:

	100 KVA.	100 KVA.
	100 r.p.m.	1200 r.p.m.
$k = f_b \times f_w \times f_{ch} \times C_p$	Approx. the same	
k_1 = flux density per sq. in. in air gap	6	7
$k_2 = 1/\sqrt{3}$ for three-phase	No change	
k_3 = current density per sq. in.	2300	3000
k_4 = approx. slot width \div tooth pitch.	Approx. the same	

Illuminating Iron and Steel Mills

An Analysis of Some Actual Lighting Equipments in Foundries of This Kind and Recommendations for Their Improvement—Difficulties to Be Overcome in Lighting Large Yards

By C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

SUMMARY.—Because of the great amount of government work now being conducted by iron and steel mills, the lighting of such plants has become a subject of unusually timely importance. The author points out that among the most striking characteristics of the larger steel mills are the high roof clearances and the large amounts of dust in the air, which impose special requirements on the upkeep of lamps and reflectors. Typical installations are analyzed by means of diagrams based on actual practice and by data compiled from lighting installations under service conditions in Pennsylvania steel mills. These data show how inadequate much of the mill lighting has been in the past and indicate the need for more attention in the future to higher intensities of illumination for the general processes conducted around such plants. Yard lighting, because of its peculiar importance to such mills, receives considerable attention in the article. Comparative views taken under the artificial lighting in typical departments show the uses of tungsten and mercury-vapor lamps in foundries, shops of various kinds and yards.

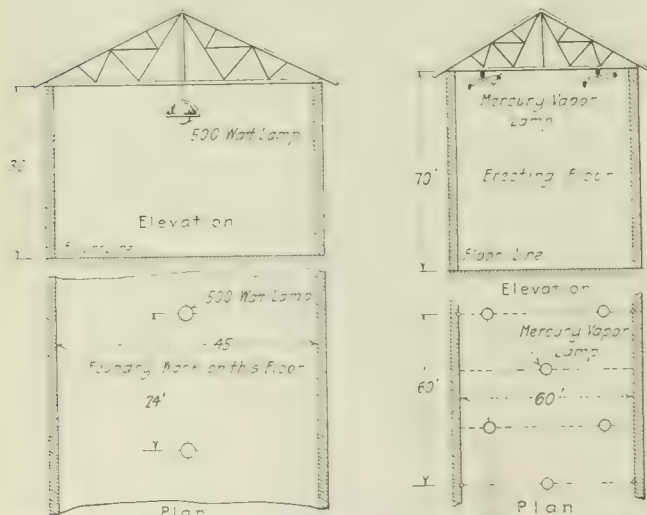
LIGHTING in steel plants may be looked upon at present as a most timely subject. The vast scale on which munition work has been taken over by these mills, the expansion into new buildings and the use of existing departments for night work give the problem of illumination a most significant aspect.

It is only necessary to visit a few typical mills at night to appreciate the unusual illumination requirements imposed in such plants. The large interiors, the high roof clearances, the very dark wall and other surroundings, the rough and often bulky nature of the

as found in Pennsylvania steel plants a few years ago is intended to show some of the values of watts per square foot and of illumination under various types of lamps as used in different departments. This table in no sense indicates good or acceptable practice, but merely shows values of intensity at the work found

TABLE SHOWING ILLUMINATION CONDITIONS FOUND IN VARIOUS DEPARTMENTS OF PENNSYLVANIA STEEL PLANTS

Class of Work	Approximate Watts per Sq. Ft.	Approximate Foot-Candle Intensity at the Work	Nature of the Illumination for the Purpose
Tungsten lamps:			
1. Power house	0.6	1.0	Fairly good
2. Machine shop...	0.4	0.4	Inadequate
3. Carpenter shop	0.5	1.0	Fairly good
4. Pattern shop...	0.8	1.5	Good
5. Foundry	0.4	0.3	Inadequate
Mercury-vapor lamps:			
6. Laying out floor	0.5	0.6	Fairly good
7. Flanging work...	0.5	0.1	Inadequate
8. Laying out floor	0.7	0.5	Fair
9. Machine shop...	0.4	0.4	Inadequate
10. Machine shop...	0.5	0.7	Good
11. Erecting work...	0.4	0.3	Only fair
12. Power house...	0.6	0.6	Good
Inclosed-carbon arc lamps:			
13. Lea ling	0.2	0.2	Inadequate
14. Blooming mill.....	0.3	0.6	Inadequate
15. Open hearth.....	0.5	0.1	Inadequate
16. Machine shop.....	0.7	0.3	Inadequate
17. Machine shop.....	0.5	0.3	Only fair
18. Foundry.....	0.7	0.3	Inadequate
Flame-carbon arc lamps:			
19. Flanging work...	0.1	0.3	Fair
20. Loading.....	0.1	0.4	Fairly good
21. Laying out floor...	0.4	0.4	Fair
22. Laying out floor...	0.3	0.5	Fair
23. Flanging work.....	0.1	0.1	Inadequate



FIGS. 1 AND 2—ARRANGEMENT OF VACUUM-TUNGSTEN LAMPS AND MERCURY-VAPOR LAMPS FOR STEEL MILL

material handled, coupled with the fact that in some of the mills large areas are occupied by a relatively few workmen, make it difficult to secure the illumination intensities required for night shifts.

The accompanying table¹ of illumination conditions

¹Compiled from data gathered personally by the writer during a series of inspections of various steel plants in Pennsylvania.

during an inspection of several plants. The lamps and reflectors were not cleaned before the readings were taken, and hence the values of effective lumens per watt indicated by the table may be considerably lower than those which could be realized under more favorable conditions.

Some idea of how very inadequate many of these lighting installations are may be had when it is considered that the illumination values obtained in cases two and nine are only about one-fourth of the minimum intensities required for rough work in recent factory lighting codes. Obviously, the inadequacy of such systems points to the need of larger quantities of light for these large areas and indicates that careful attention must be given to systematic lamp and reflector cleaning.

ACTUAL CASES ANALYZED

To illustrate some details of typical practice, Fig. 1 is drawn up from a portion of an actual steel mill foundry and shows the spacing conditions of 500-watt tungsten lamps. Although the illumination furnished by these lamps at night is fair, the arrangement of the lamps is not entirely symmetrical with respect to the floor dimensions, and hence the illumination lacks the uniformity which would result with a more symmetrical lay-out.

The unfortunate placement of lamps which is found here and there is illustrated by Fig. 3. To the left, the lamp wastes much of its light on the dark wall surface and is ineffective in lighting much of the floor space between the wall and the furnaces. To the right

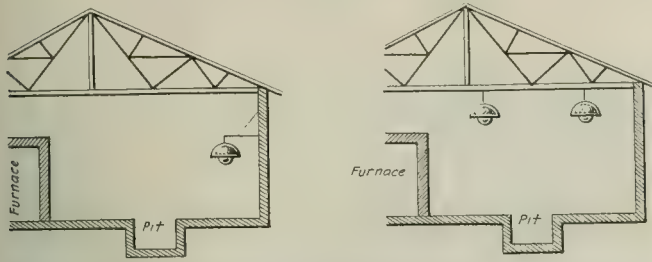


FIG. 3—POOR AND IMPROVED PLAN OF LIGHTING OPEN-HEARTH FURNACE BUILDING

an improved scheme is suggested, on the basis of the defects noted in the building in question.

Fig. 2 represents an interesting case of a very high erecting floor where type "HH" mercury-vapor lamps furnish a fairly satisfactory low degree of illumination to the work beneath. This overhead arrangement of lamps for such heights is rather less common, perhaps, than the scheme of placing them lower down on the side walls or columns of the spaces. The scheme shown here, however, has the great advantage of more uniform light distribution and less glare.

Fig. 4 shows an installation of 500-watt tungsten lamps mounted less than 20 ft. (6 m.) above the floor. Personal observation of this shop at night shows clearly the great need for concealing the bright filaments of the lamps when so near the floor, a feature which received less attention than it deserved in the plant of which this pattern shop forms a part. Aside from this point, the illumination of Fig. 4 is good.

The bulky nature of much of the work in steel plants

tions of dark and massive surroundings. The advantages of tungsten lamps in such locations, where there is no regular trimming, is apparent from the high mountings. At the same time, the importance of frequent cleaning is increased by the dust and steam in

the air, which will otherwise soon impair the good effects of the best equipment. In other words, the regular handling of arc lamps for trimming, if it insures frequent cleaning of the globes, may actually be an advantage over the tungsten lamps with no trimming unless the latter receive systematic cleaning.

Good examples of lighting by mercury-vapor lamps are shown in Figs. 7, 9 and 10, where vast areas with high roof clearances are again equipped with overhead lamps in such numbers as

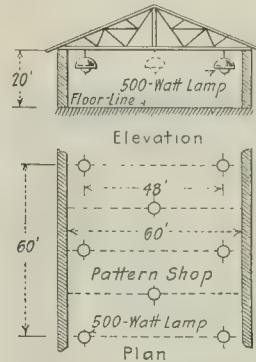
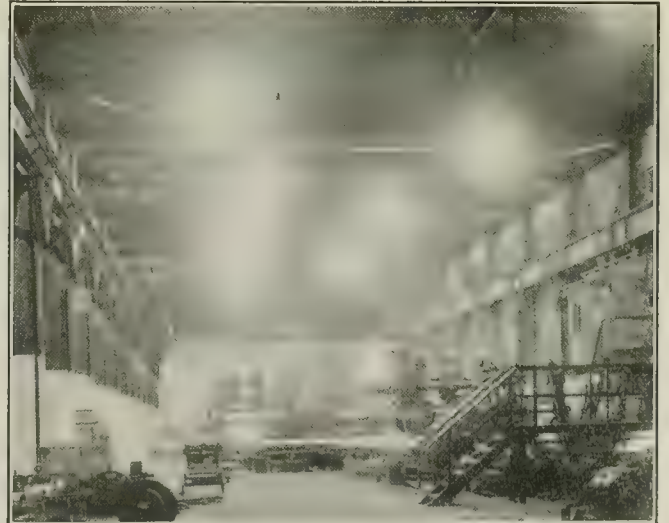
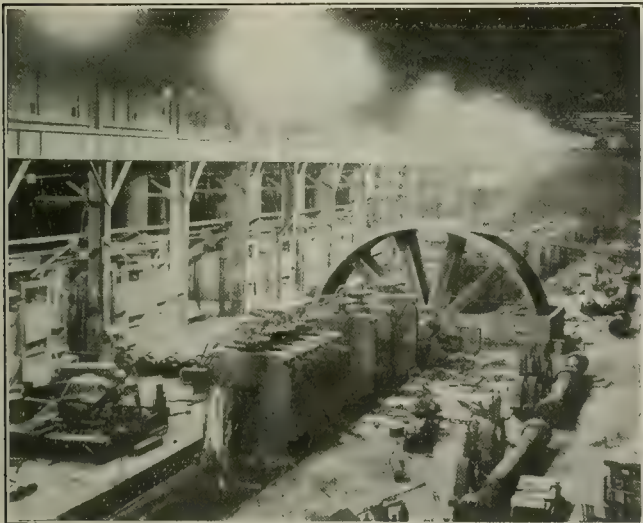


FIG. 4—LOW-MOUNTED LAMPS IN PATTERN SHOP

to throw good light on work below. Special attention is directed to Fig. 9, which shows the unusually good illumination on the switchboard instruments at the right, near the floor. The unusual nature of this result is apparent at once when it is considered that this illumination is furnished by lamps 45 ft. (13.7 m.) above the floor.

SUITABLE LAMPS FOR INTERIOR WORK

There is very little if any question as to the superiority of tungsten and mercury-vapor lamps for most of the interior work of steel plants. The latter type possesses features of great value in such cases as laying-out floors, where accuracy in marking metal surfaces is the most important matter. For such departments as machine shops, foundries and pattern shops either type may be used with advantage, but it



FIGS. 5 AND 6—ROLLING-MILL ROOMS LIGHTED BY TUNGSTEN LAMPS. CLUSTERS OF FOUR 250-WATT LAMPS ARE USED IN THE FIRST CASE, WHERE THE FLOOR AREA MEASURES 60 FT. BY 300 FT.

is well illustrated by Figs. 5 and 6.² In addition, these two views give an idea of what can be accomplished by large tungsten lamps under these extreme condi-

should always be kept in mind that the low intrinsic brilliancy of the mercury-vapor lamps makes them superior for relatively low mounting heights unless the very intense filaments of tungsten lamps are properly concealed or shaded, by frosting the bowl of the lamps or by other means, and also by using suitable reflectors.

²Figs. 5 and 6 are due to the Edison Lamp Works of the General Electric Company, Figs. 7, 9 and 10 to the Cooper Hewitt Electric Company, and Fig. 8 to the Thompson Electric Company, Cleveland, Ohio. Figs. 7 and 8 were taken under the direction of the author.

It is rather more difficult in many steel-mill departments to evaluate the lighting costs as compared with wages, as a means for demonstrating the great value of light to production, than it is in the ordinary manufacturing plant. This is due to the comparatively small number of men per unit of floor area in such mills, for example, as those shown by Figs. 5 and 6.



the unparalleled profits brought about by the abnormal conditions which have prevailed during the last few years.

The proper illumination of large yard areas at night has always been more or less difficult. Ten or fifteen years ago, before the development of the tungsten lamp or the more recent forms of arc lamps (the flaming



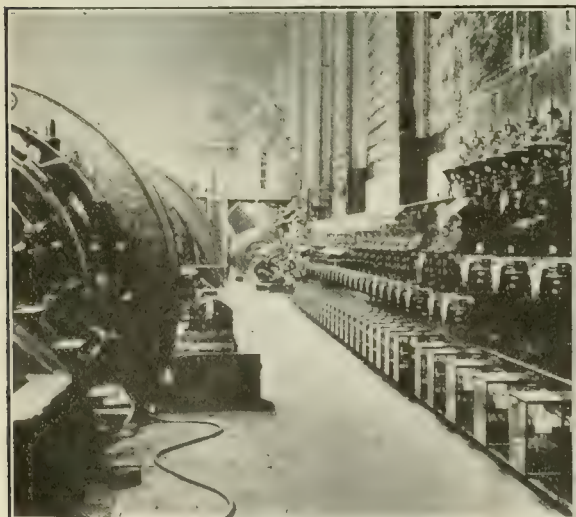
FIGS. 7 AND 8—MACHINE SHOP LIGHTED BY MERCURY-VAPOR LAMPS IN CENTER AND AISLES; AND YARD ILLUMINATED BY BRACKET-TYPE FILAMENT LAMPS WITH DISCONNECTING HANGERS

Here, however, the tonnage output is sometimes made the basis for determining the efficiency with which the work is performed from month to month, and it has been suggested that the value of adequate lighting to the department may conveniently be stated in terms of the increased tonnage made possible by its use. The difference in output by the day and night shifts may also serve as some indication of the presence or absence of suitable facilities for the night work.

Taken as a whole, the steel plants, including the numerous smaller as well as the larger corporations, must face the question of expending an amount for

carbon and the magnetite), the problem was still further limited in its solution by the lack of suitable lamps for the purpose. With the introduction of the larger and more efficient illuminants the lighting of these large areas has become less difficult. Note, for example, in Fig. 8, the installation of tungsten units along the switching tracks of a large steel plant. As an incidental item, this view also shows the practical use of automatic disconnecting hangers for such lamps on a large scale.

Among the points to consider in planning yard lighting is that the lamps be high enough not to be



FIGS. 9 AND 10—STEEL-PLANT POWER HOUSE AND FOUNDRY ILLUMINATED BY MERCURY-VAPOR LAMPS

lighting equipment which is capable of furnishing, even for the enormous mill spaces, light in sufficient volume for bringing up the intensities at night at least to the minimum values required by recently enacted factory codes. Not to do so will entail losses for night work which are not to be overlooked, even if they may seem trivial at the present time because of

blinding to those who are at work in the yard. At the same time, if the lamps are very high they may be so far above the yard surface as to be of little effect in its illumination. Furthermore, a type of lamp for this purpose must often penetrate fog and smoke, and the light developed, whether from carbons, from a filament or otherwise, should be so distributed that it pro-

duces the most effective illumination on the yard areas.

Those who have observed yard lighting conditions have been struck with the brilliant yellow light of the flaming-carbon arc lamp, which is quite widely used. The volume of light from these lamps is large, and there is a tendency to look upon the yellow light as more penetrating in fog and smoke than the whiter light of the older open or inclosed carbon arc lamps. The larger-sized tungsten lamps have also been applied to yard lighting with success, and they are particularly well adapted to yard passageways and to the smaller exterior loading spaces.

The quartz-tube mercury-vapor lamp is also used for yard lighting. Among the advantages of this type of lamp are its high candle-power rating, which affords a large volume of light per unit; the quality of the light produced, which brings out detail even with low intensities; its low specific consumption of from 0.31 watt to 0.44 watt per candle-power, and the fact that no trimming is required as in arc lamps.

In one case where quartz lamps were used for yard lighting a photometer was arranged to measure the illumination on a horizontal plane 3 ft. 6 in. (1.06 m.) above the ground. The maximum and minimum intensities observed in the relatively well-lighted space were 0.135 ft.-candle and 0.031 ft.-candle respectively, the average of the readings taken being equal to 0.075 ft.-candle. Again, with the photometer arranged to measure the illumination on a vertical plane at the same height above the ground as before, the maximum and minimum intensities observed were 0.147 ft.-candle and 0.019 ft.-candle respectively, the average of the readings taken being equal to 0.070 ft.-candle. To the eye the effect of the light from this lamp, notwithstanding its great height, 61.5 ft. (18.74 m.), above the ground, was very satisfactory. High mounting places the lamp well above the line of vision of any one who may be working in or walking across the yard.

REPULSION MOTOR WITH IMPROVED SPEED SYNCHRONISM

By Centrifugal Action Armature Is Forced to Maintain Synchronous Speed with Considerable Change of Load

For numerous purposes, for instance, driving current rectifiers, measuring apparatus, synchronous rotary spark gaps, etc., it is necessary to provide a motor which allows an absolutely synchronous speed to be maintained. M. Lucien Rouset of Levallois-Perrett, Seine, France, presents an improved type of repulsion motor in patent No. 1,205,937, which by means of an added short-circuiting device tends to maintain practically perfect synchronism of the motor when under load.

The commutated armature winding has stationary short-circuiting brushes placed slightly behind the neutral axis so that the motor tends to rotate at a speed slightly above or very close to synchronism. After the motor has reached a predetermined speed a further rotative short-circuiting of the armature is effected by means of slip rings or automatically by centrifugal action. By the latter procedure the armature is forced to maintain a truly synchronous speed for a considerable change of load.

PERMANENT CAMP FOR CONSTRUCTION WORK

Missouri Company Accommodates About 250 Men in Permanent Camp During Construction of Large Plant

To meet the needs of present construction work involving an expenditure of more than \$1,000,000, and also of the work to be carried out in the future at its main power plant at Riverton, the Empire District Electric Company of Joplin, Mo., has been building a permanent construction camp. A two-story hotel accommodating eighty men was built near the plant in 1910. To this the company has recently added a bunkhouse capable of housing 130 men, a mess hall for about 150 men, a house for the construction superintendent and his fifteen assistants, and another house for the operating engineer. In addition, six neat six-room bungalows are being erected for the engineers on duty at the power house. The buildings possess such modern conveniences as steam heat and electric light, refrigerators, hot and cold water, and shower baths. The company accommodates about 250 men with board and room for \$6 per week. The present construction work will last until December of this year, with prospects of considerable additional work on this plant for some time to come.

HYDROELECTRIC ENERGY SOLVES RAILWAY POWER PROBLEM

Central New England Transportation Companies, Sufferers from Fuel Shortage, Relieved by Water-Power Contracts

Hydroelectric energy is solving power problems of electric railways of central New England, some of which are feeling keenly the high cost of fuel which prevails. At a hearing before the Massachusetts Waterways Board in Boston plans were presented for the construction of an additional 66,000-volt line across the Connecticut River at Springfield for the supply of power to the Springfield Street Railway by the Turners Falls Power & Electric Company. Bentley W. Warren, counsel for the Massachusetts Street Railway Association, spoke of the increasing difficulties of electric railways in securing capital to provide for power plant extensions. For the Springfield company \$1,500,000 would be required to provide an adequate power supply of its own. This and other companies are turning to the large hydroelectric systems for relief.

C. V. Wood, president Springfield Street Railway, said that on account of delays in receiving coal the road came within twelve hours of complete shutdown several times last winter. About 35,000,000 kw.-hr. is generated yearly at the Margaret Street station of the road. Mr. Wood said that he hoped that by 1919 the road would be fully supplied by the Turners Falls company, which is about to build a two-million-dollar steam plant at Chicopee Junction to supplement its existing generating facilities.

Philip Cabot, president of the Turners Falls company, said that the margin of profit in the power contract with the Springfield company is small, but that interconnection of the various large plants will prove advantageous in economical production and distribution.

Comparison of Dissimilar Transformer Ratings

Effect of Ambient Cooling Temperatures on Ratings and How Ratings Based on Old and New Rules of the American Institute of Electrical Engineers Can Be Compared

BY E. HAGENLOCHER

WHAT is the difference in capacity between transformers guaranteed to give a certain rise of temperature on 25 deg. C. air temperature and those which are guaranteed to give the same rise on 40 deg. C. air? This is a question which comes up frequently when checking over propositions submitted by the various manufacturers selling transformers, since they do not all use the same standard. The uncertainty exists chiefly because some correction factors which had frequent application have been omitted in the new standardization rules of the American Institute of Electrical Engineers (1915).

SELF-COOLED TYPE

Some of the transformer manufacturers still rate self-cooled transformers with a certain rise based on 25 deg. C. ambient air temperature, while others follow the new rules, which state that the ambient temperature of air should be considered as 40 deg. C. Under the old rules the rise in temperature of a transformer under test had to be corrected if the air temperature at the time of test differed from 25 deg. C. This correction consisted in increasing the observed rise on test by one-half of 1 per cent for each degree that the actual air temperature was below 25 deg. and decreasing the rise by the same amount for each degree the air temperature was above 25 deg. This correction was applied to take care of the increased copper loss due to the greater resistance at higher temperatures, which therefore caused more heating. The reverse of this holds true for the lower temperatures. For example, if a transformer were tested at 40 deg. C. instead of the 25 deg. prescribed and its observed temperature was 90 deg., giving an observed rise of 50 deg., it would be necessary to decrease the observed rise of 50 deg. by applying the correction of (40 deg. — 25 deg.) \times 0.5 per cent. This would give the result of $7\frac{1}{2} \times 50$ deg., or 3.75 deg., to be subtracted to get the true rise or 46.25 deg.

The new rules have eliminated this correction as a result of actual tests having shown that it does not hold true. This may be accounted for by the explanation that at a temperature of say 90 deg. C. the fluidity of the oil has increased to such an extent as to give better circulation, thereby increasing the cooling and compensating somewhat for the increase in copper losses. There may also be less iron loss at the higher temperatures, which would also tend to annul the effect of the increased copper losses.

Under the old rules a transformer that gave an observed rise of 50 deg. on an air temperature of 40 deg. was considered a larger transformer than one that gave an observed rise of 50 deg. on 25 deg. air. It is now considered that a transformer rated at 1000 kva. and designed to give a rise of 50 deg. C. based on a room temperature of 25 deg. C. is a transformer of the same size as one rated at 1000 kva. and designed for a rise

of 50 deg. C. based on a room temperature of 40 deg. C. If the former (transformer A) is tested under the designed conditions, the ultimate temperature will be 75 deg., and the latter (transformer B) will be 90 deg. If A were tested at 40 deg. air, its ultimate would also be 90 deg. Likewise B if tested in 25 deg. air would reach an ultimate of 75 deg. It has been known for some time by the transformer manufacturers that the old correction was not corroborated by test results. The new rules did not cause any change in their designs in this one respect. The same transformer would be supplied for either guarantee.

Any self-cooled transformer can be run at an increased capacity if the air temperature is less than that specified in the design. Conversely, if the air is warmer than that specified, the transformer must be run at a reduced capacity to prevent the ultimate temperature from reaching a high value, which might damage the insulation. The ultimate temperature, of course, is the one that limits the loading, and the rise is that which determines the rating.

According to the old rules transformer A was smaller than B by a small per cent, whereas the new rules, representing the result of many tests, showed conclusively that the variation in losses due to ambient temperature variations was negligible. Therefore the two transformers A and B will be built on identical lines.

AIR-BLAST TRANSFORMERS

The corrections for ambient air temperatures referred to under "Self-Cooled Transformers" applied also to the air-blast type under the old rules. In addition, the old rules called for a correction, due to variations in barometric pressure, which amounted to 1 per cent of observed rise for each 10-mm. deviation from the 760-mm. standard; i.e., if the barometer showed 680 m. the observed rise was to be reduced by 8 per cent. (Increased altitude increases temperature rise of air-blast transformers owing to the air being less dense and therefore less efficient as a heat conductor.)

The new rules call for a correction for air temperature, which is proportional to the absolute temperature, owing to the difference in resistance when the temperature of ingoing cooling air differs from 40 deg. C. This consists of multiplying the observed rise by the ratio of the absolute temperatures of 40 deg. C. to ingoing air. Thus, if the air at the time of test was 30 deg. C. and the observed rise 50 deg., then the actual rise would be $(274.5 \div 264.5) \times 50$, or 52 deg. C., which represents the rise which would have been obtained had the air temperature been 40 deg. C.

The correction for altitude consists of the permissible rise at sea level, being reduced by 1 per cent for each 100 m. (328 ft.) by which the altitude exceeds 1000 m. (3280 ft.).

The standard temperature of ingoing water was assumed under the old rules to be 25 deg. C. (the same

as for air in connection with self-cooled transformers) because this type was not considered separately. Since the new rules state definitely that it should be taken as 25 deg. C., there is no chance for misunderstandings to arise from change in ambient temperature specifications.

The discussion in connection with self-cooled transformers applies in this case as the cooling medium (oil) bears the same relation to the heating; that is, there will be no correction if the transformer is tested with other than 25 deg. C. water.

UTILIZING CONDUCTOR DROP IN SUBSTITUTION FOR SHUNT

Fairly Accurate Results Can Be Obtained by Using
Portion of Feeder as Shunt and Compensating for Temperature Changes

BY ALBERT MARTINEAU

In stations having a large number of direct-current feeders, each carrying a large current, the problem of providing space is a very important one, especially where they are located in sub-basements and other congested places. Since meter shunts for carrying large currents occupy considerable space, are costly to purchase and install, and may cause noticeable losses and poor voltage regulation, their substitution has been considered in a number of cases for the space saved as well as for the other reasons mentioned.

In attempting to eliminate the shunt the first thing to do is to determine the current required by the meter-ammeter—or really a millivoltmeter—to give full-scale deflection. From this the resistance and voltage drop across the meter coil are obtained. The next thing is to determine approximately the distance from the meter to the conductor which is to be used as a shunt. Knowing the length of the meter leads and the current required by the meter for full-scale deflection, the size of wire for the leads and the voltage drop in them for the requisite current are determined. Where many meters are to be used it is advisable to standardize the size of leads, keeping within two sizes, depending upon the distance from the conductor to the point where the meter is mounted. The next step is to choose a length of conductor such that the voltage drop along this length will exceed that required to overcome the voltage drop in the meter coil and leads at full-scale deflection by about 30 to 50 per cent. The reasons for this additional or surplus voltage will be explained later. The section of conductor chosen for the "shunt" should preferably be a straight section and free from bolt holes and bends, and should be accessible. The leads are connected to this conductor in different ways. Where the conductor is a copper bar a hole is tapped in it and the meter leads fastened thereto by means of screws. Where the current is so heavy that several bars constitute the conductor, one or all of the bars may be used as the shunt. It is perhaps better to use them all, since this tends to eliminate errors resulting from unequal current distribution in the various conductors by connecting all bars together at each end by a brass or copper strap and connecting the leads to the straps.

The voltage drop along the conductor or shunt is proportional to the current flowing. This voltage drop does not have a constant value for a definite current, how-

ever, but depends upon the temperature of the shunt. As the conductor increases in temperature, due to current or ambient temperatures, the resistance of copper increases also. Hence for increased temperatures the voltage drop increases for a definite current. This would give rise to an error, and quite a serious one, in many cases where the temperature of the station is high* and not compensated for. The ideal compensation should be such that the resistance in the meter circuit varies in direct proportion to the voltage increase; that is to say, the resistance of the shunt.

It has already been pointed out that the voltage drop along the shunt is greater than the sum of the voltage drops due to the meter coil and the leads. If, now, a coil be made of such resistance that the potential drop across it is sufficient to absorb the excess voltage of the shunt, and, moreover, if this coil be made of copper or the same material as that of the shunt and then placed in such a position that it is maintained at the same temperature as the shunt at all times, the resistance will increase with increasing temperatures at exactly the same rate as that of the shunt. In other words, as the voltage drop along the shunt increases, the resistance in the meter circuit increases likewise and proportionally, hence the current flowing through the meter will remain unaffected by temperature.

In actual practice a coil is built up of fine wire wound upon a piece of fiber board and placed in direct and intimate contact with the copper bar, but insulated therefrom by insulating cloth or similar material. When the conductor is circular it is wrapped around it. As there is practically no temperature gradient between the two, error due to lag of temperature is eliminated. Such coils are called compensating coils. While the meter leads are usually made up of No. 12 or No. 10 wire, or even No. 8, where the distance between the shunt and meter is rather long, and because they must have the needed strength to withstand pulling through conduit, etc., the wire used for the compensating coil is much smaller and is chosen for its resistance instead of mechanical strength. Another use of this coil is that any variation in resistance desired may be made by changing this easily and quickly.

To make the method of substitution for a shunt clear a typical example will be considered in which current has to be measured in a 2000-amp. circuit. The most suitable part for use as a shunt measures 3 in. by 0.5 in. (7.6 cm. by 12.7 mm.) in cross-section.

The voltage and current required to produce full-scale deflection of the meter are 0.02472128 volt and 0.0304 amp. respectively, and the leads have a resistance of 0.0126 ohm. The voltage drop in the latter with full load would be 0.00038304 volt. Allowing 50 per cent of the total drop to be absorbed in the compensating coil, the shunt voltage would have to be $2 \times (0.02472128 + 0.00038304)$, or about 0.05 volt. At the maximum current (2000 amp.) to be measured the resistance between meter taps would therefore have to be $0.05 \div 2000 = 0.000025$ ohm, and the corresponding separation 5.5 ft. (1.67 m.). As the actual drop in the main circuit after taps were made was 0.0518 volt, the compensating coil was adjusted to absorb 0.0518 — $(0.02472128 + 0.00038304) = 0.02662$ volt, making the resistance $0.02662 \div 0.0304 = 0.8756$ ohm.

*Ninety degrees Fahr. is not uncommon at some periods of the year.

STATION AND OPERATING PRACTICE

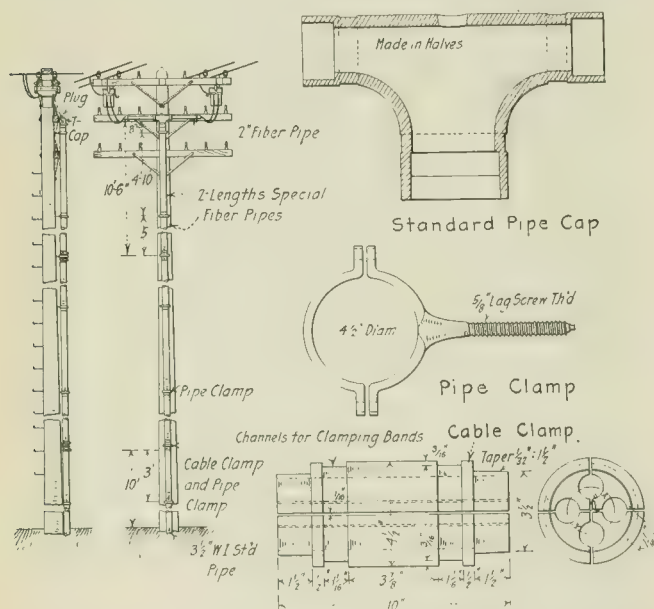
A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

CONNECTING OVERHEAD AND UNDERGROUND CIRCUITS

Use of an Improved Type of Pole Standpipe Which Protects Cable and Removes Hazard of a Ground Near High-Tension Lines

BY R. A. PAINE, JR.

For connecting underground and overhead four-wire, 2400-volt lines the Edison Illuminating Company of Brooklyn, N. Y., has recently developed an improved standpipe which is illustrated herewith. A standard $3\frac{1}{2}$ -in. (8.9-cm.) iron pipe is installed from the manhole



TYPICAL JUNCTION BETWEEN OVERHEAD AND UNDERGROUND CIRCUIT AND DETAILS OF EQUIPMENT USED

up the side of the pole to a point 10 ft. (3 m.) above the ground. From this point to a point about 4 in. (10.2 cm.) below the bottom of the cross-arm below that on which the wires to be connected are run a $3\frac{1}{2}$ -in. (8.9-cm.) fiber pipe with a $\frac{7}{16}$ -in. (11.1-mm.) wall is installed. A clamping device of maple boiled in paraffine is placed between the iron and fiber pipes and another clamping device is installed in the fiber pipe about 15 ft. (4.6 m.) from the top of the pole. The object of these clamping devices is to hold the vertical weight of the cables.

After the cables are pulled in the standpipe the clamps are tightened and a split T cap made of electrose is fitted to the top of the standpipe. The upper part of the T cap is fastened to the cross-arm below the cross-arm carrying the wires to which connection is to be made. Generally four single-conductor cables are installed. The lead sheath of the cables is removed to a point about 2 in. (5.1 cm.) above the bottom of the T cap and gum-faced rubber tape is applied to the stripped ends of the

cables, which have been left to reach the overhead wires. Two of these ends are brought out through one side of the T cap and the other two through the other side.

The cables are trained along the side of the cross-arm below the cross-arm carrying the wires to which connection is to be made to a point where they can be run vertically to the pin on the cross-arm carrying the wire to which each is to connect. A 2-in. (5.1-cm.) fiber pipe about 18 in. (45.6 cm.) long is slipped over that portion of the cable that is on the side of the lower cross-arm, and the connection is then made to the overhead wires. After the T cap is filled with compound, the filling hole is plugged and the installation is complete.

This construction eliminates the hazard to linemen of having a ground (the lead cable sheath) at the top of the pole and is giving excellent results.

COOLING TOWER SAVES \$350 A MONTH FOR EASTERN PLANT

Consists of an Elevated Wooden Trough from Which Water Drops Onto Baffles in Falling Into Cooling Pond

The demand for water for jet-condenser service increased so rapidly with the growth of load in a certain



COOLING TOWER CONSTRUCTED FOR 2000-HP. PLANT

Massachusetts steam plant that the company was obliged to spend about \$350 every month for city water. To reduce this expense steps were taken to make a home-made cooling tower, using make-up water from a stream a quarter of a mile away. The tower, which is illustrated herewith, is constructed mainly of 2-in. by 4-in. (5-cm. by 10.2-cm.) spruce timbers, and is about 90 ft.

(27.4 m.) long, 10 ft. (3 m.) wide and 12 ft. (3.7 m.) high.

Along the top of the tower are two wooden trays which are supplied with water by the two pipes shown in the foreground. The water discharges from the trays through orifices along each side and drops onto five tiers of steps, or horizontal baffles, which retard the water in falling to the cooling pond, thereby increasing the cooling. As the water spreads out over the surfaces of these baffles, considerably more radiating surface is exposed than if the water fell directly into the cooling pond.

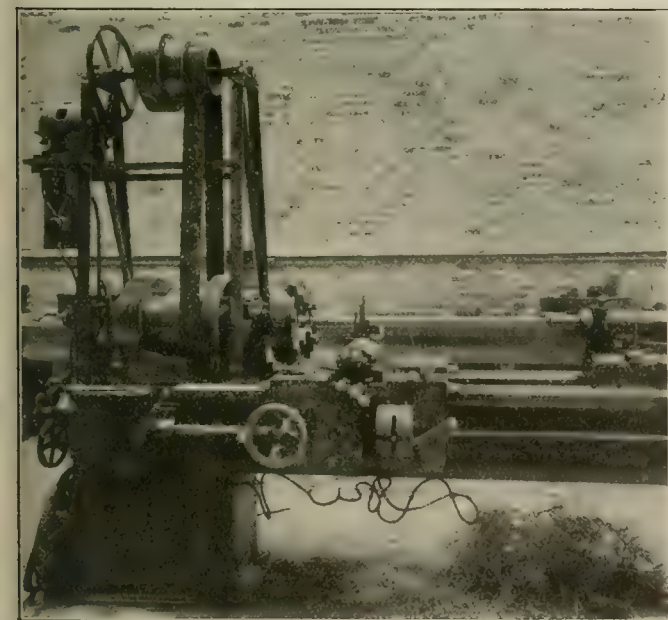
The tower is supported by 12-in. (30.5-cm.) spruce posts set in concrete piers. The pond is about 7 ft. (2.1 m.) deep. Excluding the piping, the total cost of the tower was about \$600. This tower cares for all of the condensing water used for four engine-driven units having a combined rating of 2050 hp.

CONVERTING BELT-DRIVE LATHE TO MOTOR DRIVE

Motor Geared to Jack Shaft Supported by Steel Frame Over Lathe Head—Control Attached to Lathe Carriage

BY FRED W. WALTER

The method employed in converting the lathe illustrated herewith from an ordinary countershaft and belt drive into a motor-driven machine can be applied to almost any installation. Aside from the usual advantages of individual drive, the method illustrated is especially attractive in that it permits of the lathe being operated in the usual manner and allows the spindle to be turned slightly in centering the work and adjusting



ORDINARY LATHE CONVERTED TO MOTOR-DRIVEN MACHINE

the tool. Furthermore, belt slippage can be depended on to relieve the driving mechanism of excessive strains and to safeguard the tool when too deep cuts are being taken. A maze of overhead shafts is eliminated and the lathe may be installed in any place desired.

No change in the lathe construction is required, it being only necessary to attach steel framework to the

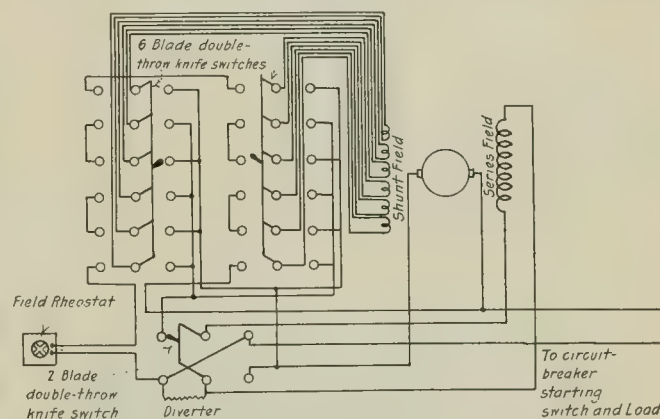
lathe head for carrying a short cone-pulley jack shaft which is gear-driven by a motor also carried by the framework. The wires leading to the motor are inclosed in conduits and the main switch is attached just below the motor within convenient reach of the lathe operator. As shown, the motor controller is mounted on the lathe carriage and connected with a motor circuit by a flexible cable which is kept from dragging on the floor by rings sliding on the horizontal wire beneath the lathe body. The controller is inclosed so no energized parts are exposed to accidental contact. A high torque motor is employed. The controller reverses the direction of rotation quickly for cutting screws, etc.

STARTING GAS ENGINE BY MOTORING GENERATOR

How Difficulties That Arose Because of Large Starting Current Were Overcome in Using Storage Battery in a University Laboratory

BY KARL B. M'EACHRON

Starting a three-cylinder 35-hp. gas engine by using the direct-connected generator as a motor has been found an entirely satisfactory method during the last



SWITCHING CONNECTIONS EMPLOYED TO SECURE HIGH STARTING TORQUE FROM GENERATOR OPERATING AS MOTOR

two years in the electrical laboratory of the Ohio Northern University. A 110-volt, 80-amp.-hr. storage battery and a 15-kw., 125-volt generator driven by a single cylinder 20-hp. gas-engine constituted the available supply of power for starting.

When a resistance is used in the armature circuit and the shunt field is fully excited, the current taken to start is about 75 amp. at 110 volts. As this current exceeds the one-half-hour discharge rate (40 amp.) of the battery, this method was not thought wise. Some method had therefore to be devised which would eliminate the starting resistance and still get the required starting torque without overloading the batteries. Thus the method shown in the connection diagram was tried and gave good results.

The shunt field was connected as shown, so that by throwing both the six-pole switches to the right the field coils were all connected in parallel. At the same time the two-pole double-throw switch is thrown to the right, reversing the series field, cutting out the diverter and placing the paralleled shunt-field coils in series with the series field and the armature. Thus the connection is virtually that of a series motor, with the advantage that the inductance of the shunt-field winding allows the

armature current to build up slowly. With this connection, and by placing the two halves of the battery in parallel, it is possible to attain a speed of about 100 r.p.m., drawing a current of 65 amp. at 65 volts. When the engine attains full speed the circuit breaker in the battery circuit is opened, the batteries are disconnected, and the switches shown in the diagram are all thrown to the left, making the usual connection for a compound generator.

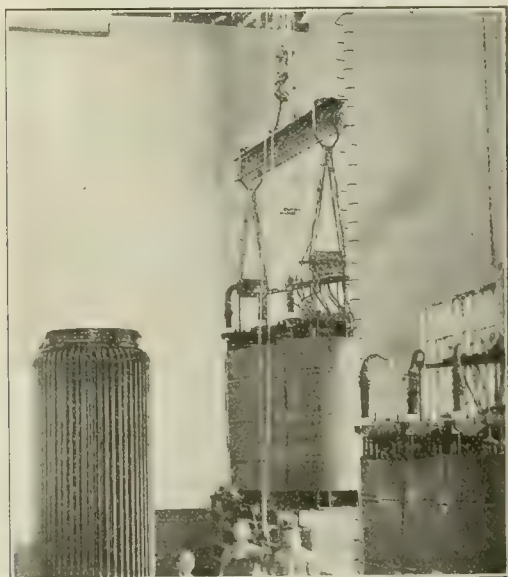
It is possible to start when the 15-kw. set is running on 110 volts, but the current taken is about 130 amp., so when convenient to do so the voltage is reduced to about 70 volts while starting.

In adopting this scheme it was thought that trouble might develop owing to the shunt-field circuit having so many switch contacts in series. Once during the first month of operation an open circuit occurred at one of the switch contacts. Since then, however, no trouble has been experienced.

HANDLING A TRANSFORMER CORE WEIGHING 13 TONS

How Special Apparatus Made It Safe and Easy to Put Core of 3000-Kva., 100,000/2300-Volt Unit in Its Case

The accompanying picture shows the method used in assembling one of the 3000-kva., 100,000/2300-volt transformers used in a step-down substation along the electrified portion of the Chicago, Milwaukee & St. Paul Railroad. The core shown weighs 13 tons (11.8 t.) and the case weighs 11 tons (10 t.). Since the transformer room contained no crane, it was necessary to pick up the core with a chain hoist so that the case could be placed under the core which was to be lowered into it.



13-TON TRANSFORMER CORE BEING LIFTED FOR LOWERING INTO CASE

The upper end of the chain hoist was attached to the roof trusses.

On the lower hook of the hoist was hung a beam made of two 10-in. (25.4-cm.) channel irons placed back to back and reinforced beneath with a 0.5-in. (1.27-cm.) plate. Between the backs of the two channels was riveted a 1.75-in. (4.4-cm.) beam, to which was at-

tached a bent rod, engaging with the lower hook of the hoist. Yokes of 1.5-in. (3.81-cm.) round stock were hung over each end of the beam to carry the slings supporting the cores. The slings were made of $\frac{5}{8}$ -in. (15.9-mm.) wire cable fastened together with Crosby clamps to facilitate changes in length. To keep the stud bolts from bending together under the strain, oak blocks 6 in. by 6 in. (15.2 cm. by 15.2 cm.) in section were fastened between the eyes.

STANDARDIZATION OF TOOLS

Steps to Reduce Number of Kinds and Types of Tools in Construction Departments

One of the conservation movements which are under way in the operating department of a large Middle West company has to do with standardization of tools. An example will illustrate how the plan is being worked out.

The superintendent of the overhead construction and maintenance departments called his gang foremen together and told each to bring the best cant hook he had on his wagon. There were six different types. By an elimination process the poorer styles were rejected and a style different from any of the six was, by common consent, determined to be best. Blue-printed specifications of this new style were made, checked by each foreman and submitted to a prominent manufacturer of tools. He learned that the local telephone company had heard of the test and had also decided on the same style as the light and power company. To him this was evidence that the proposed cant hook was good, and he has begun to manufacture it as a part of his standard line.

Not all tools must go through this tedious process to become standard. Nevertheless, standardization of tools in a large company proceeds slowly. But as the work goes forward it becomes more and more easily handled and the savings it will effect both in efficiency in the crews and in first cost of equipment become more apparent. It has even been suggested that the saving through a broad construction equipment standardization movement could be made to pay the cost.

Fuse Replacer for 13,000-Volt Lines

A convenient device for removing and replacing fuses on 13,000-volt outdoor lines is being used by the Cumberland County Power & Light Company of Portland, Me. The equipment, illustrated herewith, consists of an oak staff about $1\frac{1}{4}$ in. (3.2 cm.) in diameter and 7 ft. (2.1 m.) long, with a metal socket and clamp for



FUSE STICK EQUIPPED WITH CLAMP AND SOCKET FOR HOLDING FUSE

holding a fuse. The socket is attached to a ramrod of $\frac{1}{2}$ -in. (1.27-cm.) treated maple, which can be slid up and down in clips passing around the staff. Thus the socket can easily be locked in position or released in case it is desired to withdraw the fuse from the clamp. The equipment was designed by L. G. Scott, superintendent of underground distribution.

CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

KITCHEN SERVICE CUSTOMERS COMPLETE WIRING OF HOUSE

**Dayton Company Finds that Virtually All Who
Signed Up for Limited Installation in 1914
Now Have Complete Wiring**

Just to get a foothold, the idea was conceived some years ago that central stations should sell a kitchen installation, wiring complete, with meter, flatiron and lighting outlet. It is not necessary to describe the plan further as it is now rather generally known, but results that are now coming to light should be of interest.

In the latter part of 1914 the Dayton (Ohio) Power & Light Company conducted a campaign for such business and was very successful in signing up a large number of new customers.

Recently an investigation was made of the places which received this limited service in 1914, and it was revealed that virtually all of the customers have since completed the wiring of their entire house.

As a result the Dayton company is again putting on a campaign for this class of business. This campaign is along the same lines as the 1914 campaign. The price per installation is \$15. This includes wiring to house, meter installation and kitchen service wiring, 40-watt incandescent lamps with drop cord and socket, a 6-lb. electric iron complete with cord, plug and wall receptacle, and also a folding ironing board. Customers receive twelve months in which to pay, \$1.25 down and \$1.25 monthly.

SPECIAL LINEMAN-COLLECTOR FOR AUDITING DEPARTMENT

**Georgia Company Thus Frees Meter Department
from Interruption Caused by Applications
from Auditors for Readings**

BY N. NESBITT TEAGUE

Two features of operation of the auditing department of the Augusta-Aiken Railway & Electric Corporation, Augusta, Ga., are the following:

First—One man is employed whose sole duty is reading of meters for the auditing department. Thus the meter department is freed from bother, worry and interruption from applications made by the auditors for the various meter readings that they require.

Second—Like other electric service utilities, the company has a small percentage of bills that it is unable to collect when due, and to meet this exigency after ample notifications of such indebtedness have been sent through regular and special bills, the latter having attached to them notices requesting payment, and being delivered both by mail and in person by a collector, the company disconnects the service wires at the poles of the delinquent customers.

Therefore, instead of the auditing department having

to place a request with the distribution department to have such and such a customer cut off and having to place a similar request to have the customer cut on again, and at times having to wait in case the men in the electric department are busy, it employs as one of its collectors a man who is a lineman and can climb a pole and knows when and how to cut off a service. The man is examined by the superintendent of the electric department before being employed or being allowed to ascend any pole.

Upon cutting off a non-payer this lineman-collector telephones the trouble dispatcher, who posts the name on a special list. When the bill is settled the cashier telephones the auditing department, and the lineman-collector is able to restore the service immediately, causing no delay or complaint.

INCREASING THE LOAD FACTOR ON LINES ALREADY EXISTING

**Indiana Central Station Man Favors Introduction of
Irons and Washing Machines as First Appliances
to Sell New Electric Customers**

Speaking before a convention of the commercial men of the Indiana Electric Light Association at Fort Wayne, N. A. Perry, new-business manager for the Indianapolis (Ind.) Light & Heat Company, made a strong plea for the intensive sale of household and industrial appliances to increase the load factor on existing lines as a means of maintaining central station growth profitably in face of the high prices of construction material. "For every dollar's worth of appliances sold the annual revenue to the central station will be increased \$1," said Mr. Perry.

"When a central station campaign has been decided upon the question arises as to what particular appliance or appliances shall be made the leaders. Opinions differ on this point, but it is my personal opinion," continued the speaker, "that the electric iron is the best vehicle for the initial attack. It permits approach along the lines of least resistance.

"But the selling of the iron should be supplemented by the sale of another appliance of equal domestic value. I would therefore suggest that along with the iron the washing machine be sold. I urge this combination in order to equalize the cost of distribution—an important item in placing appliances in the home. These two appliances inevitably lead to a demand for other labor-saving devices.

"In order to show that the other appliances have value as energy-consuming devices, the following data may be given: The toaster has an annual consumption of 60 kw.-hr., which at 8 cents per kilowatt-hour amounts to \$4.80; the percolator uses 36 kw.-hr. per year and returns \$2.88; the grill uses 30 kw.-hr. and returns \$2.40."

METER CARDS TO HELP CUSTOMERS TO CHECK BILLS

Scheme of Southern Public Utilities Company Resulting in Better Understanding Between Company and Patrons

A plan to reduce the number of complaints on the ground of too high bills has been introduced by the Southern Public Utilities Company at Anderson, S. C. To each customer is given a meter card, a reproduction of which is shown, and he is requested to hang it up by the meter and record the readings. The card says:

"We read meters in Anderson from the twentieth to twenty-fifth, and in Iva the twenty-sixth of each month.

"If you will read your meter about this time and make the proper record, you will be sure you are getting what you pay for.

"We strive to make every customer a satisfied customer."

HOW TO CHECK YOUR LIGHT BILL

YOU WOULD NOT PAY YOUR GROCERY BILL WITHOUT FIRST CHECKING IT—SO WHY NOT CHECK YOUR LIGHT BILL



The accompanying cuts show the face of your light meter. Each meter face has ten digits to read in tens, hundreds, thousands.

For example, referring to Fig. 1, the first dial reads 100, and you have used 100 kilowatt hours. Suppose you have started at 100 and have used 100 kilowatt hours, at the end of the month you will find the meter face has moved up to 200, and you have used 200 kilowatt hours.

Suppose at the end of the following month your reading would be 300. You have used 300 kilowatt hours, or 200 more than you did last month. Your meter will show you have used 300 kilowatt hours, and you will find the meter face has moved up to 300.

On this card you will find a table which will help you to check your bill. We read meters in Anderson from the twentieth to twenty-fifth, and in Iva the twenty-sixth of each month.

If you will read your meter about this time and make the proper record, you will be sure you are getting what you pay for.

We strive to make every customer a satisfied customer.

If at any time you have a complaint to make of our service, write to us.

SOUTHERN PUBLIC UTILITIES COMPANY

ANDERSON S. C.

PHONE 223

THIS CARD IS HUNG BY THE METER TO ENABLE THE CUSTOMER TO CHECK HIS MONTHLY BILL FOR LIGHTING

The card, it is stated, is resulting in a better general understanding between the patrons and the company. A large number of customers are habitually reading their meters, which is reducing the questioned accounts to a great extent.

CO-OPERATION WITH LOCAL CONTRACTORS

Some of the Policies Established by Central Station Operating in Small City That Have Proved Successful

For some time there has been in existence a well-defined feeling in the central station industry that the standing of local contractors should be strengthened and that the lighting interests and contracting interests should work more in harmony for the advantage of both. To do this, of course, the contractor must be made to feel that the central station is not "bucking" him but is really helping him. It requires something tangible to accomplish this, for the contractor must "be shown."

In Bloomington, an Illinois city of slightly over 25,000 people according to the 1910 census, some definite policies have been established in this connection and favorable results noticed. Before the recent meeting of the Illinois contractors C. F. Snyder, superintendent of light, heat and power of the Bloomington & Normal Railway & Light Company, described these policies and the results secured. He spoke in part as follows:

In Bloomington we adopted a definite policy to foster and encourage this spirit of business co-operation not only between our company and the contractors but among the contractors themselves. In a sense every contractor, every fixture salesman, every wireman is a direct agent for us, because every bit of electrical apparatus installed, every fixture and appliance sold becomes a permanent income producer for the central station. This being the fixed principle from which to start, it means that the company should be willing not only to lead the way toward more amicable relations but should assist by every means in its power to build up the contractors into a group of successful, aggressive concerns.

One of the first things we did was to give the contractors the benefit of our buying power, which, notably in the case of a central station operated as part of a syndicate, is very considerable. This was of great value, especially in the case of special sales and drives. If we put on a sale, we saw that the contractors were furnished with the article at a cost which would enable them to sell at the sale price and realize a small profit. This kept his customers in each contractor's store and placed him in a stronger position with his own trade. It changed a feeling of resentment against the company for underselling into one of strong hearty co-operation and thanks, and the sale of an appliance from the store of a contractor still meant the regular monthly income to the central station. It helped make the sale a larger success because it became a strong concerted drive by every man in the industry instead of confining it to the central station salesroom.

In connection with appliance sales our company instituted a rummage sale at its salesrooms, in which every contractor in the city was represented. All the old appliances were taken from the shelves, where they had become shopworn, and put on display. The company advertised the "week" extensively in full-page newspaper copy, and the sale was an unqualified success. For our expense in conducting and advertising the sale we charged 10 per cent overhead. Every one shared in the benefits, and it was another stimulus to the co-operative spirit.

The same general plan has been followed in housewiring campaigns, and here again we were able to be of assistance to the contractor. We did away early with the policy of cheap prices with corresponding cheap unsatisfactory jobs which would foster the curbstoner to the detriment of the man with an establishment and an overhead expense. We employ high-class, well-trained salesmen and believe in a fair profit, longer time payments and satisfactory work. We solicit the business and carry the account. The contractor is paid every month, and we collect the account in monthly payments. The contractor is satisfied. He gets the business at a living profit, his payment is prompt, and he has every inducement based on self-interest to do a high-class satisfactory job. As a result the customer is satisfied and the central station sees the connected load increased.

Here we were able to assist the contractors by making a special housewiring campaign in January and February, which are generally dull months. With the overhead expense going on and in constant danger of losing his organization through lack of work, the contractor welcomed a drive that resulted in enough work to hold his men and also show a handsome profit during this slack time.

We found that old-house wiring was not aggressively pushed by the contractors through the dislike of the average wireman to work in dirty, hot attics and do his work without the convenience of adequate light. We overcame this and secured the co-operation of the contractor in securing this highly desirable class of business by the simple expedient of running our service before the house was wired instead of afterward. This allowed the use of an electric fan in the attic and afforded proper lighting and working facilities.

As a result we are gradually eating our way into the 4200 old houses in Bloomington and Normal. The proportion of old houses wired yearly to new ones has jumped more than 50 per cent. We also offered during campaigns a commission of \$15, payable out of the first payment, to any employee of the company or of any contractor who turned in a "prospect" that developed eventually into a customer.

EFFECT OF WAR CONDITIONS ON LIGHT AND POWER BUSINESS

Tendency Toward Greater Economy on Part of Residential Customers Is Noticed in Central Northwest

Conditions brought about by war have, of course, had very decided effects on central station business. The most evident naturally has been the great increase in the power load. Little, however, has been heard of the effect on domestic business.

H. E. Young, sales manager of the Northern States Power Company, which serves Minneapolis, St. Paul and many of the communities of the Central Northwest, makes the following comment on the effects of war conditions on the business of his company:

Of course, the first class of business to notice war conditions and the results of the propaganda for economy was the residential lighting business. There was at first noted a tendency for people to move out of town on farms, resulting in numbers of town houses being vacant for the summer; also there was some tendency to remove meters during the summer to save the minimum bill. There was also some tendency on the part of poor people to double up and live two families in a house, all of which had its effect in showing a decrease in meters for residential lighting in the beginning. This situation, however, appears to be changing back to normal very rapidly, so that there is every indication that when the lighting season begins in the fall the company will not suffer and will continue to show satisfactory increases in this class of business.

In the industrial power field the company has been affected in quite the opposite way. High coal prices, scarcity of coal, scarcity of labor, eagerness to get plants running at full capacity as soon as possible, have all had a tendency to help our sales department in closing all deals on which it has worked.

REPETITION INCREASES EFFECTIVENESS OF SALES

Return Post Cards Found to Bring in More Orders than Any Other Form of Advertising— One-Day Iron Campaigns

Special sales at approximately the same time each year undoubtedly gain in effectiveness with each repetition, provided always that quality merchandise is put on sale. How well this is borne out in St. Louis, Mo., is shown in the following table, which gives the results of iron sales conducted by the Union Electric Light & Power Company of that city in the last six years:

Year	Irons Sold	Year	Irons Sold
1912.....	987	1915.....	4,259
1913.....	1,475	1916.....	7,155
1914.....	2,760	1917.....	7,381

Each of these sales lasted one day. The last five campaigns were conducted by C. E. Michel, manager office sales department for the company, and have been much alike in general character. Each year, however, it has been possible to work out refinements in advertising copy and to emphasize features that show "pulling power." The greatest increase in business is attributed to the more general use of the stamped return post card in connection with the campaign, and to the fact that the public has come to believe advertising statements made by the company.

In analyzing the results of the sale it was found that from 50,000 post cards 3607 sales resulted. The office orders amounted to 1751, and the remainder, or 2033

orders, were taken by telephone, by personal solicitation or at branch stores.

In commenting on the campaign Mr. Michel said that the whole affair was handled at a profit, small but real, and that it added nearly 4000 kw. of connected load.

FREE APPLIANCE REPAIRS INCREASED BY PUBLICITY

Effect of a Single Street Car Advertisement Offering Free Appliance Repair Service to Electric Service Customers

The Columbus (Ohio) Railway, Power & Light Company on Feb. 5 placed a 19-in. by 24-in. (48.26-cm. by 60-cm.) advertisement in all street cars. The advertisement invited electric service patrons to make use of the company's free repair service. The effect of the advertisement can be traced in the numbers of trouble calls received. A tabulation of these calls for the months preceding and succeeding the announcement is given herewith:

Month	Total Trouble Calls	Appliance Calls
January	2439	792
February	2617	978
March	2625	951
April	2437	739

From these data it is evident that the advertisement had the effect of assisting the company to place back in service speedily about 200 appliances a month. On such of these repairs as required no material the company made no charge. If material was needed it was charged to the customer at the regular retail price. The repairmen each carry blueprinted sheets giving the retail prices of common supplies. The customer can either pay cash or can settle for repairs with his electric service bill.

CAPITALIZING ON THE SHORTAGE OF LABOR

Scarcity of Domestic Help Offers Opportunity for Central Stations to Campaign Strongly on Household Appliances

There has sprung up in different sections of the country a feeling among central station managers that now is the time to campaign strongly on electrical household devices, from the labor standpoint. Immigration has fallen to practically nothing, and, besides, women are being attracted more and more to the industries. The factory holds out larger pay, shorter hours and more personal freedom. Consequently domestic labor, such as that of maids and cooks, is scarcer and more expensive.

The housewife in a growing number of instances is therefore faced with the necessity of doing all of her own work where she formerly did none or only a small part. Now she has the family washing and ironing to do unless she follows the not always satisfactory plan of sending it to the laundry, the meals to get, the floors to sweep, the clothes to mend, and many other duties.

Progressive central stations realize that electricity offers in almost every case a way to lighten household duties, and profit from it by starting "drives" on flat-irons, ranges, washing machines and all other household appliances, often making a good profit because of the prevailing high prices.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

ELECTRICAL PROPERTIES OF SILVER SULPHIDE

May Be Drawn Into Wire Which Has Zero Temperature Coefficient—Resistance of Rolled Strips Temporarily Increases with the Passage of a Small Alternating Current

ACCORDING to investigations made by George W. Vinal, assistant physicist of the Bureau of Standards, silver sulphide may be prepared in the form of short wires or thin strips like a metal.¹ The wire, which must be drawn hot, has been found to conduct electricity like a metal of high specific resistance and practically zero temperature coefficient. A strip of the

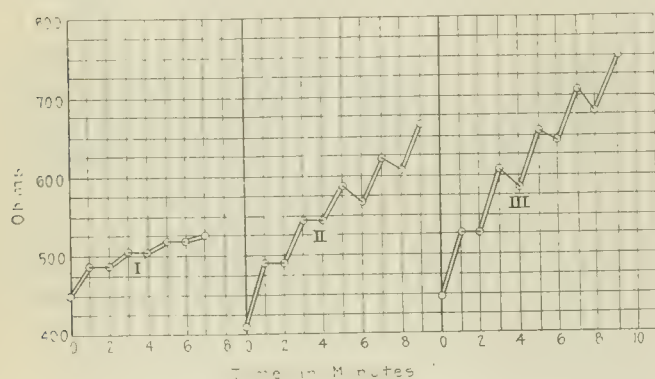


FIG. 1—EFFECT OF PERIODICALLY IMPRESSED ALTERNATING CURRENTS ON SILVER-SULPHIDE STRIP

Curve I represents conditions with 8.8-milliamp. currents, curve II with 14-milliamp. currents, and curve III with 18.6-milliamp. currents.

sulphide rolled at room temperature has a large negative temperature coefficient and shows metallic and electrolytic conduction at the same time. It has a volt-ampere current characteristic of a pyroelectric² conductor.

The resistance of these strips has been examined with both alternating and direct current, with the result that the alternating-current resistance was nearly always found to be higher than that with the direct current. The passage of a small alternating current at a frequency as low as 60 cycles increased temporarily the resistance of the sulphide, while a small direct current produced the opposite effect. Similar measurements on hot-drawn silver sulphide wire did not show the same peculiarities as the strip, however. According to Pelabon³ the melting point of silver sulphide is about 825 deg. C. Below 175 deg. the sulphide is an electrolytic conductor, according to Bädcker,⁴ and above this temperature it is a metallic conductor, the transition being marked by an abrupt

change in the electrical resistance as the temperature passes this point in either rising or falling.

Although the rolled strip and drawn wire of silver sulphide exhibited marked differences, it is not easy to explain why mechanical working of a substance such as this makes so radical a change in electrical properties. It seems likely, however, that rolling the sulphide at room temperature may produce minute cracks.

The effect of passing alternating currents through a strip of silver sulphide for short intervals is indicated in Fig. 1. The downward tendency of the single lines indicates that the effect produced is not a permanent one. It is possible that the decrease in resistance of a strip of silver sulphide when a direct current is passed through it may have some relation to the voltage effects⁵ noted in the case of selenium and stibnite cells.

In subjecting a strip of silver sulphide to alternating and direct currents it was found to be similar to a pyroelectric conductor. When the current passing through the specimen is small the resistance is very high, but when relatively large current is forced through it the resistance becomes very low. The results of the test are shown in Fig. 2. Measurements of the specific resistance of sulphide wire at 25 deg. C. indicated a value of 17,300 microhms per cubic centimeter, or about 10,000 times the specific resistance of copper.

In studying the electrochemical decomposition of silver sulphide due to the electrolytic conduction of the strips of the sulphide, it was found that a myriad of

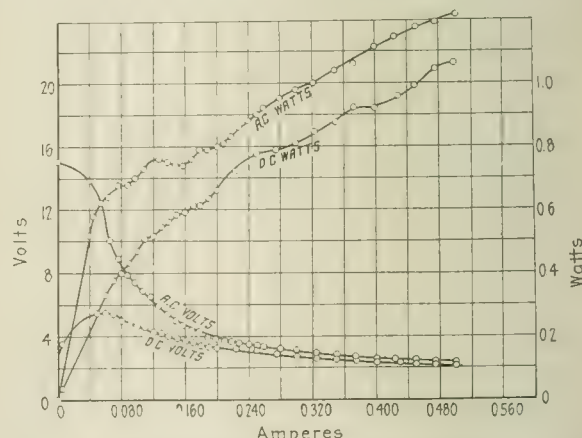


FIG. 2—CHARACTERISTICS OF SILVER-SULPHIDE STRIP WITH ALTERNATING AND DIRECT CURRENTS

shiny silver crystals appeared on the black surface of the sulphide after the current through it was increased gradually from 50 milliamperes to 300 milliamperes. The crystals appeared in various forms, some of which suggested that they had been expelled from the interior of the sulphide by considerable force. Similar experi-

¹Published by permission of the Director of the Bureau of Standards.

²Stemmetz, *General Electric Review*, Vol. 19, page 362, 1916.

³*Comp. Rend.*, Vol. 143, page 294.

⁴*Ann. d. Phys.* Vol. 327, page 758, 1907.

⁵Elliott, *Physical Review*, Vol. 5, page 53, 1915.

ments with alternating currents increased to 600 milliamperes produced no visible decomposition of the sulphide. Other experiments indicated some microphonic action when two pieces of the sulphide were pressed together and in circuit with a telephone receiver and battery. No data were obtained on the stability of silver sulphide. However, Clarke⁸ says that it is less stable than the sulphides of copper, lead and mercury.

Generators, Motors and Transformers

Modern Dynamo-Electric Machinery.—ALEXANDER GRAY.—This paper deals with the developments made in generators up to the present time, pointing to central station installations that were considered the last word in development at the time they were equipped. The relation of reactance voltage to commutation is then discussed briefly, and the extent to which the output of a machine was limited in 1907 by permeability, core heating, copper heating and commutation is pointed out. To illustrate some of the problems involved in the design of interpole and compensated machines an actual example is worked out. The effect of speed on the output of electrical machines is also discussed.—*Journal of the Franklin Inst.*, July, 1917.

Lamps and Lighting

Measurement of Light in Some of Its More Important Physiological Aspects.—D. T. MACDOUGAL and H. A. SPOEHR.—Characteristics of different kinds of glass for transmitting various parts of the spectrum are given in this paper. It is also pointed out that the universal method of calibration of sunlight intensities by the pyrhelimeter does not give results which are adequate or correct in all of the various aspects of the physiological effects of light. The sodium cell connected with a suitable portable galvanometer offers many advantages for the measurement of light intensities in natural habitats, and a comparison should be made between it and the various photometers and illuminometers which are now being recommended to the forestry student and the ecologist. In any case the action of the photoelectric cell in light is more nearly parallel to that of the organism than that of any other light-measuring instruments hitherto available.—*Science*, June 15, 1917.

Practical Limitations in the Projection of Light.—J. A. ORANGE.—A simple method of considering the important factors in light projection is presented by the author. After a brief comparison of the general merits of this method with those of the complex analytical methods, there follows a detailed treatise on the subject of brightness. A discussion of the projection of light by mirrors, searchlights, lenses, post-card projectors, magic lanterns and motion-picture machines is included.—*Gen. Elec. Review*, July, 1917.

Artificial Illumination of Factories.—A continued article, of which this installment deals with the evils entailed by insufficient illumination, classifying them as accidents, disturbances of eyesight and of the general bodily system, injury to health, diminution of production and relaxation of discipline. To be satisfactory the illumination should facilitate production from the point of view of both quantity and quality and should not injure the health, the comfort or the safety of the operatives. To this end the light should be as nearly as

possible constant and uniform over the entire superficies of the workshop, should never shine directly in the eyes of the operator as he works or walks across the floor, and should cast no shadow on machines and other objects.—*Rivista Tecnica d'Elettricità*, June 7, 1917.

Generation, Transmission and Distribution

Revision of Swiss Federal Rules Concerning Electric Lines.—A. PILLONEL.—The author discusses the modifications and expresses the opinion that the present law might be amended so as to permit greater economies in line construction without sacrificing security. He says that in alignment the span of aerial lines may not exceed the critical value $a_c = (2\sigma_{max}/P'_{max}) \sqrt{(6\sigma_{max}/E)}$; where σ_{max} = max. tension per sq. mm. permitted in the wire = limit of elasticity; P_{max} = total weight of wire (including any extra load) in sq. kg./mm; E = modulus of elasticity in sq. kg./mm. The tension in conductors must not exceed the limit of elasticity, when the wire is fully loaded at 0 deg. C., the value of the greatest extra load being determined by periodic tests as prescribed by the supervising department. Alternatively, the tension may not exceed one-fifth of the breaking load of the wires at —20 deg. C. Under normal working conditions, the permissible load not exceeding the limit of elasticity, the posts should resist the forces set up by the following circumstances: (a) Wind exerting a horizontal pressure of 100 sq. kg./m. of flat surface or 70 sq. kg./m. of longitudinal section in the case of circular parts, the pressure being exerted in the direction most unfavorable to the line, the temperature being —20 deg. C. and the tension in wires = one-fifth of the breaking load; or (b) the vertical pressure due to full load, the maximum extra load being determined by the supervising department from periodic tests, and with the tension in wires equal to the limit of elasticity. For the calculation of forces due to wind pressure on the wires, the latter may be taken to be rigid; the pressure on them is 50 sq. kg./m. of projected section. Stay poles must withstand unilateral tension equal to the breaking load of the wires and in addition a wind pressure of 100 sq. kg./m. of flat surface in the direction most unfavorable to the line. This pressure is reduced by one-half for the wires and by one-third for wooden poles or tubular supports. The maximum permissible stress is 110 sq. kg./cm. for impregnated wood or for resistant non-impregnated wood (larch, chestnut, etc.). For iron the maximum stress is: 1500 sq. kg./cm. (normal tension) for tension, compression or bending; 1200 sq. kg./cm. for rivets in shear, and 750 sq. kg./cm. for bolts in shear. Care must be taken also that pieces in compression do not buckle.—*Schweiz. Elektrot. Verein Bull.*, March, 1917.

Laurentide Power Company.—Some of the construction features of the Laurentide Power Company, Grand'mère, Quebec, Canada, are brought out in this article.—*Toronto Electrical News*, June 15, 1917.

Energy Distribution.—JULIAN SMITH.—Data showing the growth in the use of electrical energy and its effect on the development of electric service plants.—*Toronto Electrical News*, June 15, 1917.

Attendantless Substation.—Attention is called to the large magnetizing and copper losses which will result if transformers are not disconnected when not in use. Prevention of these losses may pay for attendants in such substations.—*London Elec. Review*, June 1, 1917.

⁸"Data of Geochemistry," page 561.

Traction

Electric Traction on the Mont Cenis Railway.—LUCIEN PAHIN.—An illustrated article on the electrification of the Italian state railway from Bussoleno to Modane. This railway comprises two sections. One extends from Bussoleno to Bardonecchia, 40.6 km. (about 25 miles). Here there are declivities averaging 50 mm. in the meter (1 ft. in 20 ft.) and many tunnels and artificial structures where steam operation creates intolerable conditions. The other section extends from Bardonecchia to Modane, on Mont Cenis. It is 19 km. (11.8 miles) in length and includes the Col de Fréjus tunnel, 13,636 m. (about 45,000 ft) long, which is ventilated artificially. The growth of traffic had caused many difficulties in the operation of this road by steam, all of which have been overcome by the adoption of electricity, with the increased capacity, regularity and speed thereby obtained. Power is to be supplied eventually by hydroelectric installations in the valleys of the Alps, contract having meanwhile been entered into with the municipality of Turin for three-phase energy at 55,000 volts, 50 cycles, produced by a 3500-kva. turbo-alternator—this to be supplemented by energy from other sources.—*L'Industrie Elec.*, June 10, 1917.

Electrophysics and Magnetism

Motion of Ions and Electrons Through Gases.—E. M. WELLISCH.—Results of experiments conducted in the Sloane Laboratory of Yale University to determine the mobility of ions and electrons in various gases as well as a few vapors. A discussion is given with regard to the bearing of the results on certain outstanding problems of ionic theory. The following conclusions were reached: A trace of impurity is effective in reducing the number of free electrons when the gas is at a relatively high pressure; at low pressures the effect of the impurity is often inconsiderable. In most cases a velocity greater than that arising from thermal agitation at ordinary temperatures appears to be necessary to enable the electron to effect a permanent union with an uncharged molecule of the gas or impurity. For the vapor of petroleum ether, whose molecules contain only atoms of carbon and hydrogen, the negative carriers appear to consist practically entirely of free electrons; a trace of impurity, however, is sufficient to effect the production of a considerable number of negative ions. From a brief investigation of the motion of free electrons through CO₂ it was concluded that the velocity of the electron is proportional to the applied field, but that the electron may traverse a considerable distance with accelerated motion before its terminal velocity is acquired. In no instance was any evidence obtained of a change in the nature of either the positive or the negative ion as the pressure of the gas was reduced.—*Journal of Science*, July, 1917.

Units, Measurements and Instruments

Determination of Sequence of Phases from Wattmeter Readings.—DR. GIBERT KAPP.—The so-called "two-wattmeter method" of measuring the power flowing through a three-phase line may be used to determine the power factor according to the well-known formula

$$\cos \phi = (1 + r) / 2\sqrt{(1 - r + r^2)}$$

where r is the ratio between the two readings. The fol-

lowing method is quite practicable; it does not interfere with the power supply to the load, and the additional cost is confined to the provision of a paper condenser of a few microfarads capacity. The arrangement of apparatus is shown in Fig. 3. W is the wattmeter

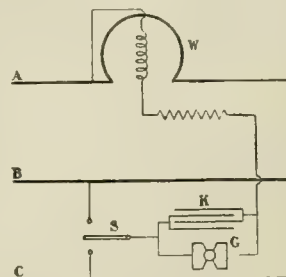


FIG. 3—ARRANGEMENT TO DETERMINE PHASE SEQUENCE

as ordinarily used, S is the change-over switch, also as ordinarily used, and K is a condenser which can be short-circuited by inserting the plug G . When the plug is inserted the sum of the wattmeter readings gives in the usual way the total power. If the plug is withdrawn, the condenser

is in series with the pressure coil of the wattmeter, and the current through this coil is slightly advanced as compared with the usual test. The two readings will, therefore, be different from those obtained with the condenser short-circuited, and by analyzing the two sets of readings it is possible to determine whether the sequence of phases is $A-B-C$ or $C-B-A$, and also whether the current supplied to the load is lagging or leading. If P_c and P_b are the wattmeter readings when the switch is connected to C and B respectively, and P'_c , P'_b the corresponding readings when the plug is withdrawn, the following table will be found applicable:

	READINGS TAKEN IN THE USUAL WAY GIVE			
	$P_c > P_b$		$P_b > P_c$	
If readings taken with condenser give	$P_b > P'_b$	$P'_b > P_b$	$P'_c > P_c$	$P_c > P'_c$
Then sequence is	$A-B-C$	$C-B-A$	$A-B-C$	$C-B-A$
And current	Lags	Lags	Lags	Lags

In using this table, care must be taken to insert the powers with their proper sign; thus if P_b is numerically smaller than P'_b , but the latter is negative while P_b is positive, then P'_b must be considered to be smaller than P_b . The same table may be used if the measurement is made by two wattmeters in the usual way. In this case the free terminals of the pressure coils must be connected through condenser and plug to the phase line labeled A , and the wattmeter must be inserted into the phase lines labeled B and C .—Abstracted from the *Journal of the Inst. of Elect. Eng.* in London *Electrical Review*, May 25, 1917.

Miscellaneous

Shortage of Platinum.—Notes on the production of platinum, the amount used, principal sources of supply, condition in which it exists naturally, and tests therefor are given in this article. It is pointed out that the adequacy of the future supply of platinum in the United States, as far as it can be assured, depends on the results of work of three kinds—first, the determination of the present supply, particularly of unmanufactured platinum metals, in order that it may be mobilized; second, systematic search for new deposits, and third, scientific exploitation of the deposits discovered, to assure their maximum yield.—*Science*, June 29, 1917.

Scientific and Industrial Research

A Department Devoted to Interchange of Ideas, Investigations Contemplated, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University

STATE RESEARCH COMMITTEE IS TO BE ORGANIZED SOON

National Research Council Considers Such Action
Essential During the War and in the Period
of Readjustment After the War

The National Research Council has carefully considered the question of general organization of state committees of research and has come to the conclusion that such organization should be determined by local needs and conditions. Local causes, such as the development or investigation of natural resources, or the proper development of the use of research methods in industries, or the correlation of industries with research laboratories already existing at educational institutions, may make it very desirable to organize such state research committees. According to George E. Hale, chairman of the Council, the present emergency offers in some respects an unusual opportunity for improving the correlation of industry and research, and it is highly desirable that those persons concerned with this development should not only consider it with reference to the present emergency, but should also plan for the permanent continuance of any research committee which may be formed.

The following scheme of organization was suggested. The committee should be organized under the state council of defense (or similar official body) and at least its general expenses should be provided by the state. It should be representative of the universities and other leading educational and research institutions through members chosen from their scientific and engineering research departments, and also those industries in which applied science plays the most important part.

URGENT NEEDS OF NATION ARE BEING CONSIDERED

Research Problems Bearing Upon Present Emergency and the Government's Needs Are Considered by National Research Council

Activities in the National Research Council are largely centered at present on efforts to formulate research problems bearing directly upon the needs of the government in the present emergency and on the selection of groups of investigators qualified to undertake such study. Considerable assistance in handling this task has been received from the French Scientific Mission through extended discussions and conferences relating to the conditions prevailing at the battle front.

Problems undertaken by the physics committee of the National Research Council in co-operation with the engineering committee of the Council relate most-

ly to aircraft and the submarine. Through the direction of the Council important agencies which have been engaged in developing devices for detecting submarines have been merged into one group. Magnetic methods of detection have been considered and studied, as well as devices for locating submarines by audible and sub-audible means. Methods of detecting invisible airplanes by means of various sound devices have been studied, and a special committee has been appointed by the navy department to test such devices at a naval station.

Among other problems which have been considered are methods of improving vision at sea, torpedo control by signal, wireless messages for aircraft and individual soldiers, electrostatic charges in dirigibles and the location of airplanes.

Summary of Investigations, Available Apparatus and Research Suggestions

SUBJECTS BEING INVESTIGATED (RESEARCH WORK
REPORTED SINCE JUNE 16)*

RADIO TRANSMISSION.

(1) Measurement of radiation resistance (direct method), taking into consideration all losses and field influences. (2) Measurement of form factor of radio antennas. (3) Investigation of the methods for finding the direction and distance to origin of electromagnetic waves. (4) Influence of imperfect conductors and networks in the field of radio antennas. (5) Study of a new type of platinum-iridium and telluride vacuum thermoelements to be used for the measurement of very small current in conjunction with a sensitive galvanometer. (6) Development of stable and sensitive thermo-elements for measuring small alternating and oscillatory currents in conjunction with low-resistance galvanometer (completed 1917). (7) Measurement of antenna inductance, capacity and resistance with 1 per cent accuracy, taking into consideration the reflection and refraction throughout the system with capacity, inductive or parallel loading (completed 1916). (8) Influence of weather conditions on the logarithmic decrement of the radio antenna systems and the influence of corona losses (completed 1916). (9) Antenna ground losses and the influence of the geologic formation upon the natural free period of the system (completed 1915).—*Radio Research Laboratories, Philadelphia, Pa., Charles S. Ballantine, director.*

SUGGESTIONS FOR RESEARCH

ARCS.

Characteristics of high-tension arcs such as occur with horn-gap arresters, horn-type fuses, arcing grounds and air-break switches.—*S. A. Stigant, Manchester, England.*

CONDUCTORS.

Current-carrying capacities of conductors in different sizes and materials when immersed in fresh moving water.—*D. D. Ewing, Purdue University.*

DIELECTRICS.

Performance of fibrous insulating materials and the like under sustained high-frequency wave trains and impulses.—*S. A. Stigant, Manchester, England.*

ELECTROLYSIS.

Effect of grounds on various electric circuits on electrolytic action.—*H. A. Hornor, Philadelphia, Pa.*

ELECTROPHYSICS.

Can a practical ray be projected through a brine solution so as to distinguish objects at some distance from the light source, but so the ray can be detected only by special apparatus? That is to say, the light ray should be invisible from the object upon which is projected.—*H. A. Hornor, Philadelphia, Pa.*

INSULATION.

Economical means of insulating corrodable metals from the alternate exposure to salt water and saturated salt air.—*H. A. Hornor, Philadelphia, Pa.*

INSULATORS.

Methods of detecting faulty line insulators with lines in service.—*D. D. Ewing, Purdue University.*

LIGHTNING.

More definite information regarding duration, frequency, current and voltage values and wave shapes of atmospheric lightning.—*S. A. Stigant, Manchester, England.*

RADIO TRANSMISSION.

Why is radio transmission better on salt water?—*H. A. Hornor, Philadelphia, Pa.*

SURGES.

The velocity of electric waves in or through electrical machinery such as transformers and generators.—*S. A. Stigant, Manchester, England.*

TRANSMISSION LINES.

Magnitude of currents which prevent ice and snow from collecting on overhead lines and cables; surveys of transmission systems in different localities, with particular reference to the possibilities of interconnection of systems to insure service continuity and conserve fuel.—*C. D. Ewing, Purdue University.*

*The names of individuals given after each institution reporting investigations are those of persons with whom others interested should communicate. All institutions reporting research work should give such names.

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

MIDDLE WESTERN UTILITIES ARE ANXIOUS ABOUT COAL

Investigation Made by "Electrical World" Indicates
Grave Public Unrest Also Over Prices
Asked—State Action Possible

Careful investigation by the ELECTRICAL WORLD in Middle Western States shows that the coal situation still presents a menacing problem. Some central station companies are having difficulty even at this season, when railroad operation is not handicapped by weather. All complain of the great increase in price and of the still unrelieved doubts as to cost with which they now face the approaching winter.

In such states as Indiana, Ohio and Illinois the public outcry against the excesses of the coal market is so loud that it may lead to drastic action by State authorities in the direction of rigid control of the price and distribution of coal. Whether or not public dissatisfaction leads to such steps, the Central Western public utilities are making extensive preparations to protect themselves. They believe, however, that if they are to be assured of adequate supply at reasonable figures much will have to be done between now and winter.

SHIELDS WATER-POWER BILL UP ONCE MORE IN CONGRESS

Measure Favorably Reported to the Senate by Its
Committee on Commerce, and Action on It
Will Await Pressing War Legislation

The Senate committee on commerce has ordered favorably reported to the Senate the so-called Shields water-power bill. This has been done, and Senator Shields is now preparing a formal report on the measure to be presented to the Senate the first of next week. The bill is now on the calendar and can be called up at any time, although it is not expected that it will be called up until the present emergency war legislation is out of the way.

This measure is the one which passed the Senate at the last Congress by a vote of 46 to 22, and it is known as the proposed amendment to the general dam act and to provide for the improvement of navigation and the development of water power with private capital.

Senator Shields commented on the measure to the Washington representative of the ELECTRICAL WORLD as follows:

"There has been some talk that President Wilson is opposed to this measure, but I do not understand that he is. The President is advocating water-power legislation such as this bill provides. I do not know just how he feels toward the particular provisions of this bill.

"There has also been some talk of possibly combining Senator Newlands' proposal for a waterways com-

mission, which includes a water-power control, with this bill. That proposal, however, has been added to the rivers and harbors bill and will probably be disposed of there. I do not yet know what attitude I shall take toward the proposed commission. I have not yet made up my mind."

Senator Shields said he does not intend to force his bill at present, and perhaps not at all, unless it is seen that Congress cannot get away this summer. If Congress is to remain in session, he will bring the bill up.

PLANTS TO PRODUCE NITRATES TO BE BUILT IMMEDIATELY

While No Definite Plans Have Been Announced, It
Has Been Officially Stated that Water Power
Will Not Be Used for the Purpose

The Secretary of War has authorized the following statement:

By direction of the President certain plants will be immediately constructed for the production of nitrates from atmospheric nitrogen. The plants to be constructed do not involve the use of water power, but use a process which is a modification of processes previously known, and the total expenditure involved in these projects is about \$4,000,000. Nothing further can be said at this time about the process or the location of the works which are to be constructed. Of the total amount appropriated by Congress—namely, \$20,000,000—substantially \$16,000,000 remains undesignated as to its expenditure by the President.

The committee, consisting of the Secretaries of War, Interior and Agriculture, to which the President referred the question of the selection of a site or sites for the development of water power, has made no report to the President on that subject, but is engaged in the making of further engineering studies, and the subject is temporarily closed to further discussion by localities and communities desiring to be considered as possible sites for the plants.

ELECTRICAL ENGINEERS AND THE SUBMARINE PROBLEM

Frank J. Sprague and Professor Whitehead Both Said
to Have Presented Plans to the Government
for Combating U-Boats

Frank J. Sprague, former president of the American Institute of Electrical Engineers, and Secretary Daniels of the Navy Department had a conference in Washington in the past week, after which it was announced that Mr. Sprague had presented to Secretary Daniels a plan to aid the government in combating the submarine problem.

Neither the Secretary nor Mr. Sprague would make

any statement in regard to the plan. Department officials and the General Board of the Navy will consider it. It may be said, however, in a general way, that "the proposal is based on a recognition of the principle that offensive rather than defensive measures are to be preferred in combating submarines," and the plan is said to provide "for new types of sea-going patrols, equipped in part with a new weapon of offense, whose functions would be to make certain regions of the sea more perilous for the submarine than for cargo boats."

Dr. J. B. Whitehead of Johns Hopkins University has submitted to the government a new type of mine, electrically controlled by means of wireless apparatus located at a distance from the mine itself.

SHIPPERS ARE TO POOL ALL TIDEWATER COAL

Saving of 133,000 Coal Cars Effected, and Kinds of Bituminous Coal Reduced from More than a Thousand to Forty-one

An agreement reached July 7 by all shippers of tidewater bituminous coal to pool their coal at the ports of New York, Philadelphia, Baltimore and Hampton Roads will, it is estimated, effect such a saving in the use of coal cars as to enable the railroads to haul to these ports 6,640,000 tons more than they did last year, when they hauled 31,000,000 tons. This arrangement was brought about through the co-operative efforts of the committee on coal production of the Council of National Defense and the railroad's war board.

Under the new plan, instead of shippers sending 1156 kinds of coal to the Atlantic seaboard, they will reduce the number to forty-one. When coal of a certain grade is wanted for a steamer, the coal of that kind of any and all shippers will be used to fill the order. Coal men have sacrificed long-established trade names in the adoption of this plan, and from now on coal will be coal when it gets to tidewater, and there will no longer be any holding of coal in freight cars until one shipper accumulates a full cargo of a particular grade.

The use of 133,000 freight cars will be saved by this pooling arrangement, it is thought. Delays to cars at ports will be cut down, and a very large part of the shifting of cars at tidewater terminals will be eliminated.

To manage the bituminous coal pool, the shippers have organized the Tidewater Coal Exchange, with offices in Washington and with Rembrandt Peale of New York as general commissioner.

RADIO-TELEPHONES FOR LOAD DISPATCHING

Public Service Company of Northern Illinois Preparing for Use of Wireless Telephones to Supplement Metallic-Circuit Instruments

While the government will not permit the use of wireless telegraph and telephone equipment at present except under its supervision, the Public Service Company of Northern Illinois is investigating the practicability of using radio-telephones for load dispatching so that some development can be made along this line when conditions will permit. Two radio-telephone sets suit-

able for communication between sections 150 miles apart have been purchased and are being tested with the co-operation of the United States Navy Department. If the units prove satisfactory on test, and the indications are that they will, one unit will probably be installed in the system operator's office, which is in the new Joliet (Ill.) generating station, and the other will be placed in the company's generating station at Blue Island, Ill. It will be possible to use the instruments in these locations to facilitate load dispatching in emergencies that may be occasioned by failure of the company's private metallic-circuit line. If the units prove practicable in these locations, their use will probably be extended to other important switching centers. The use of the radio-telephone rather than the wireless telegraph was favored by the engineering department of the Public Service Company of Northern Illinois because the instrument can be used without a knowledge of the Continental Morse code and because it is possible to transmit messages with greater speed by telephone than by telegraph.

MISSOURI PUBLIC UTILITIES PETITION FOR INCREASED RATES

Public Utilities Commission Will Hear Case, Which Involves All the Gas, Electric and Traction Companies of the State

The Missouri Association of Public Utilities, representing the gas, electric and traction companies in each of the 114 counties of the State, has filed a petition with the Missouri Public Utilities Commission asking to be allowed a general increase of 25 per cent on all rates, such increase to continue during the period of the war.

In filing the petition announcement was made that on account of the vast increase in the price of coal and other commodities many plants will be forced into bankruptcy unless the increase is allowed. Members of the commission are said to have indicated that some increase probably would be permitted.

LEGISLATION AFFECTING OREGON PUBLIC UTILITIES

A Certificate of Convenience and Necessity Required for New Utilities—Serious Handicaps Not Imposed on the Electric Companies of the State

The public policy committee for Oregon of the Northwest Electric Light & Power Association has recently submitted a very complete and interesting report on the work of the committee before the Oregon Legislature in the spring of this year. The most important legislation affecting the utilities of the State was a bill providing for a certificate of "convenience and necessity."

An inspection of the report indicates that during the 1917 Legislative Assembly there were considered just fifty resolutions, bills and proposals that affected more or less directly the activities of public utilities. Of this number, seventeen bills became law. These covered such matters as the use of streams for booming logs, the creation and maintenance of drainage districts, making it unlawful to interfere with canals and bridges, requiring public utilities and municipalities to

pay interest on customers' deposits; regulating the collection and expenditure of hospital fees, and a considerable number of minor matters.¹¹ None of the bills passed by the Legislature seriously interferes with the operation of the utilities. There were, however, a considerable number of objectionable bills introduced covering bi-weekly payment of wages and some small matters. In addition to the above, the legislative committees in the Senate and House had under consideration at various times several proposals in which the utilities were interested and on which the committee of the association asked for hearings. Among these bills was one which provided that before any employee could be discharged, the action being taken upon a "spotter's" report, there should be a public hearing at which all concerned were to be required to be present. Another bill required that the employers of labor and utility companies furnish the names and addresses of witnesses in damage suits. A third bill prohibited blacklisting, and a fourth bill provided that the valuation for tax purposes should be the same as that fixed by the Public Service Commission for rate making. None of these propositions, however, was introduced in either house.

COAL CLAUSE ADDED BY RHODE ISLAND COMPANIES

Blackstone Valley Company and Tiverton Electric Light Company Provide for Increase in Rates as Coal Rises

The Blackstone Valley Gas & Electric Company, Pawtucket, R. I., has filed with the Rhode Island Public Utilities Commission new tariffs for power and off-peak loads on both its Pawtucket and Woonsocket divisions. These contain the following coal clause:

The above rate is based on an average cost to the company of \$4 a gross ton for Pocahontas or New River coal or other coal of equivalent grade (a coal containing approximately 14,800 B.t.u. a pound dry), or a proportional average cost for coal of other heating value, delivered into the Pawtucket storage of the company.

The total cost of the coal used by the company for the generation of electricity in Pawtucket in each calendar month shall be determined on the basis of the cost delivered into the company's Pawtucket storage of all coal held in the Pawtucket storage of the company on the first day of such month, and if this total cost varies from such average the aggregate amount of the variation shall be divided by the total number of kilowatt-hours of electricity delivered by the company in such month for power purposes and to other public utilities, and the variation per kilowatt-hour for such month so determined shall be added or deducted as the case may be to or from the charge per kilowatt-hour for all electricity delivered in such month under this rate, and such variation shall not be subject to any discount.

If a bill covers electricity delivered partly in one calendar month and partly in another, all such electricity shall be deemed to have been delivered in the latter calendar month.

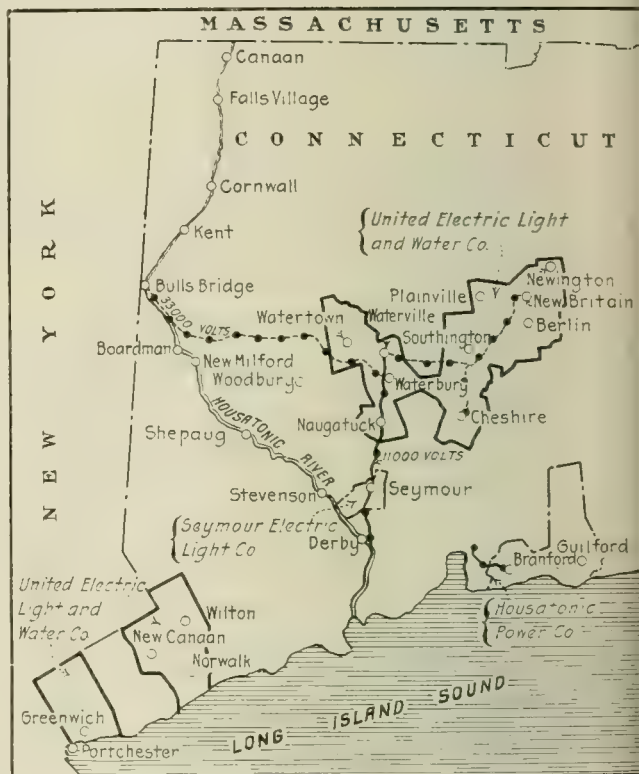
According to the provisions of the public utilities act, a tariff upon which thirty days' notice is given to the public and the commission becomes lawful unless otherwise ordered by the commission.

The Tiverton (R. I.) Electric Light Company has supplemented its power rate tariff filed with the Public Utilities Commission. It provided for an additional charge based on the increased cost of coal alongside its wharf, amounting to one one-hundredth of a mill per kilowatt-hour for every 1 cent of excess in the price of coal above \$4 per long ton.

CENTRALIZATION OF SYSTEMS IN THE HOUSATONIC VALLEY

Three-Million-Dollar Hydroelectric Development Inaugurated at Stevenson, with Wide Plans for Using Power Sites

Another important consolidation of New England electric power interests was outlined July 12 at Hartford, Conn., when the Public Utilities Commission of Connecticut gave a hearing upon the petition of the Rocky River Power Company for authority to purchase



MAP SHOWING POWER SITES ON HOUSATONIC RIVER

the United Electric Light & Water Company of Waterbury, the Housatonic Power Company and the Seymour Electric Light Company. J. H. Roraback, president of the Rocky River company, outlined the plan of the utilities concerned and presented a chart of prospective hydroelectric power developments on the Housatonic River between the Massachusetts boundary and Derby. The properties are to be merged under the title of Connecticut Light & Power Company, and it is planned to build a three-million-dollar hydroelectric station at once at Stevenson, northwest of Derby and west of Seymour. Important power sites in control of these interests and the outlines of the territory served are shown above. In the future it is expected that a large steam-turbine relay station will be constructed to supplement existing plants, but the location has not been announced. A probable site is on the shore of Long Island Sound, where the best possible facilities for fuel delivery at low cost and ample condensing water exist.

Mr. Roraback said that the properties purchased by the Rocky River company will be turned over for a cash outlay of \$6,600,000. By the consolidation, engineering improvements and centralized operation will be effected to the great advantage of the residents of the Naugatuck and Housatonic Valleys, including the important

ities of Waterbury, New Britain and Berlin. In a general way the new system will occupy the territory between the Hartford and the New Haven central station areas, while a systematic utilization of the water power available on the Housatonic River will enable power to be generated at better efficiency through the co-ordination of plants and control of stream flow. There was no opposition to the company's plans at the hearing. Earning power and prospects figured more in the purchase price than the physical valuation of the equipment of the properties.

Below is a reproduction of a chart submitted to the commission by Mr. Roraback showing present and prospective developments on the Housatonic River. On six sites acquired by the Rocky River and affiliated interests an approximate total development of nearly 60,000 kw. is scheduled, yielding an annual production of 307,100,000 kw.-hr. Data as to pondage, head and output of developments existing and prospective on the river are fully shown on the diagram, which also indicates the power capabilities of the Stone & Webster property (Connecticut Power Company) at Falls Village and other large users of stream flow. Borings are now being made, with other preliminary engineering work, prior to the construction of a hydroelectric plant of 18,000-kw. rating at Stevenson. A 7500-kw. Westinghouse steam-turbine extension is being added to the Waterbury plant of the Housatonic Power Company at a cost of \$193,200, including turbine, condensing apparatus and building accommodations, increasing the capacity of the station from 21,500 kw. to 29,200 kw. At Bulls Bridge, on the Housatonic, a 6000-kw. station is now in operation. Mr. Roraback said that costs are at present double normal figures in construction, and that the erection of a large new steam plant will be deferred for the present on this account. The transmission lines of the Housatonic Power Company at

territory for electricity for light, heat and power service are rapidly increasing, and special emphasis was laid at the hearing upon the possibilities in the way of increasing available generating and distributing capacity through the consolidation. In a general way, the Housatonic company is a wholesaler of electrical energy. Besides operating generating plants in Kent (Bulls Bridge) and Waterbury, it operates substations in Waterbury, New Britain, South Norwalk and six other municipalities. The United company distributes energy in Waterbury, New Britain, Plainville, Berlin, Norwalk and ten other municipalities. The Seymour company serves a small local territory only.

CALIFORNIA FUEL OIL SITUATION IS SERIOUS

Conservation of Oil Resources of the State Now Vital Need—Committee Outlines Plan and Appeals for Government Aid

A report has just been completed by the committee recently appointed by Governor Stephens of California to make an investigation of the petroleum resources of that State, with particular regard to the industrial and military needs of State and nation in the present war emergency. The committee found that the oil production in California (whence comes one-third the entire supply of the United States and about one-quarter of the world's supply) is falling behind consumption at the rate of 35,860 barrels per day. This excess of consumption over production is now being taken from oil in storage, and at the present rate the storage in California will be reduced to the 10,000,000-barrel safety margin by Sept. 20, 1918. Should consumption increase or production decrease, both of which are likely unless immediate action is taken, the safety margin will be reached at an earlier date.

The substitution of hydroelectric energy has already taken place to a considerable extent in industrial and agricultural uses, but this has been hampered by difficulty in securing copper and other material, and also by the disturbance of existing conditions that would be entailed by diverting large blocks of hydroelectric energy to service previously rendered by oil-burning plants. Large additional oil saving through the substitution of hydroelectric energy cannot be expected during the war, the report states; but after the war and the restoration of normal industrial conditions wherever hydroelectric energy is available, it will play an increasingly important part as a substitute for the fuel. Meantime interconnecting the transmission systems of electric companies is suggested as a means of eliminating, or at least reducing, the necessity of maintaining steam-electric plants.

The difficulties standing in the way of prompt and substantial increase of production must be quickly removed, the report states, if a serious industrial crisis is to be forestalled. The emergency cannot be met without the assistance of the federal government, and the report urged that California State officials make direct appeal to the administration at Washington. While it is believed possible to increase production more than 30,000 barrels per day, this increase cannot reasonably be expected to be available before June 1, 1918.

The committee, which is officially known as the committee on petroleum of the State Council of Defense,

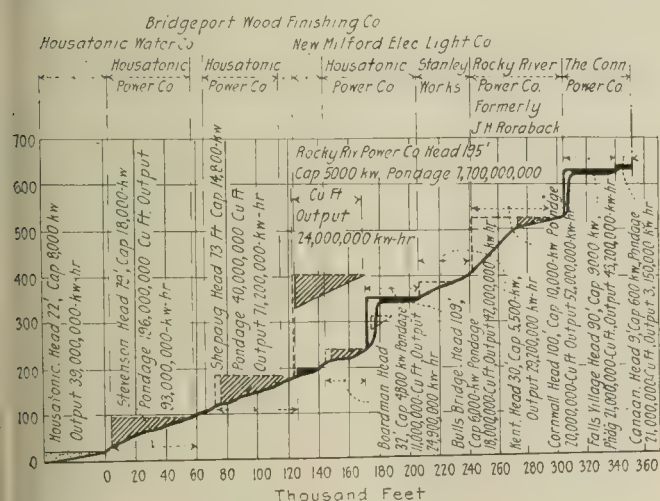


CHART SHOWING PRESENT AND PROSPECTIVE DEVELOPMENTS

present run from Bulls Bridge station eastward to the Waterbury-New Britain district, the pressure being 33,000 volts. Additional line construction will necessarily follow the development of the power sites.

All the companies affected operate in territory having important industrial customers for power, and in the Naugatuck Valley in particular products directly or indirectly bearing upon the prosecution of the war are manufactured on a large scale. The demands of the industrial concerns and of other occupants of the ter-

consists of Max Thelen, president of the California Railroad Commission; Eliot Blackwelder, professor of geology University of Illinois, and David M. Folsom, professor of mining engineering Leland Stanford, Jr., University. The preliminary outline of the committee's report was telegraphed to Washington on July 7 by Governor Stephens, and a prompt acknowledgment was received by wire signed by President Wilson, expressing appreciation of the importance of the work and promising federal support for the general plan.

WATERWAYS LEGISLATION IN RIVERS AND HARBORS BILL

Commission of Seven Members Appointed by the President, with Annual Salaries of \$7,500, Will Co-ordinate Work of Departments

Senator Newlands has succeeded in tacking to the rivers and harbors bill his measure to create a commission on waterways which will deal with the water powers of the country. He has been working for such a commission a long time, and as the bill, which has passed the House, has the backing of the President as a war measure, there is some chance of its enactment. The bill is now in the hands of the Senate committee on commerce. That part of it referring to the proposed Waterways Commission reads as follows:

That a commission, to be known as the Waterways Commission, consisting of seven members to be appointed by the President of the United States, at least one of whom shall be chosen from the active or retired list of the Engineer Corps of the army, at least one of whom shall be an expert hydraulic engineer from civil life, is hereby created and authorized, under such rules and regulations as it may adopt, to bring into co-ordination and co-operation the engineering, scientific and constructive services, bureaus, boards and commissions of the several governmental departments of the United States and commissions created by Congress that relate to study, development or control of waterways and water resources and subjects related thereto, or to the development and regulation of interstate and foreign commerce, with a view to uniting such services in investigating, with respect to all watersheds in the United States, questions relating to the development, improvement, regulation and control of navigation as a part of interstate and foreign commerce, including therein the related questions of irrigation, drainage, forestry, arid and swamp land reclamation, clarification of streams, regulation of flow, control of floods, utilization of water power, prevention of soil erosion and waste, storage and conservation of water for agricultural, industrial, municipal and domestic uses, co-operation of railways and waterways, and promotion of terminal and transfer facilities, to secure the necessary data, and to formulate and report to Congress as early as practicable a comprehensive plan or plans for the development of waterways and the water resources of the United States for the purposes of navigation and for every useful purpose, and recommendations for the modification or discontinuance of any project herein or heretofore adopted. Any member appointed from the retired list shall receive the same pay and allowances as he would if on the active list, and members selected from civil life shall receive compensation of \$7,500 per annum.

In all matters done or to be done under this section relating to any of the subjects, investigations or questions to be considered hereunder, and in formulating plans, and in the preparation of a report or reports, as herein provided, consideration shall be given to all matters which are to be undertaken, either independently by the United States or by co-operation between the United States and the several States, political subdivisions thereof, municipalities, communities, corporations and individuals within the jurisdiction, powers and rights of each respectively, and with a

view to assigning to the United States such portion of such development, promotion, regulation and control as may be undertaken by the United States, and to the States, political subdivisions thereof, municipalities, communities, corporations and individuals such portions as belong to their respective jurisdictions, rights and interests.

The commission is authorized to employ or retain and fix the compensation for the services of such engineers, transportation experts, experts in water development and utilization and constructors of eminence as it may deem necessary to make such investigations and to carry out the purposes of this section. And in order to defray the expenses made necessary by the provisions of this section there is hereby authorized to be appropriated such sums as Congress may hereafter determine, and the sum of \$100,000 is hereby appropriated, available until expended, to be paid out upon warrants drawn on the Secretary of the Treasury by the chairman of said commission.

The commission shall have power to make every expenditure requisite for and incident to its authorized work, and to employ in the District of Columbia and in the field such clerical, legal, engineering, artistic and expert services as it may deem advisable, including the payment of per diem in lieu of subsistence for employees engaged in field work or traveling on official business, rent of offices in the District of Columbia and in the field, and the purchase of books, maps and office equipment.

REDUCTION OF RATES ORDERED IN DISTRICT OF COLUMBIA

Commission Bases Reduction on Valuation of Property, on Which a 7 per Cent Rate of Return Is Allowed—Contractual Relations Questioned

The Public Utilities Commission of the District of Columbia handed down its decision in the Potomac Electric Power Company's case on July 13 and ordered the following reductions:

(1) That the maximum rate for energy should be reduced from 10 cents to 8 cents per kilowatt-hour, with corresponding reductions in schedules where the secondary rates are in excess of 8 cents per kilowatt-hour;

(2) That the minimum monthly charge should be reduced from \$1 to 75 cents;

(3) That the present point of division between the primary and secondary rates should be changed from 120 hours' use monthly of the connected load to sixty hours, the rate for the amount of electricity used in excess of sixty hours to be 5 cents per kilowatt-hour; and

(4) That the rates for street lamps be reduced 10 per cent.

The commission estimates that the changes and reductions indicated above will reduce the gross annual revenue of the respondent company approximately \$320,000. It is further estimated that when reduced by this amount the revenues of the company, even under abnormal conditions now existing and after allowing for increased operating expenses, will yield a return in excess of 7 per cent on the fair value of the property of the company.

In making the analysis of the operating revenues and expenses of the Potomac Electric Power Company for the year 1916 the commission proceeded upon the following assumptions: That the fair value of the property of the respondent company (\$11,731,000), as found by the commission in its order dated May 2, 1917, is just and reasonable; that 7 per cent constitutes a reasonable rate of return upon said fair value, and

that the joint operation of the main generating station of the Potomac Electric Power Company by that company and the Washington Railway & Electric Company in view of their relation to the public be conducted upon terms fair, just and reasonable to both companies.

Commenting on the contractual relations of the two companies, whereby the railway company receives about 50 per cent of the entire output at a very low rate because it guaranteed the bonds of the power company and rendered it certain financial assistance, the commission said:

The Potomac Electric Power Company, in the exercise of those rights derived from public authority which enable it to use the public streets and the public space in the prosecution of its business, is under the primary duty to furnish its product to the public at reasonable and non-discriminatory rates. Whatever might have been its contractual capacity, if it had been an entirely independent corporation, it is the opinion of the commission that such contractual rights could not be extended to a point which affected this primary duty. If it has contracted or should contract in such a way that its operating expenses, which are paid by the public, are unjust to the public, it is the duty of this commission to allow to it as one of the factors entering into its rates only such operating expenses as it should properly and reasonably pay. If this company had entered into contracts for coal at ten times its usual market price, or for any other operating item at ten times what it could be purchased for in the open market, while it might well be that as between the contracting parties the commission could not interfere, it is not conceivable that it could consider for a moment the contract prices as a legal operating charge ultimately paid by the public in rates. If the contrary were true, every public utility could, by the exercise of its contract power, defeat the right of the public to a reasonable rate, open the door to fraud and connivance of the most generous proportions, and make the duty of public regulatory bodies a farce. No matter what private contract may be entered into by a public utility, the public is entitled under the common law and under the statutes to receive the product or services of that utility at a just, reasonable and non-discriminatory rate.

The fact that all of the stock of the power company is owned by the railway company, that the officers and boards of directors of the two companies are the same, and that the two companies do not deal with each other at arm's length, makes it unnecessary for this commission to require any change in the actual method of payment for power produced by the power company and sold to the railway company. The duty of this commission is to protect the public from unjust and unreasonable charges, and this duty will be most effectively and most expeditiously performed by permitting the two companies to continue to exercise their wills as to the method of payment for power sold by the one to the other. But no such arrangement should be permitted to affect the public which consumes the power sold by the power company at wholesale and retail for private use. In other words, the inter-pocket transfer of money between the two companies does not affect the principle that the public is entitled to rates, tolls and charges for the sale of electric energy which are reasonable and just and which are based upon allowing the company a fair return upon the fair value of its property.

C. P. King, president of the Potomac Electric Power Company, commented on the decision as follows:

In view of the abnormal conditions now existing, with the prices of coal and other supplies rising by leaps and bounds and wages constantly going up, we are surprised at the drastic reduction of rates ordered by the commission.

The 7 per cent rate of return fixed by the commission is inadequate to attract the necessary capital to provide for future extensions, additions and improvements that must be made if the public utilities of Washington are to keep pace with the growth of the city.

The valuation fixed by the commission is entirely too low, being based upon the low prices of 1914, and the commission having failed to include in its valuation many items that

should have been given consideration and have been allowed by other commissions and the courts.

There is nothing in the relations between the Potomac Electric Power Company and the Washington Railway & Electric Company which is detrimental to the interests of the public of Washington, either as consumers of electric light and power or as patrons of the railway. On the contrary, the relations that exist between these companies have been mutually beneficial to the public and the companies and were authorized by Congress.

MANY INDIANA TOWNS INVOLVED IN RATE CASE

Public Service Commission Issues List of Communities Served by Public Utilities Which Seek to Raise Rates for Service

The Public Service Commission of Indiana has just made public the list of Indiana towns and cities that will be affected by the results of the recent petition of the Indiana Electric Light Association, which seeks authority to add a surcharge of 30 per cent to each monthly bill for electric light and power furnished, because of heavy increases in costs of manufacturing electricity. The list of towns and cities covers practically the entire State. It is as follows:

Princeton	Monticello	Indianapolis
New Albany	Morocco	Broad Ripple
Jeffersonville	Newcastle	Ben Davis
Fort Fulton	Lebanon	Mars Hill
Clarksville	Remington	Danville
Ohio Falls	Salem	Clayton
Howard Park	Seymour	Plainfield
Atlanta	Shelbyville	Avon
Bunker Hill	Wolcott	Clermont
Carmel	Plymouth	Brownsburg
Chesterfield	Culver	Pittsboro
Daleville	Knox	Sullivan
Fortville	North Judson	Shelburn
Galveston	Ober	Farmersburg
Hobbs	Hamlet	Hymera
Home Place	Walkerton	Coalmont
Kennard	North Liberty	Wilfred
Lafontaine	Tyner	Jasonville
Lawrence	Mount Vernon	Clinton
McCordsville	Poseyville	West Clinton
Mohawk	North Manchester	Blanford
Montpelier	Riverside	St. Bernice
Mount Comfort	Normal City	Dana
Mount Summit	Shideler	Mulberry
Oaklandon	Eaton	Dayton
Orestes	Hartford City	Evansville
Parker City	Dunkirk	Winslow
Pendleton	Redkey	Haubstadt
Selma	Rochester	Fort Branch
Sharpesville	Bourbon	Fiatt
Shirley	Fulton	Balbec
Springport	Argos	Pennville
Summitville	Brazil	Oakland City
Walton	West Terre Haute	Terre Haute
Wilkinson	Batesville	Seelyville
Windfall	Hammond	Staunton
Yorktown	Whiting	Knightsville
Valparaiso	East Chicago	Harmony
Albany	Indiana Harbor	North Terre Haute
Columbus	Munster	Madison
Mooresville	Highland	Boonville
Martinsville	Dyer	Southport
Sheridan	Griffith	University Heights
Bedford	Schererville	Beech Grove
Crown Point	Michigan City	Woodruff Place
Brook	Chesterton	Owensville
Earl Park	Porter	Laporte
Fowler	Lafayette	Westville
Franklin	West Lafayette	Brookville
Goodland	Elwood	Huntington
Greenwood	Alexandria	Rockport
Kentland	Dundee	Corydon
Lowell	Cammack	

The hearing on the petition will be held July 23, 24 and 25.

WISCONSIN COMMISSION ISSUES SAFETY CODE FOR UTILITIES

Standards for Safe Construction and Operation of
Electrical Supply, Signal and Utilization
Equipment in the State

To make it possible to cover all the requirements of electrical construction and operation, to safeguard electrical employees, consumers and the general public, the Railroad Commission of Wisconsin and the Industrial Commission of Wisconsin have jointly issued an order covering standards for safe construction and operation of electric systems.

The commission states expressly that "it is intended that this order shall be considered with the exceptions, alternatives and explanatory material included in the corresponding rules of the National Electrical Safety Code. In cases where more specific requirements or closer interpretations are necessary the National Electrical Safety Code should be followed." Throughout the rules issued by the Wisconsin commission the corresponding rules in the safety code are noted in parentheses.

The Wisconsin order comprises twenty-six printed pages and takes up practically the same points covered in the 323 pages of the National Electrical Safety Code. The rules were worked out after four conferences between the utility men of the State and the commission, the last of which was held on March 16, 1917, at Milwaukee. The Wisconsin rules are applicable as a minimum requirement for all new construction and replacements which are begun subsequent to July 1, 1917, provided, however, that until May 1, 1918, parties may insist upon higher standards in any particular location subject to review by the commission upon application. All work on existing lines and equipment required by this order which can be accomplished by the addition of new material without the abandonment of existing equipment and material must be completed by May 1, 1918. The commission states, however, that in event a rigid application of its rules should work a hardship on any utility on account of peculiar local conditions, application for exception can be made to the commission.

PATENT OFFICE LEGISLATION AWAITING ACTION OF CONGRESS

Three Pending Measures Provide for Withholding
Patent Grants, Increasing Number of Employees,
and Regulating Use of Enemy Patents

Much needed additional employees for the Patent Office at Washington were authorized under a bill introduced by Representative Charles B. Smith and reported favorably to the House from the committee on patents. A sum of \$43,500 is authorized for additional employees specified as follows: Two principal examiners and one examiner of interference at \$2,700 a year, four first assistant examiners at \$2,400 a year, four second assistant examiners at \$2,100 a year, four third assistant examiners at \$1,800 a year, four fourth assistant examiners at \$1,500 a year, five clerks at \$1,200 a year, and two laborers at \$600 a year.

The committee has also reported a Patent Office war measure to prevent the publication of inventions that might be useful to the enemy. The bill provides that

the Commissioner of Patents may withdraw the granting of a patent in his discretion until after the end of the war. However, an applicant whose patent is withheld need not fear that his invention will be used by the government without recompense. In the latter case, he may sue for compensation in the Court of Claims. However, if it is found that the patent has been published or an application for the patent has been filed in a foreign country without the consent of the United States government, the inventor will lose this right.

In the "trading with the enemy" act, read and referred to the Senate Committee on Commerce on July 13, provision is made for granting patents to alien enemies and safeguarding the interest of inventors in the same. It is also proposed to issue licenses to citizens and corporations of the United States who desire to use any patent or copyright granted to an alien enemy, provided that the public welfare is served thereby. The Federal Trade Commission will issue the licenses.

COAL WASTE LAST YEAR IS FIGURED AT \$500,000,000

Director of the Bureau of Mines Draws Attention to
the Inefficiency of Steam Plants and Comments
on Spectacular Lighting as Waste of Energy

Fully \$500,000,000 was wasted last year in this country through the inefficient use of coal, according to V. H. Manning, director of the Bureau of Mines, Department of the Interior. He further declared that this waste was continuing at an even greater rate and at a much larger penalty to the country because of the increase in the price of coal. Mr. Manning continued:

The penalty is not only a heavy tax on the American pocketbook, but it is also an unpatriotic thing. For every pound of coal we waste there is that much less available to put into energy to end the war.

Last year the United States mined 600,000,000 tons of coal, the greatest production ever witnessed in the world, and of this amount we wasted 150,000,000 tons, or 25 per cent, through inefficient use.

As an example, in the modern, efficient power plants of the country 20 per cent of the heat in the coal consumed is converted into power, whereas in the small power stations the efficiency frequently drops below 10 per cent. Although the average efficiency of all kinds of steam-power plants in the United States can be only a matter of guesswork, it is quite probable that the average is somewhere in the neighborhood of 5 or 6 per cent of the energy of the coal transformed into useful energy ready for distribution. So you can see that if it were possible to elevate the average efficiency to something near the maximum now attainable in steam plants about three times as much energy would be available for the productive industries of the country.

The Bureau of Mines has for a number of years been engaged in studying these problems and has by this time completed a number of reports that tend to solve many of the difficulties met with in the burning of coal. These reports are not only of extremely great value to the engineers and firemen of power plants, but they are also a practical aid to the householder in keeping up his furnace in an economical manner. Many of the conclusions of the bureau, as embodied in these reports, can be put into operation at once with a great saving of coal and without any expensive new equipment being installed.

And while discussing waste, allow me to say that the brilliant lighting of the roofs of apartment houses at night, merely for the purpose of making a pretty picture in the sky, ought to be stopped during the period of the war. It is a glaring example of waste of precious resources.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Liability for Injury from Wires at Abandoned Plant.—In action for personal injury sustained by plaintiff, having no implied invitation, from contact with defendant's electric wires in an abandoned plant, defendant, not bound to have anticipated such injury, was not liable, the Supreme Court of Minnesota held in *Kieffer vs. Wisconsin Railway, Light & Power Company* (162 N. W. 1065).

Rate Discrimination Practically Only Prohibition Placed on Municipal Plants.—According to a decision in the case of *James M. Butler versus the City of Columbus*, handed down by the Ohio Supreme Court on July 3, the laws of Ohio permit a municipal electric plant to do business in almost any way so long as it does not discriminate in rates. The plant may be overloaded and the streets may be inadequately lighted, but still the plant may go on selling to private consumers and at a rate for the service that will put a burden upon the taxpayers for its support. The decision of the Franklin County Court of Appeals is reversed, but at the same time the city won most of its contentions. Mr. Butler, as a citizen, brought suit to prevent the city from selling energy to private consumers on the ground that the plant is overloaded and that the rate is less than cost, and that, besides, discrimination is used. The opinion, written by Justice E. S. Mathias, lays down the proposition that the powers conferred upon cities to establish, maintain and operate light, power and heating plants and furnish the service to inhabitants are proprietary in their character, and in the management and operation of such plants municipal officials are permitted wide discretion. Courts are without authority, according to the opinion, to interfere on the ground that the capacity of the plant is overtaxed and streets are insufficiently lighted by reason of the sale of energy to private consumers, and that the rates charged are inadequate. However, where the Council fails to adopt a schedule of rates and officials discriminate, the courts may inquire into the matter and suit may be brought to restrain the officials, the right of action vesting in the city solicitor or in a private citizen. If there is no discrimination in rates, energy may be sold at less than cost of production in order to promote the business. Bargain rates may be offered, but they must be the same to all. The City Council in this case has adopted a schedule of rates, and city officials claim they are now free to go ahead and sell to outside customers regardless of the effect of such use of the plant on street lighting.

Most Favored Buyer Clause in Contract.—A contract between an electric power company and a dry-goods company whereby it was agreed that the power company should furnish electric energy to the dry-goods company at specified rates, with a proviso that if the power company made reductions in price to a customer using energy under like conditions corresponding reductions in price should be made to the dry-goods company, was not ambiguous, it was held by the Appellate Division of the Supreme Court of New York (165 N. Y. S. 572). A dry-goods company using energy for lighting and a realty company operating an office building with the power company's substation in the basement, so that the power company could furnish the realty company with energy for the building direct and without channels of conveyance, were customers "using current under like conditions," within the meaning of the contract between the power company and the dry-goods company giving the latter the right to reductions in rates when given to any other customer using energy under like conditions. An electric lighting company had a substation in the basement of an office building owned by a realty company, and the contract between the two companies provided that, in consideration of the use of the basement by the lighting company, the price for electric energy supplied to the realty company should be 3 cents per kilowatt-hour; that, should such payments exceed \$10,000 annually, any excess not exceeding \$3,500 should be credited to the annual rental of the basement, the energy to be supplied in payment of the annual rental; that for all energy supplied in excess of 450,000 kw.-hr. annually the price should be 3 cents per kilowatt-hour, and that the realty company leased to the lighting company the space in the basement free and without charge except as stipulated. The court held that the proper construction of the contract was that the rental to be paid by the lighting company for the basement was the difference between the 3-cent rate to be allowed the realty company on all energy used and the regular wholesale rate, and that in years when the realty company should use more than \$10,000 worth of energy the lighting company should pay excess rent by giving free energy to the additional amount of \$3,500. Where an electric lighting company agreed to give its customer, a dry-goods company, any future reductions in rate made to any other customer using energy under like conditions, and the lighting company contracted to furnish energy to a realty company operating an office building for less than the rate given the dry-goods company, but the lighting company was allowed to occupy the basement of the office building with its substation, the rental value of the basement being equal to or in excess of the amount allowed in rates to the realty by the lighting company as rental, the lighting company did not grant a reduced rate to the realty company within the meaning of the lighting company's contract with the dry-goods company.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Motion-Picture Rate.—In a decision affecting the East St. Louis Light & Power Company the Illinois Public Utilities Commission holds: "Electricity for the operation of a motor-generator and other motion-picture apparatus in a theater should be charged for at the power rather than the lighting rate where the theater operates from 9 a. m. to 11 p. m., practically continuously, and the load is practically uniform throughout, since the characteristics of the service rendered conform more nearly to those for power service than to those for lighting service."

Postponement Denied Potomac Company.—The District of Columbia Public Utilities Commission has denied the application of the Potomac Electric Power Company to postpone consideration of rates until the valuation of the property shall have been determined finally by the court action. Chairman Kutz said that, assuming 7 per cent to be fair, analysis showed that the company earned in 1916 an excess of \$568,000. This assumed that relations between the company and the Washington Railway & Electric Company were fair and reasonable and that the railway paid its full proportion of generating cost. The company in a brief asserted that it would be unjust and unfair for the commission to have rates on the valuation announced in May. By reason of present extraordinary economic and financial conditions it would be impossible for the commission to foretell with reasonable certainty what rates will be fair for the immediate future, when there is every reason to believe that costs will be increased. The company added: "With taxes going up, with the financial and producing resources of the country being taxed to their utmost, with the prices of labor and materials of all kinds and of everything that goes into the daily life of the citizens and the daily expenses of this respondent on a steady increase, it does not seem unreasonable to insist that this commission should not, at this time, and pending the final determination of the fair value of the property of this respondent in the very manner provided by law, by drastic, hurried and ill-advised action, ostensibly in the interest of consumers, so paralyze the credit, the efficiency and the power of this respondent as to impair, if not imperil, its ability to maintain its credit and render that quality and quantity of service to the public which it was chartered and authorized to discharge, especially when we consider that the rates now in force are much below the maximum rates prescribed and authorized by existing law."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

A Complaint Department Suggestion.—The Commonwealth Edison Company, Chicago, has reprinted an article entitled "Don't Growl—Kick!" by James H. Collins, published in *McClure's Magazine* for May, 1917. The article discusses complaints of public utility customers, showing the value of constructive criticism.

Purchases Coal Mine to Protect Fuel Supply.—In order to be assured of a supply of coal, the Barbourville (Ky.) Electric Light & Power Company will open a coal mine near the city and operate it. In spite of the fact that the company's plant is in the heart of a rich coal-producing area it has suffered from the prevailing coal shortage.

Northern States Partnership With Citizens.—A new edition of "Back of the Investment" has been issued by the Northern States Power Company, Minneapolis. It is attractively illustrated. It states that "fairness in public relations, a well-defined sense of public responsibility, reasonable rates for service, active participation in movements for community interest and the prompt extension of lines and service to promote municipal growth are characteristics of the management policies."

Atlanta Has Board of Consulting Engineers.—On the suggestion of A. M. Schoen, Mayor Candler of Atlanta, Ga., has appointed five prominent engineers to serve as a board of consulting engineers to the city. This board meets about every two weeks and makes suggestions to the City Council on important engineering questions. The members are: J. N. Hazlehurst, chairman; Cecil P. Poole, secretary; G. R. Solomon, Hal. F. Hentz and A. M. Schoen. So far the City Council has abided by the judgment of this board. The members serve without pay.

Sweden Restricts Use of Electricity and Gas.—American Minister Ira N. Morris reports from Stockholm that a recently issued royal decree prohibits the use in Sweden of electricity and gas for signs or for advertisements out of doors. The same decree also limits the use of gas and electricity in private houses and commercial buildings. In Stockholm there may be used only 60 per cent of the quantity used during the like period last year. This amount is furnished at the usual rate—12 öre (3.2 cents) per cu. m. (35.3 cu. ft.) for gas and 35 öre (9.4 cents) per kilowatt-hour for electricity. An additional 30 per cent may be used, if necessary, at greatly increased rates, i. e., 50 öre (13.4 cents) per cu. m. for gas and 70 öre (18.8 cents) per kilowatt-hour for electricity.

Purchase Spare Parts Instead of Turbine.—The chief engineer and electrical engineer, in a joint communication to the board of trustees of the Sanitary District of Chicago, recommended that instead of installing an eighth hydraulic unit in the power house at Lockport additional spare parts be purchased and carried in stock because the present cost of a new unit would be so great. They stated that while there is an element of risk in having only one spare unit with the existing load on the system the best interests of the District would be conserved by keeping a supply of extra parts for the present units so that repairs can be made quickly in event of breakdown. It was recommended that the extra parts should consist of one extra length of shafting, one extra right-hand runner, one extra left-hand runner, extra bronze sleeves for shafts, and gates and gate links. The engineers of the Sanitary District were of the opinion that the additional equipment should cost not to exceed \$5,000.

American Public Utilities Company Report.—Joseph H. Brewer, president American Public Utilities Company, says in a statement to stockholders, in referring to the completion of the Wisconsin Dam on the Chippewa River: "The ultimate capacity of the development is 45,000 hp., consisting of six generating units of 500 hp. each. Three of these units are installed and have been generating electricity commercially since April 1 last. Since then construction has continued, and with the exception of the installation of three additional generating units and some slight finishing touches on the dam proper, the undertaking is completed. When the project was inaugurated it was anticipated that it would only be profitable to install one-half the ultimate generating capacity of the dam for the initial operation, the additional units to be installed in the succeeding two years. The demand for power, however, has been so great and has come so much more rapidly than expected that the entire generating capacity will be installed and in operation, it is hoped, by Jan. 1, 1918. The contract entered into with the Northern States Power Company has been modified in some particulars, resulting in advantage to your company and making it possible for the Northern company to purchase immediately a very much larger quantity of power than was provided for in the original contract. Wherever necessary, because of increased cost of coal, labor and material, steps are being taken to increase rates, and all indications are that our customers and those officially representing them will accept and grant our applications for increases promptly. While at no time have any of our companies suffered for lack of coal, and it is not anticipated that they will suffer serious inconvenience on this score in the future, yet we are to be congratulated on the fact that approximately 35 per cent to 40 per cent of our gross revenue is derived from the sale of electricity generated by water power."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Spokane Section, A. I. E. E.—Officers were elected recently at the Spokane Section meeting of the A. I. E. E., George Nixon being selected as secretary.

Cleveland Section, A. I. E. E.—Officers were elected at a recent meeting of the Cleveland Section of the A. I. E. E., C. S. Ripley being selected as secretary.

Madison Section, A. I. E. E.—"Wave Form of Electrical Machinery" was the subject of a paper presented recently before the Madison Section of the A. I. E. E.

Seattle Section, A. I. E. E.—"Transmission Line Design" was the subject of a paper presented by F. K. Kirsten before a recent meeting of the Seattle Section of the A. I. E. E.

Beach Picnic for Electric Club-Jovian League of Chicago.—On July 19 the members and the friends of the Electric Club-Jovian League of Chicago will have a beach picnic at Miller, Ind.

Toledo Section A. I. E. E.—One of the interesting papers presented before the Toledo Section of the A. I. E. E. recently was entitled "District Heating and Electric Generation," by A. C. Rogers.

New York Jovian League.—John W. Lieb, president of the National Electric Light Association and vice-president and general manager of the New York Edison Company, addressed the members of the New York Jovian League on July 11. Mr. Lieb spoke on what the electrical industry is doing to carry the war to a successful issue. A report was read that the New York Jovians had subscribed to over \$4,000 worth of Liberty bonds. It was decided to keep the committee which sold the bonds standing in readiness to place the next issue of bonds.

Paterson Division, Public Service Corporation of New Jersey.—R. D. Mailey, chief engineer, and A. S. Hubbard, general sales agent of the Cooper Hewitt Electric Company, at the invitation of Colonel Rogers, division manager of the Public Service Corporation, gave a talk on July 10 before the solicitors of the Paterson division of the Public Service Corporation at the Public Service Building in Paterson. Mr. Mailey explained the physical characteristics of the Cooper Hewitt lamp, showing wherein it differed from other illuminants and its many advantages, and Mr. Hubbard told of the many installations which had been made in textile mills throughout the country and the numerous reasons why the lamp was so successful for this class of work.

H. C. Schimpff, formerly traveling representative of the Illinois Traction Company, has been appointed commercial manager for the company.

Albert Harris, who has been manager of the local lighting utility at La Grange, Ky., has been appointed manager for the La Grange district by the Kentucky Utilities Company, which recently took over the property.

E. C. Deal, who since the summer of 1914 has been vice-president and general manager of the utility properties until recently controlled by W. N. Coler & Company, New York City, has resigned to become manager of the Trinidad (Col.) Electric Transmission Railway & Gas Company. Mr. Deal received his first engineering experience with the Georgia Electric Light Company of Atlanta and later was employed by the Stone & Webster Management Association in various positions in different parts of the country with public service properties operated by it. In 1904 he became associated with W.



E. C. DEAL

N. Coler & Company as chief engineer of the Gas & Electric Company of Bergen County, New Jersey. On the absorption of this company by the Public Service Corporation of New Jersey, he was appointed superintendent of the Bergen division and later of the central division. In 1908 he resigned to become general manager of the Carolina properties of W. N. Coler & Company. Three years later he resigned to become associated with the J. G. White Company, Inc., as general manager of the Augusta Railway & Electric Company and the Augusta-Aiken Railway & Electric Company. When later these two companies were merged into the Augusta-Aiken Railway & Electric Corporation, Mr. Deal continued as general manager. In 1913 he became vice-president and general manager of the company, resigning in the following year to become connected again with the Coler interests. Mr. Deal has been very active in association work, having been elected fourth vice-president of the National Electric Light Association at the Chicago convention of 1913, and also in 1913 having served as president of the Southeastern Section of the N. E. L. A.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

P. R. Atkinson has resigned as treasurer of the Edison Electric Illuminating Company of Brooklyn, his resignation having become effective July 1.

John Hartshorne, Jr., has resigned as contract agent in charge of the new-business department of the Mahoning & Shenango Railway & Light Company, Youngstown, to accept a position as Eastern sales manager of the McCaskey Industrial Register Company.

H. E. White, who succeeds Adrian Tobias as superintendent of the meter department of the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, has been foreman of the company's meter department and was for nine years employed with the Duquesne Light Company and the Pittsburgh Railways at Pittsburgh, Pa.

Henry W. Brooks, who has received a commission as captain in the Engineer Officers' Reserve Corps, is stationed at Fort Leavenworth, Kan., attached to the Seventh Company of Engineers at the reserve officers' training school. Mr. Brooks was for a good many years connected with Sargent & Lundy, Chicago, and was more recently associated with J. N. Hatch, consulting engineer, Old Colony Building, Chicago.

Fred A. Otto, president of the Minnesota Electrical Association, has resigned as manager of the Minnesota Gas & Electric Company at Albert Lea, Minn., as a result of the recent change in the control of the company. Prior to going to Albert Lea a few months ago, Mr. Otto was superintendent of the electrical department of the St. Paul (Minn.) Gaslight Company and general superintendent of the St. Croix Power Company.

Cecil Poole, consulting engineer, Atlanta, Ga., and mechanical engineer for the city, has been appointed a member and the secretary of the Board of Consulting Engineers of Atlanta, which was recently formed to take politics out of city engineering. Mr. Poole, who was at one time associate editor of the ELECTRICAL WORLD and later for a number of years co-editor of *Power*, retired from editorial work in the spring of 1912 to go to Atlanta to engage in engineering work in partnership with Lamar Lyndon of New York City. For a number of years prior to going to Atlanta, Mr. Poole had made a special study of electrical machine design and construction and of gas power engineering. He is widely known as a writer on technical subjects and is a fellow of the American Institute of Electrical Engineers, besides being a member of the American Society of Mechanical Engineers.

D. E. Hayner has resigned his position as assistant to the electrical engineer of the engineering firm of Monks & Johnson, Boston, to become connected with the Turners Falls Power & Electric Company at Greenfield, Mass. Mr. Hayner has had a number of years' experience in design with manufacturing corporations as well as operating and engineering concerns.

Obituary

William G. Bee, vice-president of the Edison Storage Battery Company, Orange, N. J., died at his residence in that city July 11 at the age of forty-eight years. Mr. Bee was among the pioneers in promoting the sale of electric vehicles. He entered that field in 1897, when he became associated with the Pope Manufacturing Company of Hartford, Conn., later known as the Electric Vehicle Company of Hartford. On the outbreak of the Spanish-American War



W. G. BEE

he enlisted in the navy, after which he returned to the Pope company. While here employed he became acquainted with Thomas A. Edison, and since the perfection of the Edison storage battery and up to the time of his recent illness Mr. Bee directed the sales policy of the Edison Storage Battery Company.

James Whitefield Wood, president of the Henderson (N. C.) Light & Power Company, died at his residence, Easton, Pa., June 24, aged seventy-two years. He was also a member of the firm of Tippet & Wood, Phillipsburg, N. J., boiler manufacturers.

Henry G. Matthews, general manager of the Quebec Railway, Light, Heat & Power Company, died recently at the Jeffery Hales Hospital from an operation. He was born in Montreal on July 1, 1878, and received his education at the Montreal high school. Before becoming associated with the Quebec company in 1911 he was manager of the Marconi Wireless Telegraph Company of Canada. He was president of the Lotbinière & Megantic Railway Company and a director of the subsidiary companies of the Quebec Railway, Light, Heat & Power Company, Ltd.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

PRESIDENT'S STATEMENT ON PRICES CAUSES APPREHENSION

Suggestion That Public Receive Same Prices as Those Quoted to Government Not Meeting with Favor

The President's recent statement on the government's attitude toward business in the matter of prices for war work has caused no small amount of apprehension among the manufacturers. Every manufacturer has become reconciled to the fact that lower than market prices would be paid for government orders, but they did not believe that the government would be greatly concerned over prices to the public other than for food and fuel. It was, therefore, a great surprise to read the President's statement that the same price should exist for all, government and public.

The manufacturer believes that the government will pay a fair and just price for all that it purchases, but there is no desire to quote the same prices to all. In the electrical line it is very doubtful if many cases can be found where the increases of the past two years have not been justified. Wages are high and materials also. To put the President's suggestion into effect at the present time might cause serious embarrassment to many engaged in the electrical industry.

Jobbers would stand to lose considerable because of the size of stocks and the prices paid for them. Manufacturers would, of course, lose on the value of stock in hand, both manufactured and unmanufactured.

With this condition in mind, it is doubtful if prices to the public will be on a level with those to the government for some time. As the needs of the government increase the amount available for private consumption is lessened. The law of supply and demand therefore must undoubtedly hold sway, unless, of course, the government commands what it now suggests.

JOBBERS PROTECTED IN HEATING APPLIANCE STOCKS

Largest Manufacturer of Such Devices for Household Use Believes that Marsh Patent License Provisions Will Prove Beneficial

Realizing that it is doubtful if prices will go much higher, the electrical trade, and especially the jobbers, because of the volume of stocks carried, is becoming worried about the losses that must come with a falling market. Many of the more progressive members believe that the only protection against a fall in price is the previous rise in price, and therefore they are putting aside reserves from present profits to apply to losses from price declines when they occur. A discussion of this situation was presented in the ELECTRICAL WORLD for June 23 under the title: "Adequate Reserves Against Lower Prices."

That such a situation as there discussed does not apply to stocks of household heating appliances is expressed in a letter recently received from the largest manufacturing concern of such appliances in the United States. The letter says:

"So far as the jobbers' stocks of heating appliances are concerned, we believe they are protected, as well as it is possible to protect stocks in the event of a declining market, by the provisions of the Marsh patent on nickel-chromium alloys.

"It is true that the various licensees under this patent have had to advance their prices because of the increased cost of raw material and that each licensee has lost by these increases, because they have to buy the goods in many cases before they realize that the price is going up, and after they have bought the goods at the high price they can't change the price at which they sell the goods in time to protect their increased cost. The result is that a manufacturer in a rising market loses out, whereas the jobber and dealer has a chance to stock up in anticipation.

"When a declining market comes round, as it must inevitably come in time, the manufacturer is supposed to be able to protect the jobbers and dealers against a loss, or at least a large percentage of the loss, by reason of the restrictions of the license governing resale by licensees under it.

"Under the circumstances it doesn't look to us right to alarm the jobbers about the protection they will have on heating appliances in the event of a declining market."

ELECTRICAL EXPORTS RUN AT RATE OVER \$55,000,000

April Returns Show that Goods Worth \$4,740,995 Left the Country for Foreign Consumption, Making Four-Month Total \$18,379,351

Figures are now at hand showing the exports of electrical goods of the United States for the month of April last. During that month the value of electrical merchandise which went out of the United States for foreign consumption was \$4,740,995, as compared with \$2,630,169 in April of the previous year. Added to the figures for the three preceding months, the April exports bring the total for the first four months of 1917 up to \$18,379,351, or at an annual rate of over \$55,000,000.

A new record was set during the month for the export of metal-filament lamps, which amounted to \$215,739, or 1,056,464 lamps. A new record was also established for the export of motors, the value of which amounted in April to \$673,719.

During the ten months ended April last the exports of electrical merchandise amounted to \$41,733,199, as compared with \$23,666,267 for the ten months ended April, 1916, and \$15,922,467 for the ten months ended April, 1915. The figures in the accompanying table were compiled by the Bureau of Foreign and Domestic Commerce.

Articles	April		Ten Months Ended April	
	1916	1917	1916	1917
Batteries	\$168,142	\$212,154	\$1,252,563	\$2,362,304
Dynamoes or generators	151,727	164,337	1,139,462	2,041,161
Fans	45,528	63,820	298,370	336,588
Insulated wire and cables	386,239	653,352	2,575,002	5,930,558
Interior wiring supplies, etc., including fixtures	44,805	122,230	743,757	899,005
Arc lamps	639	1,240	15,998	13,048
Carbon-filament lamps	5,410	11,653	130,851	121,108
Metal-filament lamps	128,734	215,739	1,007,707	1,440,490
Meters and other measuring instruments	52,255	89,297	624,200	780,783
Motors	272,261	643,719	3,468,843	4,818,684
Telegraph instruments (including wireless apparatus)	7,965	90,047	123,785	417,534
Telephones	52,064	206,588	786,706	1,513,435
Transformers	68,889	94,720	763,358	951,513
All other	1,245,511	2,172,099	10,685,665	20,016,988
Total	\$2,630,169	\$4,740,995	\$23,666,267	\$41,733,199

THE WEEK IN TRADE

VERY little change was noticed in market conditions last week. A few prices showed a change. Wire followed the market for copper down in New York. Porcelain insulators advanced substantially. Demand showed no falling off on the whole, nor did it show any gain; it was just steady.

Work on the army cantonments appears to be progressing, and already a considerable amount of electrical supplies for this work has been ordered.

Labor conditions at the end of the week appeared to be more stable than at any time in the past month. Some of the larger strikes have been settled, and some of the others are in the process of settlement.

Collections have shown up better during the past two weeks than in June, when there was a noticeable falling off. Failures are few.

The movement of fans took on a better aspect during last week than the week before. Warmer weather brought a greater number of retail inquiries and orders. For a while the fan situation looked rather dark and not a few jobbers and dealers tried to cancel orders for undelivered stock. At this writing, however, conditions are reversed and manufacturers and large distributors are receiving requests to hasten deliveries.

NEW YORK

Business generally is steady and maintained in volume. There have been a few scattered changes in price, practically each of which was governed by conditions peculiar to that line. Copper declined a cent or two, forcing the price of wire down with it. Porcelain advanced in price owing to conditions underlying the porcelain market.

Metal prices were particularly weak. The President's statement that prices to the government and to the public should be the same has caused no small amount of worry. Does it mean higher prices to the government, or lower prices to the private consumer, or both? is the question asked. Buyers, therefore, anticipating lower prices, are withholding orders.

A much better situation is in evidence as the week commences in regard to fan sales. Lamp sales are weak.

Labor difficulties brightened somewhat with the settlement of the strike at the National Conduit & Cable Company's plant, but there is still considerable unrest, and in New York City there is a threatening cloud over the railways.

Collections are better, although some apprehension is felt for the future.

A statement from the Geological Survey reports 750,322 carloads of soft coal originating on eighty-five railroads and 76,079 carloads of bee-hive coke on sixteen roads in June, 1917. Each of these is a slight increase over May and a very substantial increase over June, 1916. In the early part of June production was the highest of which there is record, but a falling off in the third week in several states and in the fourth week in others served to lower the average to about equal that of May.

Shipments continue to show an improvement with the exception of porcelain products, which have been greatly delayed by labor disturbances.

CORD.—There is an enormous demand for heater cord both for domestic and export trade. The demand exceeds the supply.

WIRING SUPPLIES.—Business remains steady with no changes in price. It has been noticed that a number of concerns and central stations are holding up purchases in anticipation of a decline of prices. However, this condition, it is felt, is more than offset by purchases from concerns to which price makes practically no difference.

SPLICING SLEEVES.—Seamless copper splicing sleeves have recently been ordered by Stone & Webster, the J. G. White Engineering Corporation, the Central Hudson Gas & Electric Company, the Connecticut Power Company, the

Kingston Gas & Electric Company, the Albany Southern Railroad Company, etc., from Edwin G. Hatch, New York City.

WIRE.—Copper wire followed the copper market down and is from 1 cent to 2 cents under what it was the previous week. A number of large orders were placed during the week, principally in small material for use largely in factories and business buildings. No government orders were heard of as being in the market during the week.

INSULATORS.—Substantial advances were made in the price of porcelain insulators during the week. The demand has been normal with few large orders. There has been a considerable demand for government work, which, of course, is affecting deliveries on other orders. The heaviest demand has been for a standard design insulator.

POLE-LINE HARDWARE.—No change in prices is reported. Demand is being affected by the price of copper, which is retarding the construction of new lines. Some apprehension is felt by manufacturers on the President's statement regarding similar prices for private and government orders. While it is firmly believed that the government will pay a fair price for what it purchases, there is a fear that prices to the public may be depressed.

FANS.—At this writing the retail movement of fans appears to be more favorable to the dealer. Late in June there were three or four good fan days and the trade was blue because shipments were so slow. Later, however, retail sales slumped off to practically nil because of unseasonable weather. Up to Friday of last week there was rain nearly every day. Many members of the trade began to request cancellations of orders. They met, however, with little or no success. On the last two days of last week and the opening days of this week the weather man sent more favorable fan weather, and now that fans are moving well again the trade is besieging manufacturers and other distributors for more stock. A week or two more of seasonable weather will probably find the retail shelves empty.

LAMPS.—Factories opened this week after being closed down for the first two weeks in July to allow all employees to take a vacation. The summer months are generally the dog days of the lamp salesmen, and this summer seems to be no exception. Dealers and jobbers have normal stocks. Deliveries are becoming better, and it is expected that they will be in good shape for the fall business.

FLASHLAMPS AND BATTERIES.—Notwithstanding an advance in the price of dry batteries a couple of weeks ago, the price of flashlamps has not changed. Business shows practically no change. Dealers and jobbers are, generally speaking, buying from hand to mouth.

POLES.—Cedar poles have advanced, on an average, around 10 per cent. Advance went into effect on the bulk of the sizes, some being increased more than others.

COLLECTIONS.—Collections have now picked up after the slump in June. The Liberty Loan and the Red Cross appeal were probably influencing factors in the June slump, although it is perhaps true that these activities were taken advantage of by buyers to gain some extra time.

LABOR.—The strike at the National Conduit & Cable Company's plant ended Monday morning when an increase of 2 cents an hour in pay was granted to the strikers. They will, however, continue to work nine hours a day, having failed in their demand for shorter hours. The machinists and higher paid workers compromised their strike last week by accepting an increase of 3 cents instead of the 5 cents demanded.

MINING EQUIPMENT.—Recent orders for motors for mine hoists aggregating 1350 hp. have been received by the Westinghouse Electric & Manufacturing Company. The largest of these is a 700-hp. motor for a 300-ft. coal hoist at the Inland Steel Company's mines at Harmarville, Pa. Other items are: Diamond Coal & Coke Company, Sharpsburg, Pa., 350-hp. motor; Republic Iron & Steel Company, Youngstown, Ohio, 300-hp. motor; E. & G. Brooks Iron Company, Birdsboro, Pa., 200-hp. motor; Mount Pleasant Coal & Coke Company, Greensburg, Pa., 200-hp. motor; Valley Smokeless Coal Company, Pittsburgh, Pa., 200-hp. motor; Eclipse Gas Coal Company, Pittsburgh, Pa., 150-hp. motor.

CARBON ELECTRODES.—The demand for carbon electrodes is daily increasing by leaps and bounds, the condition being caused by the enormous demand for tungsten, steel and other products, which in turn necessitated the installation of large numbers of electric furnaces throughout the entire country.

CHICAGO

The volume of business in electrical supplies in the Chicago territory is being maintained. Deliveries from jobbers to the trade are getting better and deliveries from manufacturers to jobbers are also noticed to be improving. Prices have been extraordinarily steady during the week. Much interest is still maintained in government orders.

FANS.—Jobbers formerly thought that if fans did not move before July 4 the year's business would be slack. More recently the limiting date was moved to July 10. This year there has been no marked movement of fans as yet, but the experience of last year leads some jobbers still to feel optimistic and to believe that even yet there may be a good business in fans. In some quarters, however, jobbers are canceling fan orders which have been placed with manufacturers.

CANTONMENTS.—While it is pretty generally understood that electrical supplies for cantonments are to be ordered directly from manufacturers at prices which are practically jobbers' cost, there still remains a chance of some business for jobbers from these sources on account of the superior service which jobbers are able to give on miscellaneous items.

FRICTION TAPE.—Prices have advanced about 15 per cent.

SWIVEL PLUGS.—Augustus N. Hand, district judge for the Southern District of New York, in the cause entitled Benjamin Electric Manufacturing Company vs. Northwestern Electric Equipment Company, has rendered a decision holding that the swivel attachment plug manufactured by the Best Electric Company is an infringement of letters patent No. 1,012,970, granted to Reuben B. Benjamin on Dec. 26, 1911. The court holds that "Benjamin developed a plug that has been remarkable in its commercial supremacy in the particular industry for which it was designed," and that "it is unreasonable to confine the inventor of such an admirable device to the too literal reading of his claims." The court also said that Benjamin "simplified the structure of attachment plugs and enormously lessened their cost. He was the first man to design a practical swivel plug the operative electric parts of which were properly insulated and wholly within the threaded shell."

LABOR.—The strike which was precipitated on July 1 by the demand of the inside wiremen in Chicago and vicinity for increase in wages amounting to \$1 a day is still in progress. Some of the wiremen, all of whom are controlled by Local No. 134, are working at the City Hall and at some other establishments, awaiting the settlement of the strike. The wiremen of the contractors, however, have practically all quit. The contractors themselves are "sitting tight." The strike has taken on a rather serious aspect, as it is a part of the larger labor movement designed to secure agreements between all of the building trades and the employers of such labor. Quite naturally it has therefore affected the local building situation, since capital does not care to enter upon projects which may be held in an uncompleted condition by chaotic labor conditions for many months.

BOSTON

Very little change appears in New England electrical circles in comparison with a week ago. With the advance of the vacation season the volume of jobbing and retail trade remains at about the level indicated last week, and no modifications of note in prices have been encountered. Collections are fully as good, and strenuous efforts are being made by the railroads to improve transportation conditions. Centralized control of traffic by the Railroad War Board is

bearing fruit, and shippers are beginning to appreciate the immense help they can give the country through more rapid loading and unloading of cars. It is current opinion that, so far as available equipment and personnel go, war demands can be met efficiently if shippers will co-operate, and there will be a reflex action upon industrial traffic which will be most helpful. The demand for electric appliances holds up well. Fans are moving better, and electric flashlights are in wide demand for vacation purposes. During the week a large New England central station which recently started an electric flatiron campaign sold over 1000 irons, compared with a total of about 1300 irons in three previous weeks. Comprehensive plans for the centralization of hydroelectric power in the Housatonic Valley, in Connecticut, with the immediate construction of a \$3,000,000 plant above Derby and the construction and improvement of transmission lines in the Waterbury district, mark continued development and further opportunities for commercial expansion. In the middle Connecticut Valley the Turners Falls Power & Electric Company is building a steam relay station of 15,000-kw. initial rating at Chicopee, Mass., and extensive transmission-line construction and substation development are in immediate prospect in connection with the supply of electricity to the Springfield Street Railway. Line material is at high price levels, steel towers rating at about three times the figures of 1914 per pound. Pole-line hardware is scarce at present. Steam-turbine manufacturers are oversold for anything like reasonable deliveries. Electrical contractors find that work is not accumulating so fast as a year ago.

LINE MATERIAL.—Demand falling off slightly, but a shortage is noted in pole-line hardware, and no immediate prospect of a price reduction appears. Consumption of metal is unquestionably affecting the supply available for peaceful uses.

MOLDED INSULATION.—Trade continues brisk in this department, with prices about the same as last week.

ELECTRIC RANGES.—A healthy volume of business continues in these equipments, considering the handicaps imposed by curtailed residential construction and stiffened price. A new table range of about 800 watts connected load is receiving a cordial welcome by the purchasing public.

FIXTURES.—Fixtures are rather quiet and the fall trade has not begun to be materially felt. Business seems to be slowing up a little, and dealers are well stocked. It is intimated that further price advances may be necessary later, especially if switches and sockets rise further.

INDUSTRIAL ELECTRIC TRUCKS.—The situation is most encouraging in this field. Inquiries are coming in more rapidly, especially from manufacturers outside the larger cities who may be affected by the draft. In some cases manufacturers are in shape to give much better deliveries on these equipments than obtain in most lines of heavy equipment.

MOTORS.—Manufacturers are beginning to catch up with their orders, and better deliveries appear to be in prospect, speaking generally. There is as yet, however, little opportunity to stock up on motors at the factories. No further price advances are in sight.

LAMPS.—An excellent summer business is being done in lamps, and on the so-called "bread-and-butter" sizes of tungstens, 10, 15 and 25-watt units, deliveries are improving. Prices remain virtually the same.

WIRE AND CABLE.—The volume of business continues practically unchanged with respect to industrial orders. Average deliveries are about three months. Heavy demands for iron wire for military service are reported, especially for telegraph work. Prices show little fluctuation.

ATLANTA

There is no apparent change in trade conditions and "good business" is the prevailing report from all sources of inquiries. Owing to the varying conditions and unexpected requirements for the army cantonments in the Southeast, definite specifications covering lighting and power requirements will not be available for a few days. Authentic sources report, however, that orders have been placed

direct with manufacturers covering the bulk of material necessary for the Columbia (S. C.) cantonment.

The manufacturers report a steady demand for all lines, with the expected falling off in late June collections accredited to public service companies midyear dividend period. Demand on jobbers is steady and excellent collections prevail. Contractors are enjoying a business slightly above normal.

APPARATUS.—There is a vigorous demand for all types of equipment in the central station field, despite the knowledge of long deliveries. Some of this apparatus will, of course, be put on a preferential shipment basis in order to fulfill government requirements.

ARMORED FLEXIBLE-STEEL CONDUCTOR.—The demand is increasing and stocks are holding well.

CABLE.—No slackening in demand for the heavier sizes is evident. Deliveries about the same.

CONDUIT.—Considerable activity is noticed in the market for galvanized product, while the demand is constant for black enamel. Shipments are from four to five weeks. Manufacturers are quoting prices as of date of shipment.

COPPER.—The market is unchanged, nor is there any improvement in deliveries.

DRY BATTERIES.—Advancing prices have not curtailed normal buying.

FANS.—Real summer weather has arrived and fans are moving rapidly. Stocks are in good shape.

HEATING APPLIANCES.—No improvement is as yet noticed in the appliance situation.

LAMPS.—Moderate demand is felt from trade sources.

LAMP CORD.—Very strong demand exists, but manufacturers report difficulties in securing raw stock.

METERS.—Deliveries are holding up well under steady buying.

MOTORS.—The industrial pressure of the last few months is gradually lessening, but it will probably be some time before shipments will improve.

POLE AND LINE MATERIAL.—Insulator demand is strong, especially glass. Hardware is firm, and deliveries remain about the same.

WIRE.—There is an excellent market for the usual sizes, and much difficulty is being experienced in securing stranded products.

WIRING DEVICES.—The strong buying movement continues for standard porcelain sockets and receptacles, and the jobbers are covering all requirements.

SAN FRANCISCO

Business is good in the electrical field and still improving. The increased demand in certain lines more than offsets decreases, so that the volume of trade is better now than before the declaration of war. In fact, recent war measures have affected the electrical supply business favorably in many ways. For example, there is an unprecedented run of equipment for illuminating buildings and grounds. Projectors for floodlighting are usually selected as the preferred method.

Pacific Coast business is carried on largely with stocks on hand in the several coast centers, and, while deliveries are uncertain in many lines at present, immediate needs are supplied by shipping from San Francisco to other coast points and vice versa to balance supply and demand. Even under this plan indications are that it will be impossible to furnish the coast trade with fans before the season closes, and the reserve supply of carbon, Gem and Mazda lamps is being depleted at such a rate that the situation is now declared to be serious.

Trade is particularly brisk in all lines of supplies required in industrial construction and extension, and it is expected that the demand in these lines will increase. The Red Cross and Liberty bond effects have passed, and collections are notably better than for several weeks past.

COPPER.—The market continues steady.

CONDUIT.—Delivery of conduit is uncertain, but stocks are very good just at present.

MOTORS AND TRANSFORMERS.—The shortage in larger sizes of motors and transformers is very keenly felt. In the small sizes stocks are available.

WIRING SUPPLIES.—In wire, sockets and outlets the demand is exceptionally heavy.

SEATTLE

Conditions as outlined for the week of July 2 to 9 show practically no change during the past week with the possible exception of freight facilities. There seems to have been during the week a loosening up of freight in the East, which means considerable increase in cars arriving at Northwest points. The Public Service Commission of Oregon has issued a circular stating that the country is again facing a severe car shortage and that unless everybody does his part a most serious and distressing situation will develop. To the Puget Sound Traction, Light & Power Company, Seattle, has been given the work of all outside wiring for the American Lake cantonment, supplying electric energy for lighting and power, as well as transformers and motors, at rates to be fixed by the government. To Seattle have been awarded more contracts for construction of steel ships for the government than to any other city in the Northwest. Of thirty-four contracts let on the Pacific Coast, sixteen were awarded to Seattle concerns.

Building construction along all lines remains inactive. Real estate is moving at a conservative rate of increase. Orders for stock are placed as required. There were no changes in prices of conduit, wiring devices and appliances as compared with last week. Continued warm weather materially increased the demands for electric fans, and there is a slight increase in the demand for household devices. Credits and collections are good.

METAL MARKETS CONDITIONS

General Easing Off in Prices Noticed, with Few Buyers Taking Advantage Thereof

Metal prices went still lower last week in a very dull market. Copper fell off 2 cents, spelter half a cent, tin three-quarters of a cent, aluminum 2 cents. Practically all of the old metals were depressed from half a cent to a cent a pound.

Buyers, however, were not in the market to take advantage of these concessions. While stocks on hand may be large, consumption is enormous, and before long large consumers must begin to place orders.

The announcement by the President that there should be no difference in price between that offered to the government and that to the public caused a certain uneasiness in the markets, particularly in view of the fact that government prices, while generally felt to be extremely fair, are considerably under the prevailing market prices.

Nominal quotations for electrolytic copper were as follows on Monday last: July, 29 cents; August, 28 cents; third quarter, 28 cents; fourth quarter, 27.25 cents.

NEW YORK METAL MARKET PRICES

	July 9			July 16		
	£	s	d	£	s	d
Copper:						
London standard spot.....	130	0	0	130	0	0
Prime Lake	30.50	to	31.50*	29.00	to	30.00*
Electrolytic	30.75	to	31.25*	28.75	to	29.25*
Casting	29.00	to	29.25*	27.75	to	28.25*
Wire base	37.00	to	38.00*	36.00	to	37.00*
Lead, trust price.....	11.00			11.00		
Nickel, ingot	50.00			50.00		
Sheet zinc, f.o.b. smelter.....	19.00			19.00		
Spelter, spot	9.12½			8.75	to	8.85
Tin, Straits	62.75			62.00		
Aluminum, 98 to 99 per cent.....	54.00	to	56.00*	52.00	to	54.00*

OLD METALS

Heavy copper and wire.....	26.50	to	27.00	25.50	to	26.00
Brass, heavy	15.50	to	16.00	15.00	to	15.50
Brass, light	13.50	to	14.00	12.50	to	13.00
Lead, heavy	9.50	to	9.75	8.75	to	9.25
Zinc, old scrap	6.50	to	6.75	6.00	to	6.25

*Nominal.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor		List, per 1000 Ft.
E. & S. Size		
No. 14 solid		\$61.00
No. 12 solid		71.00
No. 10 solid		90.00
No. 8 solid		106.00
No. 6 solid		145.00
No. 10 stranded		95.00
No. 8 stranded		115.00
No. 6 stranded		160.00
No. 4 stranded		205.00
No. 2 stranded		266.00
No. 1 stranded		315.00

Twin-Conductor		List, per 1000 Ft.
No. 14 solid		104.00
No. 12 solid		135.00
No. 10 solid		185.00
No. 8 stranded		235.00
No. 6 stranded		370.00
No. 4 stranded		575.00

NET PRICE PER 1000 FT.—NEW YORK

Single-Conductor		
No. 14 solid		\$54.90 to \$61.00
Less than coil		48.80 to 59.17
Coil to 1000 ft.		
No. 12 solid		63.90 to 71.00
Less than coil		56.80 to 68.87
Coil to 1000 ft.		

Twin-Conductor		
No. 14 solid		\$78.00 to \$104.00
Less than coil		75.00 to 80.00
Coil to 1000 ft.		
No. 12 solid		121.50 to 135.00
Less than coil		108.00 to 130.95
Coil to 1000 ft.		

CHICAGO

Single-Conductor		
Discount		+10% to 10%

Twin-Conductor		
Discount		—10% to 10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+12% to 10%
1/5 to std. pkg.	10% to 20%
Std. pkg.	24% to 44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	12% to +20%
1/5 to std. pkg.	20% to List
Std. pkg.	30% to 44%

BATTERIES, DRY

NEW YORK

	No. 6 Regular	No. 6 Ignitor
Each Net		
Less than 12..	\$0.40	\$0.40
12 to 50 ..	.35	.35
50 to barrel...	.31	.32
Barrel lots ..	.28	.29

BATTERIES, DRY—Continued CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12..	.40	.40
12 to 30 ..	.35	.35
50 to barrel...	.31 to .31 3/4	.32 to .32 3/4
Barrel lots ..	.28 to .28 3/4	.29 to .29 3/4

CONDUIT, METALLIC FLEXIBLE

Size, in.	Ft. per Coil	List per 100 Ft.
5/16 ..	250	\$5.00
3/8 ..	250	7.50
1/2 ..	100	10.00
3/4 ..	50	13.00
1 ..	50	16.00
1 1/4 ..	50	25.00
1 1/2 ..	25-50	35.00
2 ..	25-50	45.00
2 1/2 ..	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less than Coil	Coil to 1000 Ft.
3/8-in. single strip	\$67.50 to \$75.00 \$60.00 to \$68.75
3/8-in. double strip	73.75 to 75.00 63.75 to 72.00
1/2-in. single strip	90.00 to 100.00 80.00 to 93.00
1/2-in. double strip	95.00 to 100.00 85.00 to 96.00

NET PER 1000 FT.—CHICAGO

Less than Coil	Coil to 1000 Ft.
3/8-in. single strip	\$71.25 to \$75.00 \$60.00 to \$63.75
3/8-in. double strip	75.00 to 73.75 67.50 to 71.25
1/2-in. single strip	95.00 to 100.00 80.00 to 85.00
1/2-in. double strip	100.00 to 105.00 90.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, in.	List, per Foot	Size, in.	List, per Foot
7/32 ..	\$0.05 1/2	1 ..	\$0.25
1/4 ..	.06	1 1/4 ..	.33
3/8 ..	.09	1 1/2 ..	.40
1/2 ..	.12	1 3/4 ..	.47
3/4 ..	.15	2 ..	.55
1 ..	.18	2 1/4 ..	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.	\$36.67-\$55.00	\$24.50-\$27.50
1/4-in.	\$36.67-\$55.00	\$21.50-\$24.75
1/2-in.	\$40.00-\$60.00	\$23.50-\$27.00

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.	\$36.66-\$55.00	\$27.50
1/4-in.	\$36.66-\$55.00	\$23.10-\$24.75
1/2-in.	\$40.00-\$60.00	\$25.20-\$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38	Conduit, List per Foot
Size, in.	
1/4 ..	\$0.08 1/2
3/8 ..	.08 1/2
1/2 ..	.08 1/2
3/4 ..	.11 1/2
1 ..	.17
1 1/4 ..	.23
1 1/2 ..	.27 1/2
2 ..	.37
2 1/2 ..	.58 1/2
3 ..	.76 1/2

Couplings, List	Elbows, List
1/4 ..	\$0.05 \$0.19
3/8 ..	.06 .19
1/2 ..	.07 .19
3/4 ..	.10 .25
1 ..	.13 .37
1 1/4 ..	.17 .45
1 1/2 ..	.21 .60
2 ..	.28 1.10
2 1/2 ..	.40 1.80
3 ..	.60 4.80

DISCOUNT—NEW YORK

1/4 In. to 1/2 In.	3/4 In. to 3 In.
Less than 2500 lb. 6% to 8%	8% to 10%
2500 to 5000 lb. 9% to 11%	11% to 13%
(For galvanized deduct six points from above discounts.)	

DISCOUNT—CHICAGO

1/4 In. to 1/2 In.	3/4 In. to 3 In.
Less than 2500 lb. 3.8% to 8.0%	6.0% to 11%
2500-5000 lb. 5.8% to 10.0%	8.8% to 13%
(For galvanized deduct six points from above discounts.)	

FLATIRONS

NEW YORK

Net	\$3.50
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CHICAGO

Net	\$3.75 to \$4.20
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FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	\$0.2
35-amp. to 60-amp.	100	.3
65-amp. to 100-amp.	50	.9
110-amp. to 200-amp.	25	2.0
225-amp. to 400-amp.	25	3.6
450-amp. to 600-amp.	10	5.5
600-Volt		
3-amp. to 30-amp.	100	\$0.4
35-amp. to 60-amp.	100	.6
65-amp. to 100-amp.	50	1.5
110-amp. to 200-amp.	25	2.5
225-amp. to 400-amp.	25	5.5
450-amp. to 600-amp.	10	8.0

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	.28%
1/5 to std. pkg.	.38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	.28%
1/5 to std. pkg.	.38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.75 to \$6.30
1/5 to std. pkg.	4.50 to 5.25
Standard package, 500. List,	\$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500. List,	\$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B.	100	\$0.27
60-watt—B.	100	.36
100-watt—B.	24	.65
75-watt—C.	50	.65
100-watt—C.	24	1.00
200-watt—C.	24	2.00
300-watt—C.	24	3.00
Round bulb, 3 1/2 in., frosted:		
15-watt—G 25.	50	.50
25-watt—G 25.	50	.50
40-watt—G 25.	50	.50
Round bulbs, 3 3/4 in., frosted:		
60-watt—G 30.	24	.72
Round bulbs, 4 3/8 in., frosted:		
100-watt—G 35.	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$30.00 to \$35.17
Coil to 1000 ft.	21.00 to 26.73

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$37.20 to \$37.84
Coil to 1000 ft.	27.90 to 28.62

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	\$18.00 to \$29.00
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CHICAGO

Net per 100	\$14.16 to \$30.00
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OUTLET BOXES

Nos.	List, per 100
101—A, A1 1/2, 4 S.C., 6200, 320.	\$30.00
102—B.A., 6200 S.E., 300, A.X. 1 1/2,	
4 S.	30.00
103—C.A., 9, 4 R. E 1 1/2	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list	33% to Net list	27% to List
\$10.00 to \$50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list	40% to 43%	35% to 37%
\$10.00 to \$50.00 list	50% to 53%	40% to 48%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$14.00 to \$20.00
1/5 to std. pkg.	13.00 to 15.00
Standard package, 2200. List per 1000,	\$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$14.00 to \$18.20
1/5 to std. pkg.	13.00 to 16.90
Standard package, 2200. List per 1000,	\$20.

PORCELAIN KNOBS

NEW YORK

	5 1/2 N.C.—Solid	Nail-It—N.C.
	Std. Pkg. 3500	Std. Pkg. 4000
Per 1000 Net		
Less than 1/5 std. pkg.	\$10.50 to \$24.30	
1/5 to std. pkg.	9.75 to 12.15	
5 1/2 N.C.—Solid		
Per 1000 Net		
Less than 1/5 std. pkg.	\$10.20 to \$18.00	\$20.75 to \$28.00
1/5 to std. pkg.	9.00 to 9.75	16.30 to 21.50

CHICAGO

	5 1/2 N.C.—Solid	Nail-It—N.C.
	Std. Pkg. 3500	Std. Pkg. 4000
Per 1000 Net		
Less than 1/5 std. pkg.	\$10.20 to \$18.00	\$20.75 to \$28.00
1/5 to std. pkg.	9.00 to 9.75	16.30 to 21.50

SOCKETS AND RECEPTACLES

	Std. Pk.	List
1/8-in. cap key and push sockets	500	\$0.33
1/8-in. cap keyless socket	500	.30
1/8-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net list
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%

SWITCHES, KNIFE

	250-Volt, Front Connections, No Fuse	List
High Grade:		
30-amp. S. P. S. T.		\$0.80
60-amp. S. P. S. T.		1.20
100-amp. S. P. S. T.		2.25
200-amp. S. P. S. T.		3.48
300-amp. S. P. S. T.		5.34
30-amp. D. P. S. T.		1.20
60-amp. D. P. S. T.		1.78
100-amp. D. P. S. T.		3.38
200-amp. D. P. S. T.		5.20
300-amp. D. P. S. T.		8.00
30-amp. 3 P. S. T.		1.80
60-amp. 3 P. S. T.		2.68
100-amp. 3 P. S. T.		5.08
200-amp. 3 P. S. T.		7.80
300-amp. 3 P. S. T.		12.00
Low Grade:		
30-amp. S. P. S. T.		0.42
60-amp. S. P. S. T.		0.74
100-amp. S. P. S. T.		1.50
200-amp. S. P. S. T.		2.70
30-amp. D. P. S. T.		0.68
60-amp. D. P. S. T.		1.22
100-amp. D. P. S. T.		2.50
200-amp. D. P. S. T.		4.50
30-amp. 3 P. S. T.		1.02
60-amp. 3 P. S. T.		1.84
100-amp. 3 P. S. T.		3.76
200-amp. 3 P. S. T.		6.76

Low Grade:

30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

Less than \$10 list	5% to +5%
\$10 to \$25 list	11% to 16%
\$25 to \$50 list	14% to 24%

DISCOUNT—CHICAGO

Less than \$10 list	+5% to 5%
\$10 to \$25 list	11% to 16%
\$25 to \$50 list	14% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp., three-point	100	.56
10-amp., three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net list
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List to +20%
1/5 to std. pkg.	15% to list
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

	List, Each
Union and Similar	
No. 155	\$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list	23% to list	
\$2.00 to \$10.00 list	23% to 20%	
\$10.00 to \$50.00 list	23% to 30%	

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list	25% to 50%	20% to 40%
\$2.00 to \$10.00 list	25% to 50%	20% to 40%
\$10.00 to \$50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

Net price	\$3.15 to \$3.50
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CHICAGO

Net price	\$2.80 to \$3.50
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WIRE, ANNUNCIATOR

DISCOUNT—NEW YORK

No. 18, less than full spools	52%
No. 18, full spools	48%

CHICAGO

	Per Lb. Net
No. 18, less than full spools	\$0.565 to \$0.6885
No. 18, full spools	0.495 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net			
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.	5000 Ft. and over
14 ...	\$15.00-18.00	\$12.00-14.50	\$11.50-12.50	11.00-12.00
12 ...	21.06-27.05	18.96-22.85	18.01-20.95	17.01-19.95
10 ...	29.60-39.27	26.64-33.66	25.31	24.31-27.25
8 ...	42.40-51.44	38.16-48.42	36.25	35.25-38.25
6 ...	72.19-89.57	64.98-76.80	61.73	60.73-63.75

CHICAGO

	Price per 1000 Ft. Net
No.	Less than 500 Ft. 500 to 1000 Ft. 1000 to 5000 Ft.
14 ...	\$18.00 \$16.00 \$14.00
12 ...	25.92-29.89 21.96-25.62 20.13-23.48
10 ...	36.48-42.28 30.84-36.24 27.36-33.22
8 ...	43.80-60.13 40.15-51.54 35.77-47.25
6 ...	69.24-82.72 63.47-77.63 58.55-66.54

WIRE, WEATHER-PROOF

Solid-Conductor, Triple-Braid, Sizes 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$40.25 to \$45.00
25 to 50 lb.	39.25 to 42.00
50 to 100 lb.	\$38.00

CHICAGO

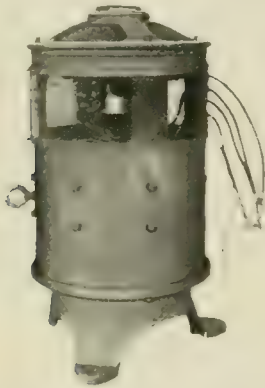
	Per 100 Lb. Net
Less than 25 lb.	\$42.35 to \$45.50
25 to 50 lb.	41.35 to 44.50
50 to 100 lb.	40.35 to 43.50

NEW APPARATUS AND APPLIANCES

*A Record of Latest Developments and Improvements in Manufacturers' Products
Used in the Electrical Field*

Heavy-Duty Vertical Motor

In the accompanying illustration is shown a type of heavy-duty vertical motor with special mountings for direct connection to the driving shaft of a centrifugal pump. This motor is capable of developing 39 hp. at 900 r.p.m. The motor and pump, it is claimed, can



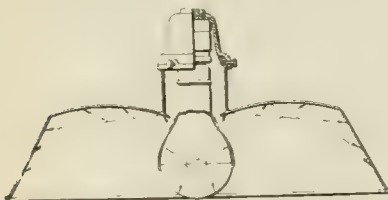
MOTOR FOR DIRECT CONNECTION TO DRIVING SHAFT OF CENTRIFUGAL PUMP

handle large quantities of water for indefinite periods.

Prominent government vessels are equipped with several of these outfits, which are operated from the deck if the vessel ships water or is punctured below the water line. These outfits are known as main-drain pumps and, operating together, can hold the ship above water unless circumstances are extraordinary. The motors are specially designed for the government by the Diehl Manufacturing Company of Elizabeth, N. J.

Reflector Cap Diffuser for Industrial Lighting

A reflector cap diffuser intended for use in all industrial installations where high intensity of light is required, and



DETAILS OF CAP AND REFLECTOR

where this intensity must be retained without glare, has been developed by the Ivanhoe-Regent Works of the General Electric Company of Cleveland, Ohio. The glare of the lamp is eliminated by shielding the filament with a cap fitting over the bottom of the bulb. This cap

is made of silvered metal, polished on the inside, so that it will redirect the light with very little loss. It is claimed that all glare from bright objects in the working plane is eliminated by providing an upper reflector which diffuses the light, both from the lamp and from the silvered cap, and directs it downward in a wide area. The diameter of the reflector is 20 in. (50.8 cm.), the depth 7 3/8 in. (18.7 cm.).

Portable Vise Bench and Pipe Bender

A portable vise bench that can, it is claimed, be set up in less than one minute's time, has been brought out by the Standard Iron Works, Inc., 508 East Seventy-fourth Street, New York City. All that is needed is to place a piece of pipe on top of the feed screw, against a beam or ceiling, give the feed screw a



WISE BENCH THAT CAN BE SET UP QUICKLY

few turns and the bench is ready for use. In the accompanying illustration is shown the bench without the vise.

Outdoor Metering Transformer Set

The Packard Electric Company of Warren Ohio, has placed on the market a line of polyphase weatherproof metering transformer sets combining the current and potential element in one oil-filled case. The polyphase unit may be adapted to two-phase, three-wire or four-wire, and to three-phase, three-wire or four-wire circuits. The two-phase set contains two current and two potential transformers. The three-

phase, three-wire set is similar to the two-phase unit, but the three-phase, four-wire set contains three current and two potential elements. These current and potential elements are interconnected and properly "phased out," which makes the polyphase meter installation as simple as a single-phase job.

The low-voltage terminals of the potential elements are porcelain-bushed



FIG. 1—SWITCHBOARD-TYPE POTENTIAL TRANSFORMER

and are carried through the case in a three-conductor flexible cable which contains red, green and black braided conductors that may be easily identified. The secondary circuits of the current elements are carried through the case in a similar manner. On the standard metering sets the cables are 8 ft. (2.4 m.) long, thus permitting the mounting of the meter at a safe distance from the high-tension lines.

The current transformers have double windings, giving a ratio of transformation which provides for 100 per cent future growth. This eliminates the necessity of changing the metering ele-

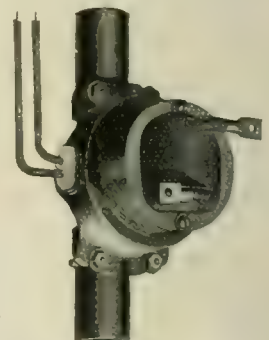


FIG. 2—SWITCHBOARD-TYPE CURRENT TRANSFORMER

ment as additional load is added. In weatherproof styles for two-phase and three-phase service, and for operating voltages up to and including 16,500 volts and maximum line currents of 100 amp., these units are now ready for the market. Such sets are equipped with:

hanger irons to permit mounting on cross-arms on outdoor substations.

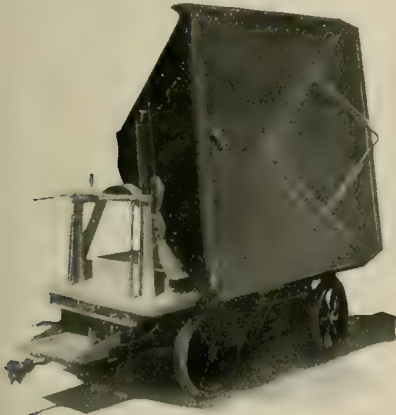
Switchboard types have also been developed. The dry-insulated potential transformers are furnished for a maximum pressure of 4400 volts, while the oil-insulated instruments are suitable for maximum potentials of 22,000 volts and ratings of 50 to 100 and 200-volt-amp. The dry-insulated switchboard current transformers are furnished for a maximum pressure of 6600 volts, and any standard ratio up to 250/5 amp., giving a capacity of 50-volt-amp.

Exit Sign with Luminous Letters

Exit signs for theaters, factories and office buildings the letters of which are made with luminous material are being made by I. P. Frink, Inc., Twenty-fourth Street and Tenth Avenue, New York City. The luminous letters "store up" light and remain visible for a considerable time in case the electric lamps are extinguished. The letters are hermetically sealed on the glass plate.

Storage Battery Truck with Cradle Body

Storage-battery trucks with cradle dump bodies mounted on them are being manufactured by the Orenstein-Arthur Koppel Company of Koppel, Pa. The trucks are of standard construction and have hinged metal-protected oak platforms. Cast-steel wheels 20 in. (50.8 cm.) in diameter are employed. Solid-rubber Goodrich tires, Timkin bearings and Wagner motors and controllers of foolproof construction are used. Energy is furnished by an Ironclad Exide battery. The frame is supported by four spiral steel springs and the wheel-base is 52 in. (132.1 cm) and the gage is 34 in. (86.4 cm.). When the trucks are carrying a load of 3000 lb. (1361



CRADLE BODY HAS DUMPING ANGLE OF 40 DEG.

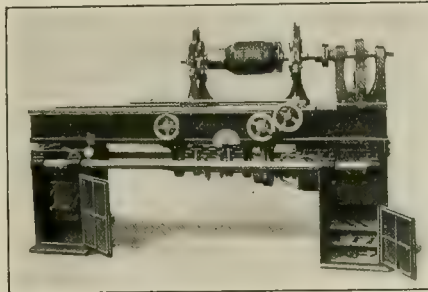
kg.) they will attain a speed of 7 miles per hour, it is claimed. The bodies of these trucks are of the self-clearing type and have a dumping angle of 40 deg. This truck can be used as a tractor and will push or pull 10,000 lb. (4535 kg.).

Charging Outfit for Storage Batteries

A 0.5-kw. battery-charging outfit especially adapted for automobile work has just been brought out by Hobart Brothers of Troy, Ohio. Low operating expense is claimed for the outfit. The armature of the motor-generator is mounted on ball bearings, and the compact switchboard, which carries only two snap switches and one rheostat, is mounted on top of the generator housing, making the complete height of the outfit about 26 in. (66.04 cm.). The manufacturer states that seven batteries of average size may be charged at one time with this machine, at an approximate cost of 15 cents each, with normal rates for electric service.

Dynamic Balancing Machine

True running balance may be quickly secured in an armature, motor crank shaft, turbine rotor, fan or other high-speed rotating part by the use of the



MACHINES WITH WHICH 100 ARMATURES MAY BE BALANCED IN A DAY

dynamic balancing machine shown herewith. This machine, which is built under the 'Akimoff patents, is convenient to operate, owing to all the adjustments being made by turning the hand-wheels while the machine is running.

The armature runs at the same speed and in the same direction as a dummy shaft. This shaft carries two weights, which may be shifted toward or from each other. The armature and the dummy shaft are supported together on a bed which is hinged at one end and free to vibrate vertically at the other end under the influence of any unbalanced couple in the armature or in the weights. When the weights are brought close together they exert no couple, but any running unbalance in the armature will cause the bed to vibrate.

The weights are then moved to such positions that the couple they exert is opposite and equal to that exerted by the armature. The vibration then stops. Since the weights and their radius from the center of the shaft are predetermined, it only remains to measure their distance apart to calculate the couple they exert. With this known, it is easy to calculate what weights should be added to or subtracted from points of known radius at known distances apart in the armature to produce a similar couple in the opposite direction. In order that the plane of unbalance may be determined the dummy shaft is ar-

ranged so that it may be rotated with respect to the armature. The weights may be shifted on their shaft without stopping the machine.

To apply the readings of the machine to the object tested a set of charts is used from which the readings in ounce-inches are converted directly into diameter and depth of holes to be drilled at the specified radii and specified distances apart. This is usually more convenient than adding weights.

The maker, the Carlson-Wenstrom Company of Philadelphia, states that the size here shown will easily handle 100 armatures in an eight-hour day.

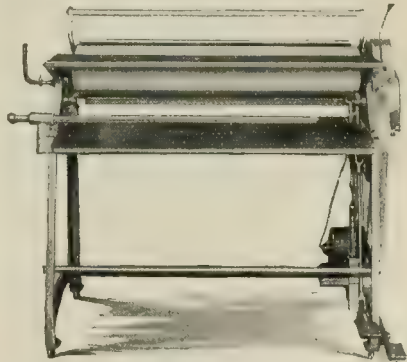
Electric Spotlights for Night Repair Work

An electric spotlight for automobiles which is particularly useful as an aid to night repair work on light and power lines is being manufactured by the Howe Manufacturing Company at 1732 South Michigan Avenue, Chicago, Ill. The bracket to which the lamp is attached has a universal joint, both sections of which turn at the same time. The lamp is maintained in any desired position by two coil springs which press the bracket joints together.

Ironing Machine That Handles Delicate Work

The electrically driven ironing machine developed by the Apex Appliance Company, 3223 West Thirtieth Street, Chicago, it is claimed, will iron everything in the average family washing except the most elaborately ruffled gowns and lingerie. For fine laces and embroideries it is said to be superior to the hand iron, as the entire article is pressed at one time and there is no pulling or drawing.

The polished ironing surface, or "shoe," is curved so that when set in position its entire surface presses firmly against the padded roll which carries the clothing over the ironing surface. The shoe is heated by units



IRONING MACHINE FOR HOME USE

which are placed inside. Gas, gasoline or electrically generated heat can be used. Two foot pedals are provided to throw the "shoe" against the roll and release it. The machine is belt-driven by a Robbins & Myers motor.

Trade Notes

W. H. QUIRK has been appointed manager of the Western Electric house at Cincinnati, Ohio. W. L. Sioussat will succeed Mr. Quirk as stores manager in the company's Cleveland house.

THE BRIDGEPORT BRASS COMPANY of Bridgeport, Conn., announces the removal of its New York office to Suite 2236, Woolworth Building, 233 Broadway, where more commodious quarters have been provided.

THE SPANGENBERG CONSTRUCTION COMPANY, INC., New Orleans, La., has discontinued active business for the period of the war because the president of the company, R. F. Spangenberg, has accepted a commission as lieutenant in the United States Navy.

THE MOHAWK ELECTRIC SUPPLY COMPANY, Syracuse, N. Y., under the title of "Co-operation the Order of the Day," has sent to the trade a leaflet showing the necessity of the jobber in the field of electrical supplies, and citing the reasons for trading through him.

THE DUQUESNE ELECTRIC & MANUFACTURING COMPANY, Pittsburgh, Pa., dealer in new and used electrical apparatus and power equipment, has opened a branch office in the Marshall Building, Cleveland, Ohio. William L. Moorehead, vice-president of the company, is in charge of the new office.

H. D. SHUTE, whose election as vice-president of the Westinghouse Electric & Manufacturing Company was recently announced, will have executive charge of the company's commercial organization, both domestic and export, succeeding Vice-president L. A. Osborne, whose headquarters have been transferred to New York.

T. G. WHALING, who has been assistant general manager and sales manager of the Westinghouse Lamp Company, has been appointed general manager. Mr. Whaling will continue to exercise the functions of sales manager and in addition will assume duties of an executive nature in connection with the administration of the affairs of the Westinghouse Lamp Company.

THE L. B. STILLWELL ENGINEERING CORPORATION has been organized to act as constructing engineer in the design and construction of steam and hydroelectric, lighting, railway and power plants, electric transmission, electrification of railroads, the design and construction of steel rolling stock, railroad terminals, steam-heating plants and general engineering construction work. The officers are: Lewis B. Stillwell, president; H. St. Clair Putnam, vice-president and general manager; Hugh Hazelton, vice-president, and W. Everett Rundle, secretary and treasurer. The principal office of the corporation will be located at 100 Broadway, New York City.

THE WESTERN ELECTRIC COMPANY announces the opening of three new electrical supply warehouses. To serve better the trade in Connecticut and adjacent territory, an office and warehouse has been opened in New Haven. The address is 135 Wood Street and Tyler L. Holmes is in charge. S. Greenfield of the Philadelphia house will head the sales force of the new Baltimore branch, which was scheduled to open on July 16, with a complete stock of electrical supplies, at 425 East Oliver Street. The company will be represented in Charlotte, N. C., by a warehouse and a sales office at 238 West First Street. R. H. Bouligny will be in charge. In order to take care adequately of the growing demands of the business in the Northwest the warehouse and sales office have just moved into new and commodious quarters at 84 Marion Street, Seattle, Wash.

THE COMBUSTION ENGINEERING CORPORATION, 11 Broadway, New York City, manufacturer of Type "E" and Coxie Stokers, has assigned one of its efficiency engineers until further notice to the work of traveling throughout the country to interview chief engineers and owners of such plants, with a view to reducing the fuel costs by increasing efficiency in every way possible, not only in so far as the stoker is concerned, but in helpful suggestions for minor improvements and changes which a great many plants can perfect with but small expense and trouble when such matters are brought to their attention. It has been estimated that \$600,000,000 is the annual fuel loss through inefficiency in power plants in the United States, and it is the purpose of the Combustion Engineering Corporation to give its full measure of co-operation to accomplishing results in cutting down this waste. In addition to this,

for plants that are inaccessible or are not now using any of the company's products, a branch of the engineering department is engaged in supplying preliminary and synoptical reports stating economies that might be effected on receipt of the information as to operation conditions in these plants, and for that reason a special blank has been prepared which will be sent to any firm on request. This blank is in the form of a questionnaire on the conditions prevailing at the plant and gives the engineering department sufficient data on which to determine whether or not material economy in fuel and increased efficiency would result from improving operation conditions.

Trade Publications

WAR LAMPS.—The war lamp is illustrated and described in a four-page folder prepared by the Conneaut Metal Works, Conneaut, Ohio.

THE STANDARD IRON WORKS, INC., 578 East Seventy-fourth Street, New York City, has prepared a bulletin descriptive of its standard portable vise bench and pipe bender.

SWITCHES.—The Palmer Electric & Manufacturing Company, 161 Franklin Street, Boston, Mass., is distributing price lists and detail information on magnet control and service switches.

DIRECT-CURRENT MOTORS.—Bulletin No. 2014, descriptive of type T "Reliance" motors for direct current, has been prepared by the Reliance Electric & Engineering Company of Cleveland, Ohio.

ELEVATOR DISPATCHER.—The Buildings Equipment Manufacturing Company, 327 South LaSalle Street, Chicago, is distributing a mailer descriptive of its "Reliance" automatic elevator dispatcher.

SAFETY SWITCHES.—The V. V. Fittings Company of Philadelphia has issued a folder describing and illustrating four types of safety switches. Each contains a high-grade slate base and an air-break knife switch of rugged construction.

TELEPHONE EQUIPMENT.—The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., has prepared bulletin No. 1019, descriptive of its exchange ringing equipment for pole changers, generators, motor-generator sets and harmonic converters.

INDUSTRIAL TRUCKS.—The Buda Company, 609 Railway Exchange Building, Chicago, has prepared a bulletin entitled "Stop Wasting Man Power." This bulletin is descriptive of the Buda electric truck and trailer, for use in terminals, warehouses, factories, etc.

ELECTRICAL CONSTRUCTION.—The L. K. Comstock Company of New York City is distributing four bulletins of progress in electrical constructions. These progress bulletins describe electrical distributing systems as used in industrial plants, machine shops, etc.

ELECTRICAL SPECIALTIES.—Steel boxes, safety switches, panelboards, switchboards and electrical specialties are illustrated and described in catalog No. 3, recently prepared by the Consolidated Electric Manufacturing Company, 223 North Thirteenth Street, Philadelphia.

STAGE LAMPS.—The Universal Electric Stage Lighting Company, 240 West Fifth Street, New York City, has prepared bulletin N, descriptive of nitrogen stage lamps and floodlights for the stage, outdoor theatricals and pageant lighting, floodlighting of architectural structures, theater fronts, buildings, fountains, flags, signboards, etc.

BUSBAR SUPPORTS.—High-tension indoor universal "unit type" busbar supports are illustrated and described in bulletin No. 31, which is now being distributed by the Delta Star Electric Company, 2433 Fulton Street, Chicago. In this bulletin are shown a few Delta Star installations in commercial service and the successful operation of this equipment.

MOLDING.—The National Metal Moulding Company of Pittsburgh, Pa., has sent out bulletins No. 201 and 400, descriptive of its "Flexsteel" armored conductors, conduits and fittings and stamped steel fixture studs. Each of these bulletins is bound in a separate correspondence folder, suitably indexed for filing either according to the material or to the name of the company. As previously noted, this company has adopted this correspondence folder plan as standard. It has now issued bulletins Nos. 50, 151, 201, 350 and 400, covering rigid conduits, "Flexsteel" non-metallic flexible conduit, "Flexsteel" products, locknuts and bushings, and fixture studs respectively.

New Incorporations

THE BROCK ELECTRIC COMPANY of Trenton, N. C., has been incorporated with a capital stock of \$25,000 by Ferniford Brock, M. Brock and others.

THE GASKELL TOWNSHIP ELECTRIC COMPANY has been granted a charter with a capital stock of \$5,000. John P. Rawson is treasurer.

THE OHIO ELECTRIC CONSTRUCTION COMPANY of Akron, Ohio, has been chartered with a capital stock of \$5,000 by James B. Conley and others.

THE SNYDER TOWNSHIP ELECTRIC COMPANY of Scranton, Pa., has been chartered with a capital stock of \$5,000. John P. Rawson is treasurer.

THE BOWERS ELECTRIC COMPANY of Reading, Pa., has been granted a charter with a capital stock of \$5,000. W. J. Martin of Topton is treasurer.

THE WASHINGTON TOWNSHIP ELECTRIC COMPANY of Scranton, Pa., has been incorporated with a capital stock of \$5,000. John P. Rawson is treasurer.

THE WASHINGTON-BERKS ELECTRIC COMPANY of Wyomissing, Pa., has been granted a charter with a capital stock of \$5,000. A. L. Hart is treasurer.

THE HENDERSON TOWNSHIP ELECTRIC COMPANY of Scranton, Pa., has been incorporated with a capital stock of \$5,000. John P. Rawson is treasurer.

THE YOUNG TOWNSHIP ELECTRIC COMPANY of Scranton, Pa., has been granted a charter with a capital stock of \$5,000. John P. Rawson is treasurer.

THE SANDY TOWNSHIP ELECTRIC COMPANY of Scranton, Pa., has been granted a charter with a capital stock of \$5,000. John P. Rawson is treasurer.

THE LAUREL RUN LIGHT, HEAT & POWER COMPANY of Philadelphia, Pa., has been chartered with a capital stock of \$5,000. John E. Zimmerman is treasurer.

THE MENNO LIGHT, HEAT & POWER COMPANY of Philadelphia has been granted a charter with a capital stock of \$5,000. John E. Zimmerman is treasurer.

THE SENECA ELECTRIC FURNACE COMPANY of Albany, N. Y., has been chartered with a capital stock of \$100,000 by Frederick W. Cameron, Parker Corning and Edwin Corning.

UNITED STATES ELECTRICAL SUPPLY COMPANY of Peoria, Ill., has been incorporated by J. A. Arenz, Louis C. Crawley and H. G. Page. The company is capitalized at \$100,000.

THE NORLINA (N. C.) LIGHT COMPANY has been incorporated with a capital stock of \$10,000 to operate an electric light and power system in Norlina. The incorporators are: W. E. Pratt, H. C. Fleming and T. D. Peck.

THE I. J. JONES COMPANY of Syracuse, N. Y., has been chartered with a capital stock of \$50,000 by Ira G. Jones, Frederick C. Faulkner and Hunter Betts, all of Syracuse, N. Y. The company proposes to manufacture electric machinery and engines.

THE SOUTHWESTERN UTILITIES COMPANY of Alva, Okla., has been incorporated by Noel R. Gascho, W. A. Farrand and Albert Emanuel of Dayton, Ohio. The company is capitalized at \$500,000 and proposes to equip and operate electric plants.

THE PIONEER ENGINEERING CORPORATION of New York, N. Y., has been incorporated by H. C. and D. C. Conkling and E. W. Picker, 80 Maiden Lane, New York, N. Y. The company is capitalized at \$25,000 and proposes to manufacture portable electric lamps, etc.

THE ELECTRIC CUSHION ARMOR COMPANY of Camden, N. J., has been chartered by George Brooks, Samuel Hough and William H. Dilmore of Camden. The company is capitalized at \$125,000 and proposes to manufacture machinery and a special protective device for ships.

THE HERCULES ELECTRIC MOTOR CORPORATION of Dover, Del., has filed articles of incorporation with a capital stock of \$100,000 to manufacture electric motors. The incorporators are: C. L. Reinlinger, Henry M. Robinson, of Wilmington, Del., and Clement M. Egner of Elkton, Md.

LARKIN & SANGSTER, Inc., of Buffalo, N. Y., has been incorporated with a capital stock of \$100,000 by E. P. Burnside, 906 D. S. Morgan Building, W. R. Daniles and R. O. Vogt, 983 D. S. Morgan Building, Buffalo. The company is capitalized at \$100,000 and proposes to do a general contracting business and electrical work.

New England States

CHICOPEE, MASS.—The Board of Aldermen has authorized the city treasurer to issue \$45,000 in bonds for improvement to the municipal electric-light plant.

FALL RIVER, MASS.—Extensive additions are being made to the underground conduit system of the Fall River Electric Light Company, particularly in the southeastern and eastern sections of the city. The cost is estimated at \$200,000.

HOLYOKE, MASS.—A permit has been granted the Valley Paper Company for the erection of a new power house, 84 ft. by 49 ft., two stories, on Water Street, to cost about \$50,000. Contract has been awarded to P. J. Kennedy & Company.

HULL, MASS.—Application has been made by the town of Hull to the Commission on Waterways and Public Lands for permission to lay and maintain a submarine cable from Nantasket Point in the town of Hull to Bumkin Island in Hull Bay in the town of Hingham.

MILLERS FALLS, MASS.—Preparations are being made by the H. P. Cummins Construction Company of Ware to begin work of putting in a new flume and construction of new electric power stations for the Millers Falls Company. When this is completed the factory will be operated throughout with electricity generated by the new power plant.

PETERSHAM, MASS.—Work has begun by the Gardiner (Mass.) Electric Light Company on the erection of an electric transmission line to Petersham to furnish electrical service. The new line will be extended from the substation at Barre, a distance of 8 miles, and will supply electricity for lamps and motors. The street-lighting system will consist of 60 lamps.

SPRINGFIELD, MASS.—The Gas & Electric Light Commission has authorized the United Electric Light Company of Springfield to issue 4000 additional shares of capital stock at \$185 per share.

WORCESTER, MASS.—Condemnation proceedings to obtain the right of way for a power cable through a strip of property between Leominster and Ayer, the new army camp, will soon be started before the Electric Light & Gas Commission by the New England Power Company. The proposed line will furnish electricity for lighting and operating the pumping stations at the camp.

MELVILLE, R. I.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 30 for extending the fuel-oil storage plant at the naval coal depot, Melville, R. I., including concrete oil reservoirs, pumps, heaters and buildings, electrical and mechanical apparatus, etc. Drawings and specifications (No. 2448) may be obtained on application to the above bureau or to the commandant of the naval station named.

HARTFORD, CONN.—The Municipal Bureau has granted a permit for the construction of an addition to the plant of the Hartford Electric Light Company for a transformer room, to cost about \$12,000. The Ellison Construction Company is contractor.

Middle Atlantic States

ALBANY, N. Y.—The Hudson Power Corporation has filed a petition with the Public Service Corporation asking permission to issue stock and bonds for the construction of an electric-light plant.

CENTRAL ISLIP, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until July 31 for construction, heating, plumbing and drainage and electric work for additional quarters for acute patients, Central Islip State Hospital, Central Islip. Specifications may be seen at the above hospital, New York office of the Department of Architecture, Room 1224 Woolworth Building, New York City, and Department of Architecture, Albany. Lewis F. Pilcher is state architect.

ELMIRA, N. Y.—The Fold Easy Company, lately reorganized with a capital stock of \$600,000, is considering the construction of a new boiler house and power plant; a well is also to be sunk to a depth of 200 or 300 ft. to provide a water supply. Mayne C. Parker is manager.

LITTLE FALLS, N. Y.—The contract for installing storage batteries in the lighting plant of the Raybrook Sanitarium has been awarded to Robert Dodge of Little Falls.

LOWVILLE, N. Y.—The installation of a new street-lighting system in Lowville is under consideration. The present plans provide for the erection of 30 ornamental standards mounted with three-lamp clus-

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

ters and 52 400-watt and 32 100-watt tungsten street lamps to be distributed throughout the village. The Wetmore Electric Company has the contract for street lighting.

NEWBURGH, N. Y.—The Fabrikoid Company of Newburgh is reported to be considering the construction of a boiler house, to cost about \$15,000.

ONEIDA, N. Y.—Investigations are being made by the Chamber of Commerce relative to establishing a municipal electric plant in Oneida.

SYRACUSE, N. Y.—The Board of Contract and Supply has awarded the contract for electric work in the new Edward Smith School to the Edward Joy Company of Syracuse.

UTICA, N. Y.—The Savage Arms Corporation is planning to erect a power plant in connection with new extensions (including three machine shops and other buildings) to its plant.

WESTFIELD, N. Y.—A special election has been called to submit to the voters the question as to whether the village shall purchase a new engine for the municipal electric-light plant or secure energy from the Niagara Falls plant.

BAYONNE, N. J.—Bids will be received by the Board of Education, City Hall, Bayonne, until July 26, for electric work, heating and ventilating for the new addition to School No. 11. James D. Boyd is secretary.

BAYONNE, N. J.—The contract for electrical work in the new school to be erected at West Forty-eighth Street and Boulevard, Bayonne, has been awarded to Harzel & Buehler, 373 Fourth Avenue, New York, N. Y., at \$12,889.

CLIFFSIDE PARK (P. O. CLIFFSIDE), N. J.—The Council is negotiating with the Public Service Electric Company for the installation of a new street lighting system to replace the present incandescent lamps. It is also proposed to install ornamental lamps in the Edgewater Park district.

GLOUCESTER CITY, N. J.—The Delaware & Atlantic Telephone & Telegraph Company has applied to the City Council for a 50-year franchise covering the construction and operation of aerial and underground lines.

NEWARK, N. J.—The Tanners' Leather Company is contemplating the construction of an addition to the power house at its plant at 390 Freylinghuysen Avenue.

NEWTON, N. J.—The Newton Gas & Electric Company is negotiating with the Borough Council for the installation of a new street-lighting system to replace the gasoline lamps now in use.

POMPTON, N. J.—The Board of Public Works has recommended to the Pompton Lakes Council the acquisition of a water-power site at the former steel mill on Pompton Lake for the installation of a plant to relieve the present steam-driven pumping station of the waterworks. The cost of the property is placed at \$100,000. An alternative plan has been proposed to include the purchase of a new engine-driven generating unit for the present plant.

TRENTON, N. J.—The Board of Freeholders is considering an application for permission to install and operate an electric-lighting system on the River Road.

BANGOR, PA.—The Pennsylvania Utilities Company of Easton has secured a contract from the Flory Manufacturing Company to furnish energy. The Flory company, it is said, is planning to equip its entire plant for electric operation.

BELLEFONTE, PA.—Application has been made to the Public Service Commission by the State Center Electric Company of Bellefonte and the Millheim (Pa.) Electric Company for permission to consolidate the two systems under the name of the State Center Electric Company.

BLAIN, PA.—Plans are being considered by the Borough Council for the installation of a municipal electric-light plant.

GREENVILLE, PA.—Plans are being considered by the County Commissioners for the construction of a power house and heating plant.

HARRISBURG, PA.—Permission has been granted to the Harrisburg Light & Power Company to build an underground conduit system in Third Street to be used

in connection with the installation of the new street-lighting system.

NORTH WALES, PA.—The Philadelphia (Pa.) Suburban Gas & Electric Company has submitted a proposal to the Borough Council for furnishing a street-lighting service.

PHILADELPHIA, PA.—The H. Belfield Company is planning to build a one-story power house at its new factory to be erected on Twentieth Street.

PHILADELPHIA, PA.—E. F. Houghton & Company are contemplating building an extension to their power plant at American and Somerset Streets.

PHILADELPHIA, PA.—The Philadelphia Rubber Company is contemplating the erection of a transformer station at its plant at Thirty-seventh and Reed Streets.

PHILADELPHIA, PA.—An extension, 34 ft. by 75 ft., will be erected to the engine room and power house of Swift & Company on Ninth Street, for which bids have been received.

PHILADELPHIA, PA.—The Philadelphia Electric Company has awarded a contract to the Keystone Paving & Construction Company, 320 Street, for a one-story gallery extension to its Tacony power house on Robbins Street.

YORK, PA.—The City Council is considering three proposals submitted by the Edison Light & Power Company for an improved lighting system in Center Square.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company, it is reported, has secured a contract to furnish power at the new shipyard extension to be built by the Baltimore Drydocks & Shipbuilding Company, to cost about \$3,000,000. Equipment for the new substation will be of the Westinghouse type, including transformers, rotary converters, and switchboard. Motors will be furnished by the General Electric Company.

HARTFORD, W. VA.—The construction of a new plant at Hartford is under consideration by the Mason Coal & Chemical Company of Charleston. The plans provide for an electric power plant to furnish electricity for operating the works. Equipment for power station, including engines, boilers, etc., it is said, will be purchased at once. The headquarters of the company are located in the Union Building, Charleston.

HARTLAND, W. VA.—The Hartland Power Company is planning to erect a 13,200-volt electric transmission system to Dorfee, a distance of 4 miles, to serve the coal mines in that district. The company has secured a contract from the Thompson-Glock Coal Company to furnish energy. W. S. Barstow & Company, 50 Pine Street, New York, N. Y., are engineers and managers.

ATKIN, VA.—The Norfolk & Western Railroad Company is planning to construct a power house to supply energy to operate the automatic signals now being installed between East Radford and Bristol. The contract for building, 46 by 70 ft., has been awarded to C. W. Wade & Co. of Roanoke. J. E. Crawford of Roanoke, Va., is chief engineer.

IVANHOE, VA.—The National Carbide Corporation of Bluefield, it is reported, will secure energy from the Appalachian Power Company of Bluefield, W. Va., to operate its proposed plant.

NORFOLK, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 30 for electric-lighting systems for the foundry and machine shop at the navy yard, Norfolk, Va. Drawings and specifications (No. 2458) may be obtained on application to the bureau or the commandant of the navy yard named.

SALEM, VA.—The Eustis Electric Company is contemplating the erection of an addition to its power house and installing another engine and generator.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 1342—Furnishing and installing one electric freight elevator. Philadelphia, Pa., Schedule 1343—furnishing and installing one electric push-button passenger elevator. Schedule 1340—one motor-driven 36-in. vertical turret lathe. Annapolis, Md., Schedule 1332—Furnishing and installing cold and hot water filters. Various, Schedule 1337—Miscellaneous electricians' pocket tool kits. Mare Island, Cal., Schedule 1341—One motor-driven tool-room lathe, two motor-driven, flat, two-spindle lathes, one motor-driven universal milling machine. Application for proposal blanks should designate the schedule desired by number.

North Central States

BARRYTON, MICH.—The Council has engaged E. E. Parks & Son, engineers of Grand Rapids, to prepare plans for remodeling the municipal electric light and power plant.

GRAND RAPIDS, MICH.—The Consumers' Power Company is building a new power station adjoining the old plant of the company. Two new water wheels will be installed to develop about 1000 hp.

LANSING, MICH.—Plans are being considered, it is reported, by the Michigan United Railways Company for extending its electric railway from Lansing to Grande Ledge, at a cost of about \$175,000.

ANTWERP, OHIO.—The Northwestern Ohio Light & Power Company has been granted a franchise to furnish electricity for street-lighting and commercial purposes in Antwerp for a period of 25 years.

ATHENS, OHIO.—The Hocking-Sunday Creek Traction Company has authorized the purchase of a heavy motor car to handle its coal trains. The company will also erect a substation on its line to furnish additional power needed, at a cost of about \$10,000.

BRATENAHL, OHIO.—Bids will be received at the office of the clerk of the village of Bratenahl at 413 East 105th Street, Cleveland, until July 28 for the installation of a police-telegraph system. C. A. Neff is clerk.

CINCINNATI, OHIO.—Bids will be received by the clerk of the Board of Education, 511 West Court Street, Cincinnati, until Aug. 13, for the installation of electric lamps in the Twentieth District School.

CINCINNATI, OHIO.—Considerable power and electrical equipment will be required in the construction of the convent group of buildings to be erected for the Sisters of Providence near Cincinnati. The plans provide for construction of power house to supply electricity for lamps and motors for the buildings and also for operating the laundry and bakery. Howard McClory of Cincinnati is architect.

CLEVELAND, OHIO.—Plans have been filed by the Cleveland Electric Illuminating Company for the construction of a foundation and retaining wall, to cost \$100,000, for an electric generating station, 195 ft. by 160 ft., at 720 East Seventieth Street.

CLEVELAND, OHIO.—Bids will be received at the office of Commissioners of Purchases and Supplies, City Hall, Cleveland, until July 27 for structural steel supports for locomotive cranes for the division of light and heat. Specifications may be obtained at the office of division of light and heat, Room 204, City Hall.

COLUMBUS, OHIO.—Improvements involving an expenditure of more than \$500,000 will be made by the Columbus, Delaware & Marion Electric Company, which recently took over the Columbus, Delaware & Marion Railway.

DAYTON, OHIO.—The Pasteur-Chamberland Filter Company, which has recently been awarded a contract by the government for electric searchlights, is making extensions to its plant at North Dayton.

TOLEDO, OHIO.—The capital stock of the Acme Power Company, a subsidiary of the Henry L. Doherty Company of New York, N. Y., has increased its capital stock from \$25,000 to \$500,000. The Acme company is building a large power plant on the East Side, to cost about \$8,000,000. Energy generated by the new company will be distributed by the Toledo Railway & Light Company. F. R. Coates is president and Henry L. Doherty chairman of board of directors.

HAZARD, KY.—The capital stock of the Kentucky River Power Company has been increased from \$100,000 to \$350,000.

LA GRANGE, KY.—The Kentucky Utilities Company of Lexington, which has been granted a franchise in La Grange, has taken over the plant of S. R. Schaff & Company.

FORT WAYNE, IND.—The Engineering Company of Fort Wayne has been awarded a contract for the steel extension to be erected at the power plant of the Fort Wayne & Northern Traction Company.

INDIANAPOLIS, IND.—Bids are being asked by the Commissioners of Marion County for the reconstruction of the power house at the Marion County Asylum for the Insane at Julietta, which was recently destroyed by fire.

BEMENT, ILL.—The Public Utilities Commission has granted the Bement Electric Light & Power Company permission to issue \$11,000 in notes.

CARBONDALE, ILL.—A certificate of convenience and necessity has been granted to the Central Illinois Public Service Company of Mattoon by the Public Utilities

Commission for the erection of an electric transmission line from Carbondale to Anna.

LINCOLN, ILL.—Bonds to the amount of \$30,000 have been voted to purchase and rebuild the local street car system.

LINCOLN, ILL.—The contract for installing the ornamental street-lighting system on Wyatt and Lincoln Avenues has been awarded to the Freeman Sweet Company of Chicago, Ill.

LINCOLN, ILL.—The property of the Lincoln Water & Light Company is reported to have been sold to W. W. Levering of Philadelphia, Pa., and Chester Snyder of Easton, Pa. The new owners, it is understood, will enlarge the plant and extend the service in Lincoln County and contiguous counties.

BELOIT, WIS.—Contracts, it is reported, will soon be awarded by the Lipman Refrigerator & Car Manufacturing Company for the erection of the first units of its proposed plant for the manufacture of refrigerator cars and the installation of refrigerating systems in old cars. The plans provide for an initial expenditure of \$50,000.

MADISON, WIS.—The Wisconsin Railroad Commission has granted the Wisconsin Interurban System permission to issue \$600,000 in bonds, the proceeds of which will be used to pay indebtedness incurred in building street railway in Portage and Madison and the remainder to be used for construction purposes. The company is building an electric railway between Madison and Portage and Madison and Janesville, Wis. J. E. Jones of Madison is president.

SUPERIOR, WIS.—The Great Northern Railway Company has awarded the contract for construction of a new power house, to cost about \$35,000, to Westinghouse, Church, Kerr & Company of New York, N. Y.

BENSON, MINN.—At an election held recently the proposal to issue \$30,000 in bonds for rebuilding the municipal electric-light plant was carried.

DULUTH, MINN.—Bids will be received at the office of the manager of the Water and Light Department until July 24 for furnishing and erecting at the Lakewood pumping station of the city of Duluth, on foundations furnished by the city, one 20,000-gal. electrically driven centrifugal pumping unit, with all necessary equipment and appurtenances. Specifications may be obtained at the office of the Water and Light Department.

LANCASTER, MINN.—Bonds to the amount of \$8,000 have been voted for the installation of an electric-lighting system.

ST. PAUL, MINN.—The Central Warehouse Company of St. Paul has awarded a contract to the Northern States Power Company for electricity to operate several miles of switching track in the Minnesota transfer district. The initial installation will call for 600 kw., using a rotary converter.

DEEP RIVER, IOWA.—The People's Gas & Electric Company of Burlington has been granted a franchise to furnish electricity in Deep River. Energy to operate the local system will be secured from the Keokuk plant.

MUSCATINE, IOWA.—The Muscatine Lighting Company has been granted permission to extend its underground conduit system west past the reservoir.

THORNBURG, IOWA.—A franchise has been granted to the People's Gas & Electric Company of Burlington to supply electricity in Thornburg. A new plant will be installed here.

CANTON, MO.—Bonds to the amount of \$10,000 have been voted for improvements to the water and light systems.

SEDALIA, MO.—Improvements are contemplated by the City Light & Traction Company, involving an expenditure of about \$60,000, which will include the installation of an electric generating unit, switchboard and erection of a 150-ft. smokestack.

BOWBELLS, N. D.—The local electric-light plant has been purchased by the Public Utilities Corporation. The new owners contemplate establishing a 24-hour service and making other improvements to the service.

BEATRICE, NEB.—A petition has been presented to the City Council asking that an election be held to vote on the proposal to issue \$50,000 in bonds to establish a municipal lighting plant.

BEAVER CITY, NEB.—Bonds to the amount of \$10,000 have been voted for improvements to the electric-light and water-works system. When completed a 24-hour service will be established.

GREELEY, NEB.—Bonds to the amount

of \$13,000 have been voted to establish a municipal electric-light plant in Greeley.

OGALLALA, NEB.—At an election held recently the proposal to issue \$10,000 in bonds for the installation of an electric-lighting system was carried.

ATWOOD, KAN.—At an election held recently the proposal to issue \$20,000 in bonds for improvements to the municipal electric-light plant was carried. A larger engine and generator will be purchased and some extensions to transmission lines will be made.

CHEROKEE, KAN.—The Kansas Gas & Electric Company of Wichita is planning to erect an electric transmission line between Cherokee and Cherryvale. Application has been made by the company to the County Commissioners for permission to construct a line from Cherryvale to the Labette County line. The towns of Mound Valley and Altamont have petitioned the company for electrical service.

FORT RILEY, KAN.—Arrangements are being made by the War Department for the installation of a complete electric lighting system for lighting the new buildings which are now being erected at the fort. It is estimated that at least 1000 kw. will be used. Fred Uhrig, manager of the Western Electric Company of Kansas City, Mo., has been advising with the army officers and the electric companies regarding the installation.

GREAT BEND, KAN.—A new long-distance telephone line, it is reported, will be erected along the Santa Fe and Missouri Pacific railroads from Great Bend to Denver.

GREAT BEND, KAN.—Bids will be received by the commissioners of Barton County, Great Bend, until Aug. 8 (extension of date from July 16) for construction of a county court house. Separate bids to be submitted on steam heating, electric wiring, etc. The cost of the building is estimated at \$190,000.

KANSAS CITY, KAN.—Contract has been awarded by the Kansas City Electric Light Company to the E. L. Winn Construction Company, 195 Railway Exchange, for construction of addition to power house, 102 ft. by 62 ft., one story high, to cost about \$70,000.

LARNED, KAN.—The general contract for construction of Pawnee County court house, to cost about \$125,000, has been awarded to William Foley of Dodge City; the contract for electric wiring was given to the Cates Electric Company of Hutchinson.

LURAY, KAN.—An election will soon be held to vote on the proposal to issue \$20,000 in bonds for the installation of an electric-lighting plant.

PARTRIDGE, KAN.—The installation of an electric-light plant in Partridge is reported to be under consideration.

WICHITA, KAN.—The directors of the Kansas Gas & Electric Company are reported to have voted an expenditure of \$1,000,000 in the State of Kansas, of which about one-half will be used in the Wichita District.

Southern States

CHARLESTON, S. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 6 for the construction of a reinforced general storehouse, 60 ft. by 321 ft., including electric wiring, elevators, etc., at the navy yard, Charleston, S. C. Drawings and specifications (No. 2469) may be obtained at the above bureau or from the commandant of the navy yard named.

COLUMBIA, S. C.—Contract has been awarded by the Quartermaster-General's Department to the Walker Electric & Plumbing Company of Rome and Columbia, Ga., for electric wiring, water-works, sewers and plumbing for cantonment at Columbia. The cost is estimated at \$400,000. The Hardaway Contracting Company of Columbia has the general contract.

ATLANTA, GA.—The Buckeye Cotton Oil Company has closed a contract with the Georgia Railway & Power Company for energy to operate its oil mill. The company is in the market for a 1200-hp., 2300-volt, three-phase, 60-cycle, 300 r.p.m., slip-ring type induction motor for direct connection to main line shaft; the motor to have primary and secondary contactor control. Claude Douthirt of Atlanta is vice-president and general manager of the Buckeye company.

EAST POINT, GA.—The Gate City Cotton Mills is planning to equip its factories for electrical operation and will use approximately 750 hp. Contract for power has been closed with the Georgia Railway & Power Company.

FOLKSTON, GA.—Steps have been taken to establish an electric-light plant and ice factory in Folkston. J. W. Buchanan and B. F. Scott are reported interested in the project.

PALMETTO, GA.—The Palmetto Cotton Mills have closed a contract with the Georgia Railway & Power Company of Atlanta for power to operate its mills. Will use 450 hp. group drive.

TALLULAH FALLS, GA.—Plans are being prepared by the Georgia Railway & Power Company of Atlanta for the construction of a sixth unit at the Tallulah Falls hydroelectric plant, increasing the output by 12,000 kw., at a cost of about \$330,000. The work will include construction of penstock from forebay into gorge, installation of a turbo-generator, equipment, etc.; provision will be made for an additional unit.

DAYTONA, FLA.—Extensive improvements are contemplated by the Daytona Public Service Company, including the installation of a 750-kw. generator in electric plant; a 400,000-cu. ft. gas-holder; erection of addition to building, two stories high, and occupied by turbine room; removal of ice plant to present engine room, increasing present 200-lb. tank to 300 lb., and installing a 400-lb. tank. Contract has been awarded for erection of building and gas holder.

TAMPA, FLA.—Contract has been awarded by the Clearwater Beach Company for the construction of an electric-light plant and waterworks system at Clearwater Beach. Clay C. Straw, Curry Building, Tampa, is sales manager.

CHATTANOOGA, TENN.—The Riddle Coal Company is reported to be in the market for second-hand (in good condition) electric trolley or storage motors, 36-in. or 42-in. gage.

NEW ORLEANS, LA.—The Appalachian Corporation is reported to have purchased a large coopeage building and proposes to reconstruct same to provide 4,000,000 cu. ft. dry storage space for public bonded warehouse and will install loading and unloading machinery, labor-saving devices, electric elevators, trucks, conveyors, etc.; also will remodel for cold-storage plant with 1,000,000 cu. ft. storage space. The company is negotiating with the Trans-Mississippi Terminal Company, the Illinois Central Railway and others for the erection of a central wholesale fruit and produce exchange with warehouses, storerooms, offices, etc., and to connect buildings by overhead conveyors with cold storage plant.

ALVA, OKLA.—The Alva Light & Power Company is planning to enlarge its power house and install additional machinery.

ATOKA, OKLA.—Preparations are being made by the Public Service Company of Oklahoma for improvements and extensions to its local system.

ROCKY, OKLA.—Bonds to the amount of \$5,000 have been voted for the installation of a municipal electric-light plant.

SHAWNEE, OKLA.—Bids, it is reported, will be received by the Monroe Power Company, recently organized, within the next 60 to 90 days for air or electrically driven equipment for its plant. For further information address L. C. Webster, Box 12, Shawnee, Okla.

STILLWATER, OKLA.—The proposal to issue \$6,000 in bonds for the purchase of a new boiler for the municipal electric-light plant will soon be submitted to the voters.

SUPPLY, OKLA.—At an election held recently the proposal to issue \$6,000 in bonds for the installation of an electric-lighting system was defeated.

TULSA, OKLA.—Plans are being prepared by the Universal Motor Company for the construction of a garage, 140 ft. x 132 ft., to cost about \$60,000. For further information address the company, care of E. M. Vanderslice, Third and Detroit Streets.

TULSA, OKLA.—Plans have been completed by the Public Service Company of Oklahoma for the installation of the ornamental street-lighting system in the business section of the city. The plans provide for 80 ornamental standards mounted with lamps of 1500 cp., to be maintained by underground wires. The cost is estimated at \$40,000.

WAYNOKA, OKLA.—Work will soon begin on the construction of a municipal electric-light and power plant for which bonds to the amount of \$26,000 will be voted on. New engines will also be purchased.

CLAUDE, TEX.—A. V. Wilson and O. F. Smalley, owners of the local electric-light plant, are installing additional machinery, for the purpose of establishing a 24-hour service, and are also building an ice factory.

DALLAS, TEX.—The Texas Electric Company, which operates a system of interurban railways radiating out of Dallas, is planning to erect an express building here, to cost about \$50,000.

HOUSTON, TEX.—Contract has been awarded by Swift & Company of Chicago, Ill., for the erection of a cottonseed-oil refinery at Houston, to cost about \$250,000. The plans provide for a four-story refinery, two-story packing house, boiler and engine building, office building, black grease plant and storage tanks.

Pacific and Mountain States

BREMERTON, WASH.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a general storehouse, 120 ft. by 240 ft., including electric wiring, elevators, etc., at the navy yard, Puget Sound, Wash. Drawings and specifications (No. 2423) may be obtained on application to the above bureau or to the commandant of the navy yard named.

SEATTLE, WASH.—The Electric Sales Corporation has recently closed a contract for the installation of the Apfel system of electric heating in the new High School in Paul, Idaho.

SEATTLE, WASH.—The Board of Public Works has approved an ordinance providing for the purchase of a motor-generator set for the municipal steam auxiliary plant at Lake Union, to cost \$13,500.

SHELTON, WASH.—The Mason County Power Company has applied to the State Land Commission for permission to overflow state lands near the north fork of the Snohomish River. The company, it is understood, contemplates the construction of a large hydroelectric power plant on this site.

PORTLAND, ORE.—The Western Reduction Company of Portland is contemplating the construction of a new factory, 100 ft. by 150 ft., and a power house, 14 ft. by 32 ft., at Twenty-fourth and Nicolai Streets.

COALINGA, CAL.—The City Council is considering the construction of a municipal ice-manufacturing and cold storage plant on property recently acquired.

PALMDALE, CAL.—The Southern California Edison Company of Los Angeles is contemplating extending its transmission lines from Lancaster into Palmdale and Little Rock.

DUBOIS, IDAHO.—Application has been made to the Public Utilities Company by C. N. Friday for a certificate of convenience and necessity for an electric-light plant to be established in Dubois. Electricity to operate the proposed system will be secured from the plant at St. Anthony.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has applied to the State Public Utilities Commission for permission to erect duplicate transmission lines in Brigham City, Perry and Willard, in Box Elder County.

WILLIAMS, ARIZ.—The power plant of the Williams Water & Electric Company was recently destroyed by fire, causing a loss of about \$100,000.

LIBBY, MONT.—The Great Northern Railway Company, it is reported, will soon begin work in equipping its railroad from the main range of the Rocky Mountains west for electrical operation. The company, it is stated, proposes to construct a power plant at the Kootenai Falls, to furnish part of the energy to operate the road.

YERRINGTON, NEV.—Preparations are being made by the Kennedy Consolidated Mines Company for the installation of an electric-lighting plant at its property.

SANTA FE, N. M.—A deed of trust has been filed with the county clerk at Albuquerque by the Rio Grande Light, Heat & Power Company for \$3,000,000, pledging its franchise and properties to the Fairmont Savings Trust Company of Philadelphia, to secure an issue of bonds, the proceeds to be used for the White Rock project.

Canada

SOUTH VANCOUVER, B. C.—A permit has been taken out by the Harvey Creosoting & Lumber Mills Company for the construction of an electric plant to cost about \$30,000.

BRANDON, MAN.—The plant and holdings of the Brandon Electric Light Company have been purchased by the Canada Gas & Electric Corporation. It is the intention of the purchasing company to ac-

quire the property of the Brandon Gas Company and to make large extensions to both systems.

WINNIPEG, MAN.—Plans are being considered by the Electrical Department for the installation of new street lamps, to cost about \$12,000. W. P. Brereton is city engineer.

WINNIPEG, MAN.—Bids will be received by the City Light and Power Department of Winnipeg until July 27 for 4500 complete high-voltage porcelain insulators. M. Peterson is secretary of board of control.

CHESLEY, ONT.—Kruk Brothers of Chesley are reported to be in the market for a 110-volt direct-current generator with sufficient output to maintain about 500 lamps.

HAMILTON, ONT.—Tenders will be received by C. C. Hooker, chairman of board of control, care of S. H. Kent, city clerk, City Hall, until July 30 for furnishing and installing at the Beach pumping station, Hamilton, the following machinery: One 10,000,000-imperial gallon steam-turbine driven centrifugal pumping unit; one synchronous motor, two transformers, switching apparatus, two Venturi meters, two water-tube boilers, and one 10,000,000-imperial gallon motor-driven centrifugal pump. Specifications and form of tender for the above may be obtained at the office of the city engineer.

IROQUOIS FALLS, ONT.—Plans have been prepared by the Abitibi Power & Paper Company for the erection of a new steel high-tension tower transmission line.

KINCARDINE, ONT.—Plans are being considered by the City Council for discarding the municipal electric power plant and securing electricity from the Ontario Hydro-Electric Power Commission.

KINGSTON, ONT.—The Hydro-Electric Power Commission is preparing plans for the erection of a substation in Kingston. Tests are being made by the commission at the plant of the Dominion Textile Company and may furnish the company with 600 hp. Rates on 750 hp. have been submitted by the municipality to the Kingston Locomotive Works; R. S. Kelsch, consulting engineer of Montreal, Que., has been engaged by the company to investigate the offer. Contracts have been awarded for pump and motor for waterworks pumping station.

MORRISBURG, ONT.—The Ontario Hydro-Electric Power Commission is considering replacing the aluminum wire between Morrisburg and Winchester with a 5/16-in., 7-strand steel wire.

TORONTO, ONT.—The City Council has approved the application of the Toronto Hydro-Electric System for an additional appropriation of \$720,000, to be used for extensions, etc.

TORONTO, ONT.—Estimates are being prepared by the Ontario Hydro-Electric Power Commission on the cost of distributing systems for Bloomfield, Omeme, Picton (remodeling present system), Port Perry and Uxbridge.

TORONTO, ONT.—Adam Beck, chairman of the Ontario Hydro-Electric Power Commission, it is reported, is working on a project for the establishment of a large hydro-electric system in Northern Ontario which will furnish electricity for the new nickel smelter to be built for the Imperial Government near Sudbury.

WELLINGTON, ONT.—The Hydro-Electric Power Commission of Ontario is making investigations of the local electric plant and distributing system, owned by the Niles Estate, and may purchase the property.

COOKSHIRE, QUE.—Preparations are being made by the Westbury Electric Light & Power Company for the construction of a concrete dam across the Eaton River, for which bids have been received.

CRABTREE MILLS, QUE.—The installation of an additional hydroelectric unit, consisting of twin horizontal waterwheels of 11,000 hp. capacity, under a 30-ft. head, is under consideration by the Howard Smith Paper Mills of Montreal.

GRANBY, QUE.—The Southern Canada Power Company of Dummondville has been granted an exclusive franchise to supply electricity in Granby for a period of ten years, and also a ten-year contract for street-lighting. The company is to take over the municipal electric plant.

LAUZON, QUE.—Bids will be received by R. C. Desrochers, secretary of the Department of Public Works, Ottawa, until July 26 for construction of an electric transmission line between the new and old dry-docks at Lauzon. Plans may be seen and specifications obtained at the above office and at the post office, Quebec, Que.

SHAWINIGAN FALLS, QUE.—The Shawinigan Water & Power Company has closed a contract with the Canadian Alox-

ite Company, a subsidiary of the Carborundum Company of Niagara Falls, N. Y., to furnish power to its proposed new plant. The Canadian Aloxite Company has started work on the construction of a large plant here for the manufacture of carborundum and other abrasives.

DAVIDSON, SASK.—Improvements are contemplated to the municipal electric-light plant, including an addition to power house, to cost \$4,500, and purchase of electrical equipment and engine, at \$4,300.

SHAUNAVON, SASK.—Improvements are being made in the town of Shaunavon involving an expenditure of over \$150,000, which will include an electric-lighting plant, hospital, and many other buildings.

Miscellaneous

HAVANA, CUBA.—The Havana Electric Railway, Light & Power Company is building two new substations, one to be equipped with two 1000-kw. rotary converters and the other with three 500-kw. rotary converters. The purchase of a new 25,000-kw. turbo-generator has been authorized.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until July 26 for furnishing pig iron, lead sleeves, portable blowers, transformers, etc. Blanks and information relating to this circular (No. 1154) may be obtained at the above office or the offices of the as-

sistant purchasing agents, 24 State Street, New York, N. Y.; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until Aug. 6, for furnishing steel and wrought-iron grills and gates, brass railings, electric cable, heater cord, monel metal, bronze steel sheets, switch brooms, power shears, etc. Blanks and general information relating to this circular (No. 1156) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

- 1,232,473. BALL JOINT. Lauritz W. Andersen, Waterbury, Conn. App. filed Aug. 10, 1916. Particularly adapted for adjustable lamps.
- 1,232,478. CONTROLLER-OPERATING DEVICE FOR VEHICLES HAVING ELECTRIC TRANSMISSION; Walter C. Baker, Lakewood, Ohio. App. filed July 22, 1912. Improvement.
- 1,232,496. CALL-DISTRIBUTING SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Oct. 4, 1915. Improvements.
- 1,232,497. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Oct. 21, 1915. Means for rendering more efficient and satisfactory service in handling of calls that are abandoned by a calling subscriber before the subscriber who is being called has answered.
- 1,232,498. AUTOMATIC TESTING SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Aug. 30, 1916. Provides an automatic arrangement which will perform a series of routine testing operations and record separately each unstandard condition found, which operations have heretofore been performed manually.
- 1,232,499. ELECTRIC SIGNALING SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Oct. 25, 1916. Particularly to do with the transmission of intelligence between telephone operators.
- 1,232,507. TELEPHONE-EXCHANGE SYSTEM; Harry L. Darrah, Chatham, N. J. App. filed Nov. 21, 1916. Private branch exchange systems.
- 1,232,512. MAGNETIC CHUCK; Louis W. Downes and Ralph Clifton Patton, Providence, R. I. App. filed June 29, 1916. Provides a chuck or holding device, with a face plate having a plurality of alternate flux carrying members and non-magnetic gaps between its center pole and its outer flux-carrying frame.
- 1,232,514. ELECTRIC AMPLIFIER SYSTEM; Henry C. Egerton, Passaic, N. J. App. filed Nov. 15, 1915. Amplifier systems for increasing the intensity of telephone currents.
- 1,232,515. RECEIVER CASE; Henry C. Egerton, Passaic, N. J. App. filed Feb. 7, 1916. More especially for those provided with a plurality of independent and separable chambers.
- 1,232,532. MAGNETIC CHUCK; Winfred S. Griffith, Worcester, Mass. App. filed June 24, 1915. Chuck has been devised in which the operating faces of the magnetic members are of magnet steel and of a peculiar form which produces great holding power.
- 1,232,548. DEVICE FOR COUPLING A TELEGRAPH TRANSMITTER AND SENDING KEY; Charles M. Holmes, Jacksonville, Fla. App. filed March 31, 1916. To improve a telegraph key for permitting a transmitter to be connected by a cord with the key.
- 1,232,562. IGNITER TUBE FOR INTERNAL COMBUSTION ENGINES; William R. Kahlenberg, Two Rivers, Wis. App. filed July 10, 1916. Provides an improved igniter structure of the hot-bulb type, and it is more specifically an object to provide a means for applying the flame of a torch to the bulb to procure initial heating thereof.
- 1,232,580. SELECTIVE CONTROLLING SYSTEM; Alben E. Lundell, New York, N. Y. App. filed Oct. 23, 1915. Relates more particularly to registering systems for automatic telephone exchanges.
- 1,232,581. SUBSTATION TELEPHONE SET; Alben E. Lundell, New York, N. Y. App. filed Jan. 3, 1916. Substation sets for automatic telephone exchanges.
- 1,232,582. AUTOMATIC TELEPHONE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed Jan. 14, 1916. In which the connection between calling and called lines is

Record of Electrical Patents

Notes on United States Patents issued on July 10, 1917

established wholly or in part by means of mechanically operated switching devices.

- 1,232,584. PROTECTIVE DEVICE FOR RAILWAYS; George W. McMunn, Pittsburgh, Pa. App. filed July 28, 1916. Improvements.
- 1,232,598. HEATING AND VENTILATING APPARATUS; John K. Norstrom and George C. Breidert, Chicago, Ill. App. filed Nov. 5, 1913. Automatically controlled system for electric heating and forced draft ventilating.



1,232,647—Insulator Switch

- 1,232,599. MOTOR-STARTING SWITCH; Ralph C. Patton, Providence, R. I. App. filed Aug. 5, 1914. For use in connection with electric motors.
- 1,232,624. ELECTRICAL CONTACT MEMBERS; Horace V. S. Taylor, Pittsburgh, Pa. App. filed Jan. 21, 1916. Adapted for use in relays, regulators, switches and similar apparatus.
- 1,232,625. ELECTRICAL CONTACT MEMBERS; Horace V. S. Taylor, Pittsburgh, Pa. App. filed Jan. 21, 1916. Adapted for use in electrical apparatus such as relays, regulators, switches and the like.
- 1,232,638. ARC LAMP; Theron H. Williams, Mart, Tex. App. filed July 22, 1915. Clutching mechanism for the upper electrode; resides in employing a spring structure that operates upon a clutch carrier to release the clutch.
- 1,232,642. LANTERN; Homer A. Woods, Indianapolis, Ind. App. filed Nov. 29, 1915. Portable self-contained electric lantern.
- 1,232,647. INSULATOR SWITCH; Carl H. Bissell, Syracuse, N. Y. App. filed June 19, 1911. Designed to be supported at the ends of insulators carried on poles or other structures.
- 1,232,650. SWITCH; Stephen F. Briggs, Milwaukee, Wis. App. filed May 11,

1914. Switch for controlling the circuit of a dynamo-electric machine, adapted for use as a generator for charging a storage battery or supplying current for electrical lamps in an automobile when driven from the gas engine.

- 1,232,660. HEATING UNIT; William H. Dalton, Salem, Mass. App. filed Oct. 22, 1915. Heating unit having a flat shape.
- 1,232,673. ELECTRIC TOY MOTOR; Jay M. Fisher, Brooklyn, N. Y. App. filed Nov. 17, 1915. Developing a strong torque and high rotative speed.
- 1,232,710. STORAGE BATTERY; Robert D. Mowry, Chicago, Ill. App. filed March 15, 1917. Means for supporting the elements or plates of the battery a sufficient distance above the bottom of the cell to prevent short-circuiting by the active material falling from the plates, and for maintaining the elements in their assembled position.
- 1,232,711. PRESS AND MEANS FOR OPERATING THE SAME; Hilmar Mueller, Trenton, N. J. App. filed March 21, 1914. For the purpose of manufacturing tiles for flooring and similar purposes.
- 1,232,727. LIGHT-VARYING APPARATUS FOR PRINTING MECHANISMS; Philmore F. Sperry, Chicago, Ill. App. filed May 21, 1914. Provides means whereby prints of a high degree of uniformity throughout may be made from strip-like films of varying light-transmitting density.
- 1,232,736. OIL-WELL HEATER; Vin Truman, Muskogee, and George L. Skillen, Boynton, Okla. App. filed Oct. 5, 1916. Improvements.
- 1,232,741. ELECTRIC LAMP; Andrew J. West, Winnipeg, Man., Can. App. filed Nov. 26, 1915. Improvements.
- 1,232,745. WARNING-SIGNAL SYSTEM; Frank W. Wood, Brooklyn, N. Y. App. filed June 7, 1915. Signal devices may be operated from a number of points and to avoid use of cumbersome circuit-breaking devices in connection with the signals.
- 1,232,774. ELECTRIC RAILWAY-CROSSING SIGNAL; Agatha L. Davis, Clinton, S. C. App. filed Sept. 26, 1916. Improvements.
- 1,232,785. QUARTZ-GLASS-MAKING MACHINE; Armin Frost, New York, N. Y. App. filed Nov. 3, 1916. Apparatus working in a vertical plane as distinguished from the ordinary horizontal apparatus for similar purposes.
- 1,232,791. METHOD OF MAKING COUNTER-BALANCED CRANK SHAFTS; George C. Gordon, Cleveland, Ohio. App. filed Nov. 1, 1916. Improvement.
- 1,232,799. ELECTRIC STARTING SYSTEM FOR INTERNAL-COMBUSTION ENGINES; Otto Heins, New York, N. Y., and Charles M. Wild, Springfield, Mass. App. filed June 12, 1915. Subordinates the action of the starting switch to the axial movement of the armature in such manner that the circuit connections effected by the switch are at all times dependent upon the position of the motor gear relatively to the flywheel gear.
- 1,232,824. PORTABLE FLASHLIGHT; Joseph L. Mayhew, Williamstown, Mass. App. filed May 3, 1916. So constructed that it may be used in situations where the ordinary flashlight is not capable of use such as between floors and partitions, around machinery and between beams.
- 1,232,834. TRANSFORMER; Louis C. Nichols, Milwaukee, Wis. App. filed July 22, 1911. Maintains in a dry condition the insulating fluid in transformers.
- 1,232,843. ELECTRICAL RESISTANCE ELEMENT AND PROCESS OF MAKING THE SAME; Merrit H. Rice, New Rochelle, N. Y. App. filed April 8, 1913. Production of a composite electrical resistance element consisting of a base and envelope or covering fused thereto or united therewith.

Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, JULY 28, 1917

No. 4

Financing—Do It Now

A LARGE manufacturing company in the electrical industry sold three-year notes last week. Its credit is rated as the very best, its business and profit are larger than ever before, yet it is selling short-time notes which the bankers disposed of to the public on about a 6.10 per cent interest basis net. A central station company in a leading city has sold a block of securities at a price lower than it would receive in normal times. Its record of earnings is consistently favorable, its management is of the very highest order, yet it gladly marketed securities on a strict war basis. It is not every company which can sell securities in these times. Bankers look closely at the position of a company and its reputation among buyers before they consent to underwrite new issues. When they contract to buy they want only securities which will go like hot cakes in winter. This is because they are competing in the money market with the biggest and safest borrower on earth. This borrower has met current needs. There is a lull now before the next Liberty Loan will come out, and this leaves an opportunity for electrical companies of superexcellent credit to do their financing. Bankers know that plant additions are urgently required to furnish the additional supply of energy which industry demands. Given the securities of the corporation of established credit, the bankers, if the price is sufficiently attractive, will find the market. But the thing must be done quickly.

A Common Forum Needed

WHEN the representatives of central station, manufacturer, jobber, dealer and contractor all get together, the discussion of their common problems is certain to facilitate co-operation and mutual appreciation, and there can be no such co-operation until representatives do so confer, understand one another and agree on fundamentals. There can be no doubt that such discussion will have a direct and important influence on the future business of the interests involved. Among dealers each firm settles its own problems within itself and carries to the association of contractors and dealers the problems common to this part of the industry. So among jobbers each firm is distinct, and yet all can put aside individual matters to get together, through the Electrical Supply Jobbers' Association, on questions affecting that branch of the industry.

Since this plan has proved so helpful to the several branches of the industry, why should not the manufacturer, jobber, dealer, contractor and central station discuss those questions which affect the electrical industry as a whole? The influence of such a combination would

be most beneficial to all concerned, and much which could not otherwise be gained could be secured through this unison of action. An organization of this sort cannot be successfully constructed on short notice, and there may be obstacles to overcome. However, the plan is fraught with such great potentialities that sooner or later a way must surely be found to ally these interests. Perhaps it will be that committees from each field, or the association in each field, will regularly sit in common council; but whatever the plan of organization, it absolutely must be such that each of the interests to be allied can be offered proper representation. Only on this basis would it be worth while to attempt such a scheme, and no compromise of this principle could be the basis of a permanent organization. In view of present conditions it would be worth while for a representative committee to make a study of this problem and report on ways and means of co-ordinating the activities of all branches of the electrical industry.

Engineers and War

WAR is a business and must be conducted by business methods. It calls for the hardest collective effort of all the individuals of a nation. The soldiers must be highly trained in advance and must be supplied with warlike instruments of precision. The officers have all to be engineers, in whatever branch they serve, and have to receive an engineering training. The food, clothes, shelter, transport, hospital supplies, tools, guns and munitions of the soldiers have to be supplied by a yet more numerous army of workers behind the lines, and a large amount of engineering is necessary in the work of this non-shooting army. There is no active man or woman in the country but can take a useful part in the war, somewhere between the firing line and the supply line at the rearmost base. Electrical workers, because they have been rendered familiar with engineering in some manner or degree, can be of particular service.

No business plans can be completed until a proper canvass is made of the available personal material. The first thing necessary is to take stock. Every engineer in the country should be registered and his abilities taken into account. A certain number of them must be retained in each industry, in order that that industry shall be properly carried on. The others should be assigned to positions either with the colors or in the special new industries that the war will evoke.

The Engineering Council has already started to approach engineers with a view to ascertaining just what work they can do individually or co-operatively for the government. All must earnestly co-operate for success

in the war, because success means the right of men and of small nations everywhere to live unmolested, so long as they behave themselves. In this work engineers can share and glory.

Getting Coal for the Winter

IT IS the aim of central stations to maintain service without interruption, come what may. A first necessity in carrying out this policy in steam stations is abundant coal supply. Until last winter abundant coal supply meant only enough to protect against the normal possibilities of mine or railroad trouble. It means more now. Neither coal-mining nor railroad conditions are normal, nor can they be expected so to be while the war or post-war activities remain intense. Mining conditions will not be easy, railroad operation will be greatly complicated by flood of traffic. Under these circumstances what can the poor central station property do? The ELECTRICAL WORLD has made a study of conditions in some of the Central Western communities for the purpose of finding whether the problem of next winter's coal supply promises to be both serious and dangerous. It will be both serious and dangerous. To secure plenty of coal at prices that they can afford to pay will tax the sharp ingenuity and latent resources of the companies. The whole of our own country, our allies on this and other continents, the entire world needs coal. Reserve stocks are low, labor is scarce, demands of industry are insatiable. To the current consumption for ordinary purposes there are being added rapidly government requirements of impressive totals.

In other years the movement of coal from the vein in the ground to the central station boiler room has been routine. It will not be that in the winter of 1917-18. Contracts broken by coal dealers, higher prices, prosperous manufacturers who put "price-no-consideration" clauses in coal orders, dearth of labor and, last but not by any means least, slow car movement and the approaching fall traffic congestion are unwelcome portents. Some of these will be lightened, others will be overcome in localities or specific instances, but they will not vanish like dew before the sun. It will take much work to keep the avenues unclogged, to maintain coal supply so that service shall not fail in the community.

It is not our desire to hamper existing agencies which are trying to settle the problem by executive planning and forethought. But in such times as these it takes more than the ordinary detail of purchasing, contract-signing and coal-handling apparatus to get coal in large reserve quantities. Even a central authority decree cannot get coal to a central station in twenty-four hours if a terminal traffic congestion develops which a week of work fails to break. Coal may be loaded on cars by the mine operator, it may be moved toward destination by the railroad, but blinding snowstorms, wrecks and pressure of traffic from connecting lines defy orders which emanate from the occupant of a comfortable armchair 1000 miles away. Some companies were too perilously near bottom in their coal-storage yards last winter to take any greater risks than are necessary.

Fortunately many central station operators are alert to the facts. Washington realizes the need of protecting fuel supply for the utilities which serve the public and speed the war industries. And local state officials are getting a very clear understanding on the subject. Central stations may depend upon it that powerful efforts will be made to supply their wants. But that is not enough. The central stations will have a strong case only after they have made every possible effort to safeguard their own rights. They will have to strain their own powers in collecting coal, in getting it safely stored in their yards. It will take persuasion, cajoling, threats and, most potent of all, cash; but it will have to be done. And the cost ought to be put straightway into the rates.

The Vanishing Peak

IF ONE looks over the series of load curves of any of the older large stations in the country, the most striking feature to impress him is that grim and terrible thing abhorred of managers, the peak. For years the ingenuity of central station men has been racked to devise means of filling up the hollows in the load curve without materially increasing the daily maximum. The answer to the problem has come in the form of industrial load, as Mr. W. N. Neibich's paper in the current issue well shows. The particular station here referred to is that in Baltimore, which is supplied very largely from the great hydroelectric plant on the Susquehanna River at Holtwood.

The result of the last decade's development has been the practical abolition of the conspicuous evening peak. If one discovers a peak at all, it is a very small one superimposed on a colossal range of hills enduring from early in the morning until near midnight, with short and precipitous canyons denoting the time during which people stop work to eat. The situation in Baltimore is a little abnormal in that the peak of eight or ten years ago fell a little later than usual, an index to slight differences in the habits of the people and the hours kept. A glance at Mr. Neibich's charts shows clearly what has happened. Through a drive at industrial load of various kinds, supplied with energy largely at high tension through the customers' substations, the load has been so built up that the peak is substantially a negligible quantity and the load factor has risen from a scant 20 per cent ten years ago to more than 50 per cent at the present time. Whether industrial conditions and the ingenuity of managers will ever combine to fill up the gulf of the early morning hours remains to be seen. This in a system like that of Baltimore is the chief factor in lowering the average load. The success of the Baltimore company in building up this industrial load and its happy effect on the service conditions shows how much may be done by a persistent drive for more power backed by a liberal and carefully adjusted schedule.

It is the possibility of bulk supply to big establishments that renders possible the abolition of the peak, for the high peak was essentially a characteristic of the days in which motor service was a small item in

central station business and lighting was the one load seriously to be considered. Artificial light under any given conditions becomes suddenly necessary at a particular time in the afternoon which does not vary greatly from point to point in the area served; hence all lamps, private and municipal, are lighted within a very short time and the peak rises skyward. This condition brought about by the need of artificial light cannot be avoided, but what can be done and what has been done in the Baltimore case is to take on so large an amount of industrial power load that the additional load due to lighting becomes very nearly negligible. This is a condition greatly to be desired in central station practice, and it is attainable wherever energy can be supplied cheaply enough to meet the industrial demands.

Some Phases of Factory Lighting

WE PRESENT this week another of Professor Clewell's interesting articles on some practical details of lighting. This paper is devoted to the proper illumination of clothing factories and similar workshops. So large a proportion of the world's clothing is made in special factories that that industry rises to great importance not only in the value of the product but in the number of employees. Consequently the effect of good and bad lighting on the workpeople and on the product cannot be passed by. The text of Professor Clewell's article is a government report dealing particularly with the women's garment factories in New York City. This report brings out the serious fact that over 50 per cent of such workshops are inadequately lighted, according to the investigations of the United States Health Department. Those who are familiar with industrial conditions in New York City will, of course, recognize that the situation is probably worse there than almost anywhere else, chiefly on account of the narrow streets, high buildings and the very common location of clothing workshops in lofts selected rather on account of cheap rent than for their effect on the efficiency of the work and the health of the workers.

Even when the exposure of the windows is fairly good, the areas of the working spaces are often so large that the inner portions receive very little light. Of course this situation seriously aggravates the difficulties of artificial lighting, as it is a commonplace of scientific illumination that spaces requiring large aid from artificial light are not easy to deal with, and that natural and artificial light do not, so to speak, mix well from the psychological and possibly the physiological

standpoint. With little clear sky to illuminate the windows and with the opposite wall surfaces dingy as they frequently are, poor lighting will be assured except near the windows and for a small portion of the day. Prism glass has been largely used to remedy this condition, but to be effective it has to be kept clean, and city conditions are such that this obligation is rarely fulfilled.

Aside from generally insufficient light, the commonest trouble in such factories as we are here considering is serious glare, both directly from the illuminants and sometimes indirectly from the work as well. This trouble comes from the usual cause of bare or insufficiently shielded lamps. Comparatively few of those controlling this particular industry have as yet seen the economic importance of good lighting, and innumerable cases may be found where bare gas burners or incandescent lamps are hung low and shine fairly in the faces of the workpeople. In not a few other instances the lamps originally in the installation may have been tolerably well shaded, but later changes have placed, for example, a 100-cp. tungsten lamp in a shade suitable for a 16-cp. carbon lamp, with the result that might be expected.

With the variety of first-class glass and steel reflectors now available there is very little excuse for glare, although in rare instances the situation of the working spaces is such that ordinary reflectors prove somewhat inadequate. In this case special reflectors may advantageously be used, and we have even seen thoroughly good results on a cutting table obtained from the original lamp and reflectors by adding a diffusing skirt deep enough to keep direct light out of the operator's eyes. The importance in the clothing industry of a good and uniform product turned out rapidly is such as to justify considerable expenditure in remedying imperfect lighting conditions. These are bad enough in dealing with white fabrics, but when dark-colored cloths are used the situation becomes much worse. As between white goods and dark blues, reds or blacks the illumination required for efficient working is somewhat in the ratio of one to four or five. For the former between 1 ft.-candle and 2 ft.-candles for ordinary work seems to be reasonably sufficient; for the latter 5 to 7 ft.-candles will prove to be none too much. Professor Clewell's data show very clearly that there is great need for reform in the lighting of clothing factories. Now and then, as he indicates, a very admirable example may be found in which the working conditions as well as the product are of the best, but such conditions are unfortunately exceptional.

AS THE question of coal supply and cost enters so prominently into the question of expense of operation and is a part of the larger problem of rate-making, special attention will be given to it in the ELECTRICAL WORLD for Aug. 4. This issue will present several articles dealing with matters of public policy which are receiving analysis and consideration in various parts of the country. The coal situation demands the best thought of operators

The Coming Issues

in order that the serious difficulties of last winter may be overcome or minimized in the coming season, and the ELECTRICAL WORLD will do what it can to assist in solving the problems involved. Prof. C. E. Clewell's article in the same issue will discuss local lamp and inspection work lighting. The usual departments will be found to be of much interest to engineers and operators, new-business representatives and manufacturers, jobbers and others.

The Disappearance of the Evening Peak

Growth of High-Tension Industrial Load in Baltimore Results in Heavy Increase in Morning and Afternoon Loads on System and in a Larger Load Factor

BY WILLIAM N. NEIBICH

THE central station industry of the country is now experiencing one of the greatest booms in its history, and the industry in Baltimore is proving no exception. For the first three months of the year 1917 there was an increase in the output of electricity throughout the country of 23.7 per cent over the corresponding months of last year. The increase of the Consolidated Gas, Electric Light & Power Company of Baltimore during the same period was 41.9 per cent. Of this increase 73 per cent was due to high-tension industrial load.

This load has grown to such an extent in recent years that it has practically caused the disappearance of the evening peak load. There are only about six weeks of the year, from the second week in December to the third week in January, when this does not apply. During this time the lighting load and the industrial load overlap owing to the shortened hours of the day.

In order to show this changed condition of the company's load, curves of load on days in 1909, 1914 and the present year are shown. The load curves of 1909 were taken because this was about the time the idea of central station service for large industrial requirements was put into practice. Those of 1914 show the great stride made in the increase of industrial load and central station service after a period of five years. The load curves of the present day show the further increase of industrial load and the changed characteristics of the total system load.

LOAD CONDITIONS FOR THE YEAR 1909

Fig. 1 shows the load of May 1, 1909, plotted hourly. Curve A represents the total load generated, 25 cycles, 13,200 volts, and curve B the amount sent to distribution lines from the company's various substations. The difference between A and B represents substation loss and transmission-line loss between substations. The peak load on the system on this day was 12,600 kw., occurring between 8 p. m. and 9 p. m., the load factor being 42.9 per cent.

The business section of the city is supplied underground with 120-240-volt direct-current service. Referring to curve C, Fig. 1, it will be seen that the peak of this class of service was between 8 p. m. and 9 p. m. and was a contributing factor of the system peak. Most of the service in this district at this time was supplied to office buildings and stores, the major portion of the load of which was lighting. The public at this time was skeptical in regard to the advantages of central station service, and there were many manufacturers and small factories with isolated plants.

The load of the residential section of the city was purely lighting, although in some sections power was used for operating small pumps. This class of service, which is 60-cycle alternating current, also contributed heavily toward the system peak, as can be seen by curve D, Fig. 1. Its peaks also occurred between 8 p. m. and 9 p. m. The municipal lighting also was a factor in the

system peak. The forenoon and afternoon peaks on this day, representing largely power load, were only about one-half of the evening peak, which was almost entirely lighting.

In 1908 the company established a scientific schedule of differential rates which were attractive to power consumers. Following the introduction of differential electric rate schedules, there began an unprecedented growth in the company's output and an unusual diversity of business.

INAUGURATION OF HIGH-TENSION SERVICE TO CONSUMERS

High-tension service in the form of 25-cycle, 13,000-volt, three-phase alternating current was supplied to consumers and metered at the company's station switchboard during the latter part of 1907. Later this service was extended so that consumers were metered at the consumer's switchboard, the company standing the transmission-line loss to the consumer's substation. This class of service proved very attractive to industrial concerns and developed very rapidly.

The first customer of this character was the Maryland Electric Railways, which was formerly a steam road operating between Baltimore and Annapolis, Md., a distance of about 30 miles (55.6 km.). This road was first operated as a single-phase system, but later the equipment was changed to a 1200-volt direct-current system. High-tension service was supplied to its substations.

Later other concerns contracted for high-tension power of the 25-cycle, 13,000-volt form. Among these was the Baltimore & Ohio Railroad, which used the power to move the trains in its belt-line tunnel beneath the city of Baltimore. The Baltimore Copper Smelting & Rolling Company was another of these concerns. Its power requirements were for the purpose of refining copper by an electrolytic process. Then followed textile mills for the making of cotton duck.

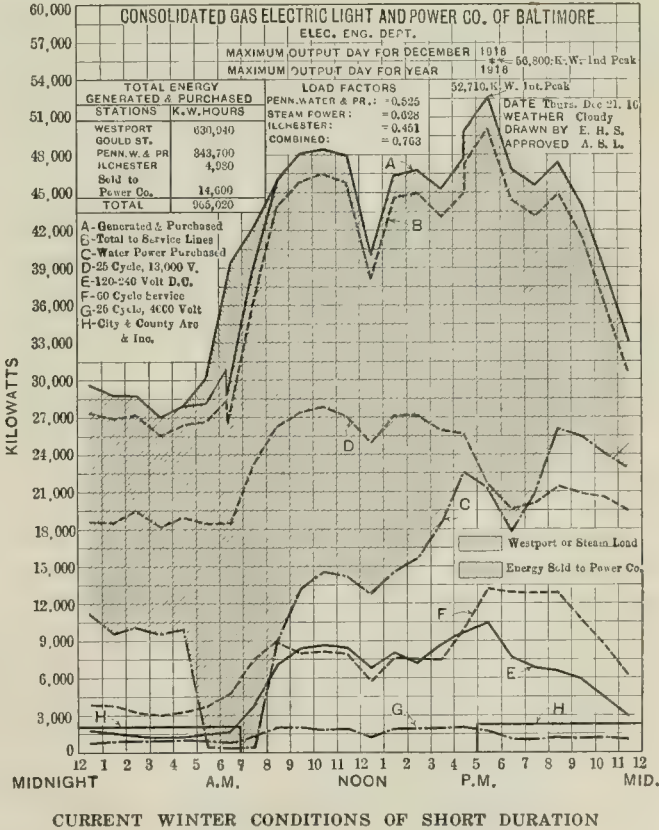
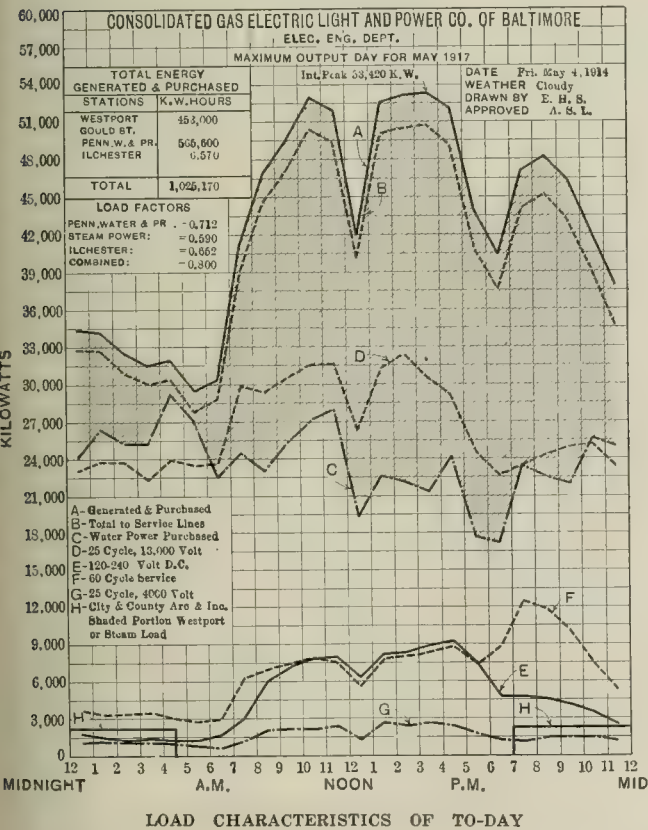
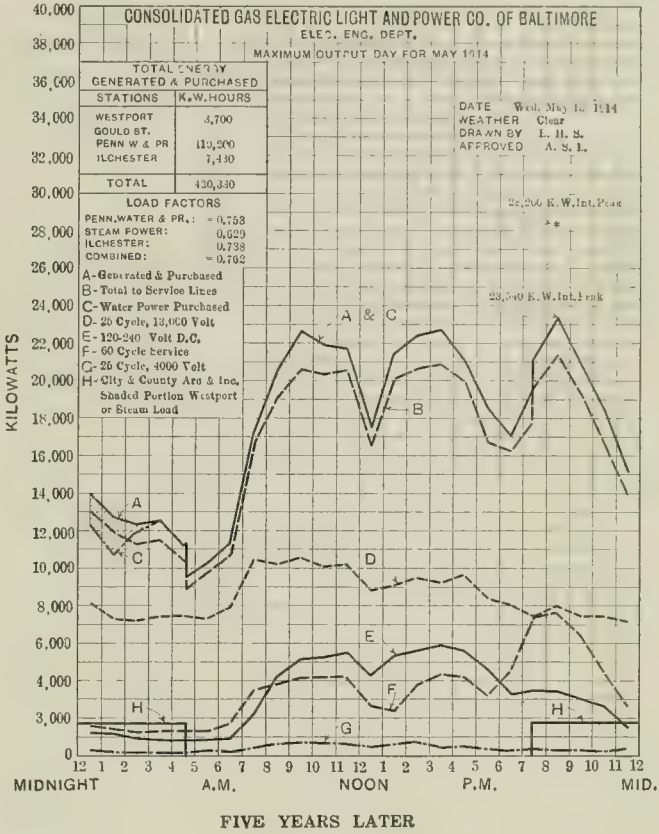
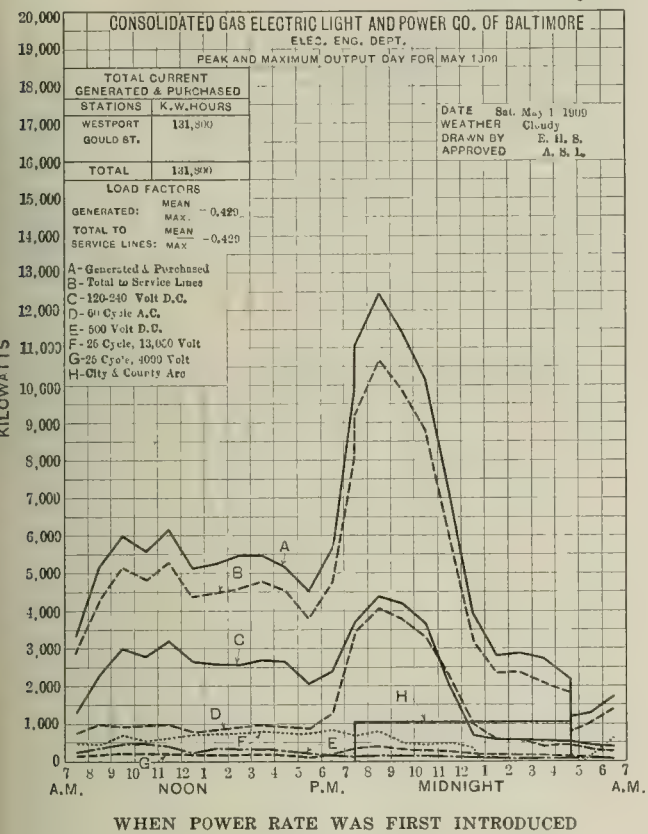
Curve F, Fig. 1, shows the load of this class of service on May 1, 1909, the only customer supplied at this time being the Maryland Electric Railways. This load was only 6 per cent of the total system load during the peak hour.

LOAD CONDITIONS FOR THE YEAR 1914

Fig. 2 shows the total system load and that of the various classes of service on May 13, 1914, five years later. By comparing these curves with those of Fig. 1, a marked difference in the character of the load will be noticed, the forenoon and afternoon peaks being nearly equal to the evening peak. The diversity of business here is very marked. The lighting load still was the contributing factor toward the system peak, which occurred between 8 p. m. and 9 p. m. This is shown by curve F, 60-cycle alternating-current service, which supplies the residential section and outlying districts of the city.

The direct-current service supplying the business district (curve E, Fig. 2), however, had assumed a different

character from that shown in Fig. 1. The peak on this class of service occurred between 3 p. m. and 4 p. m. plants in this district. A large amount of power load was thus added to the central station system.



FIGS. 1 TO 4—CURVES SHOWING DESIRABLE EFFECT OF POWER RATE ON THE LOAD CURVE

This showed the results of proving to power consumers the advantages of central station service and consequently the elimination of a great number of isolated Curve D, Fig. 2, shows the great stride made in acquiring high-tension industrial power load. This class of service averaged in 1914 about 44 per cent of

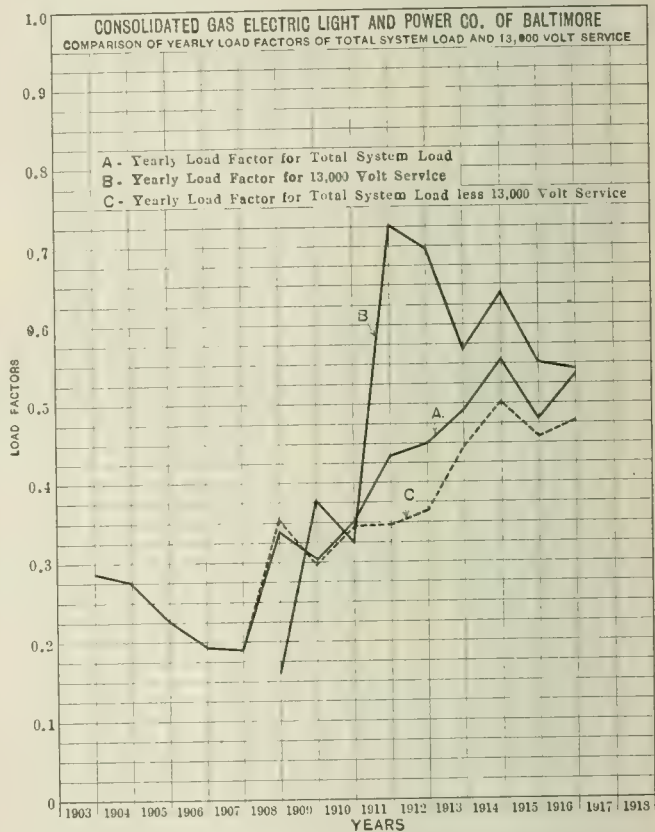
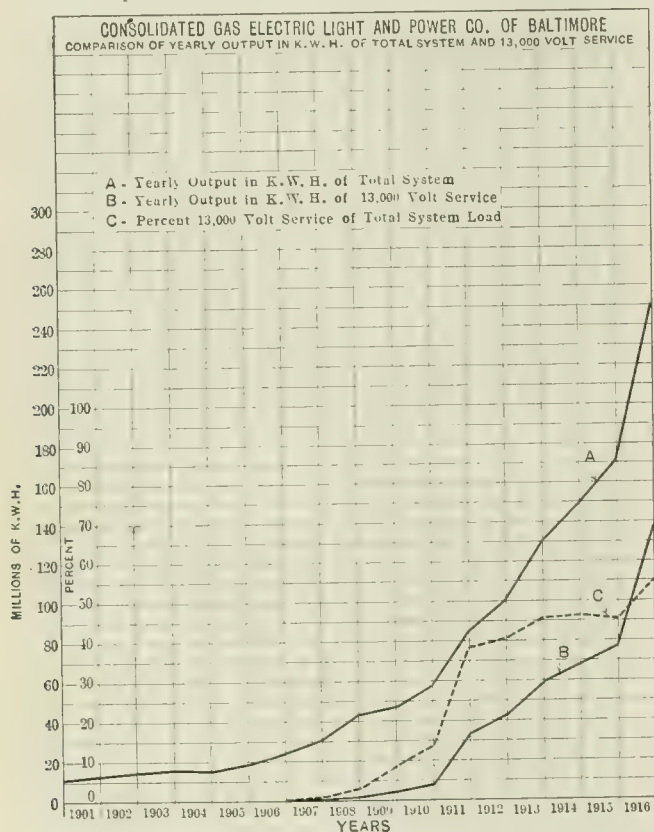
the total load. The peak occurred between 9 a. m. and 10 a. m. The load factor on this class of service was unusually high, being about 85 per cent. This was due to industries employing electrochemical processes and other industries using twenty-four-hour service of high load factor, which helped to improve the system load factor materially. The daily system load factor in 1914 (Fig. 2) was 76.2 per cent as compared with that of 1909 (Fig. 1), 42.9 per cent.

PRESENT LOAD CONDITIONS

Fig. 3 gives the load of the present day and shows the practical disappearance of the evening peak load. The lighting load is no longer the controlling factor in

started earlier because of the shortened hours of the day. The remainder of the increase was due to the residential and business sections. It is shown by curves E and F.

The diversity of business is very marked at this time of the year. Curve D, the high-tension industrial load, shows a falling off of about 4000 kw. between 5 p. m. and 6 p. m., while the lighting loads of curves E and F are increasing during this time. This helps materially to offset a large increase due to the overlapping effect and maintains a high daily load factor. The load factor on this day was 76.3 per cent, which was a decrease of only 3.7 per cent from that of the day in May.



FIGS. 5 AND 6—THE GREAT GROWTH IN OUTPUT AND LOAD FACTOR HAS PRIMARILY BEEN DUE TO INDUSTRIAL SERVICE

the system peak, being supplanted by the large increase in industrial load. Here the curves E and F have about the same characteristics as those shown in Fig. 2, but constitute a less percentage of the total load.

Curve D of the 25-cycle, 13,000-volt service is now the controlling factor in determining the system peak. This load is about 60 per cent of that of the total system.

Fig. 4 shows the load on Dec. 21, 1916. The conditions on this day were not very materially different from those in May. They last only about six weeks during the year, and show that the May conditions hold very nearly throughout the year.

The peak on this day occurred between 5 p. m. and 6 p. m. and was caused by the overlapping of the afternoon and evening peaks. This combined peak, however, is only about 4000 kw. more than that of the morning, which occurred between 10 a. m. and 11 a. m. This is an increase of only about 8 per cent. Of this 2300 kw., or more than one-half, was due purely to municipal street lighting, which necessarily must be

Fig. 5 shows the total output in kilowatt-hours per year of the high-tension industrial power load compared with that of the total system load. It points out the extent to which this industrial service has grown in importance in recent years. Curve A is the total output of the company; curve B the 25-cycle, 13,000-volt output, and curve C the percentage of the total system of the 25-cycle, 13,000-volt service.

Fig. 6 shows for a number of years the yearly load factors of the total system, the high-tension industrial load, and that of the total system less the high-tension industrial load. It will be easily seen what effect this class of service had in improving the total yearly load factor of the system.

The increase in industrial power has been largely caused by additions and growth in the following industries: fertilizer, coal piers, grain elevators, textile mills, steel companies, shipbuilding and allied interests, and industries using electric furnaces and electrochemical processes.

The industrial advantages of Baltimore, such as low

freight rates, splendid harbor, deep-water terminals for railroads, close proximity to coal mines, steamship lines, and magnificent piers for the quick handling of coal and other exports, in addition to the cheap power rates, have all been a factor in the industrial growth of Baltimore in recent years.

At the present time Baltimore is undergoing the greatest industrial growth in its history. Substantial investments are being made almost daily in new enterprises or by established concerns moving into this community. The conditions now are more favorable than ever before to central station service, owing to increased demand for power and the high cost of coal, supplies, labor and all equipment for isolated plants. Manufacturers in general have been turning to electric public service companies to supply permanent power requirements rather than submit to the delays, uncertainties and unnecessary investment in providing individual power plants. They realize also that both for low cost of power and for reliability central station service is most advantageous.

FUTURE LOAD CONDITIONS

The immediate outlook for the future comprises large additional outputs for new grain elevators, steel companies, new shipbuilding concerns and textile mills. The estimated future increase in the industrial load will further increase the forenoon and afternoon peaks and make the elimination of the evening peak more pronounced than at the present time.

ELECTRIC POWER IN BITUMINOUS COAL MINES

Kind of Power System and Apparatus, Effect of Requirements of Haulage on Selection, and Need of Good Ventilating Equipment

The best form of electric power to use in a bituminous coal mine was discussed by R. L. Kingsland in his paper submitted at the recent "war" convention of the American Institute of Electrical Engineers, held in New York City.

For the larger mines a three-phase, 60-cycle system with voltage high enough to permit a 10 per cent power loss is the most practical scheme. Three hundred volts with an allowable fluctuation of 10 per cent is being favored for underground portable machines, whereas medium or high voltages can be used to advantage safely for stationary machines if proper protection is afforded. Haulage is one of the chief factors determining the form of electric power to use underground. As no practical means has been developed for heavy haulage by the use of alternating currents, it is necessary to use direct current. Synchronous converters delivering 300-volt direct current can be installed above and below the ground where necessary, thus reducing the amount of copper required in the mine to a minimum. In small mines where locomotive haulage cannot be used to advantage all machinery may be run with alternating current if it is available.

In actual practice it has been found that more copper is required for a three-phase alternating-current circuit than for a direct-current circuit of the same voltage, this being largely due to the lagging power factor caused by induction-motor loads. For concentrated

loads of 100 hp. or over the author has found that separate lead-covered, steel-armored cables leading direct from the surface through special bore holes are very satisfactory for supplying alternating current for pressures up to 11,000 volts. For underground distribution bare copper wire is used extensively.

With proper voltage the squirrel-cage induction motor is ideal for driving the chain machines used for cutting coal. However, shunt or compound-wound motors are most frequently used for reasons given below. For drilling machines a constant-speed motor is required. A high starting torque is not necessary. Motors for coal-loading machines should have the same characteristics as those for coal-cutting machines. For the small pumps used for delivering drainage water to one or more central points the same form of power should be used as is employed for cutting, drilling and loading. The larger pumps used to remove the water from these central points should be treated as concentrated loads. Underground lighting can be most easily accomplished by the power that is used for other purposes where the lamps are required.

Shop drive and lighting should depend on the primary source of power, as they may be required when everything else about the mine is shut down. They should not depend on the operation of any more machinery than is absolutely necessary.

Ventilation is of first importance in a great many bituminous coal mines, so it is necessary to have very reliable equipment. The squirrel-cage induction motor is especially suitable for this service as it is the most rugged as well as the simplest form of electric motor. If alternating-current power is not available, shunt motors should be used, but the commutators prevent their giving the same reliable service as the induction motors.

METHOD OF FRACTIONATING HYDROCARBONS ELECTRICALLY

Fractionation Takes Place Under a Controllable Pressure Within a Retort, the Pressure Being Variable to Suit the Oil Used

Leon E. Hirt of Charleston, W. Va., in patent No. 1,222,402, suggests a method for fractionating hydrocarbons electrically which consists essentially in passing a spray or mist of oil and steam through an arc between the electrodes. The fractionation or refractionation takes place under a controllable pressure within the retort, which pressure will vary to suit the characteristics of the particular grade of oil used. A pump maintains the oil pressure to the desired intensity, and as the spray or mist of oil and steam passes through the arc and is partly broken up and fractionated by the intense heat of the arc a pressure is built up within the retort. This pressure is held back and is controlled by means of a valve in the offtake pipe. This pipe leads to any suitable condenser or rectifier. Any oil which passes the arcs untreated is trapped off into a tank, whence it may be pumped back for retreatment or otherwise disposed of.

The steam introduced with the oil is decomposed into $2H_2 + O_2$, the nascent H_2 entering into the reaction with the oils, and by holding the desired pressure in the furnace chamber any thermochemical compound of the oils can be formed.

Lighting in the Textile and Clothing Industry

Effect of Height of Adjacent Buildings, Angle of Incidence of Sunlight on Windows and Reflection Coefficient of Cloth Surfaces on Artificial Light Requirements—Actual Cases Illustrated

BY C. E. CLEWELL
Assistant Professor of Electrical Engineering, University of Pennsylvania

SUMMARY.—In this article the author points out the inadequacy of much of the artificial lighting in this field by citing investigations in certain garment industries where insufficiency of illumination as well as the prevalence of harmful glare has been especially noticeable. Since many garment industries are situated in loft buildings, their lighting requirements are considerably affected by the height of adjacent buildings which cut off portions of the sky that would otherwise be visible. On the lower floors so much light may be cut off that artificial lighting is required the greater portion of each day. The upper floors, however, being open to a wider angle of the sky, may receive sufficient natural light to make artificial illumination unnecessary for so long a period. In this same general connection, the angle of incidence with which the light from the sky falls on lateral window surfaces is shown to have a pronounced effect on the light transmitted through the glass into the interior spaces of the building. The angle of glare is defined, and one method is pointed out for its calculation in a given case. Among the most important parts of the article are the treatment of the relation of the reflection coefficient of cloth surfaces to the amount of illumination required for various colors of goods worked upon and the conclusions as to the intensities required. A number of illustrations of actual installations serve as the basis for a reference to the engineering details of the illumination in these trades.

AN EXTENDED investigation of lighting conditions in the women's garment factories in New York City¹ has shown that over 50 per cent of the plants are inadequately lighted. This statement is based on conditions found in thirty-four workshops in which actual measurements were made of the illumination on 404 working planes, representative of six classes of work. Table I shows the summary of these readings.

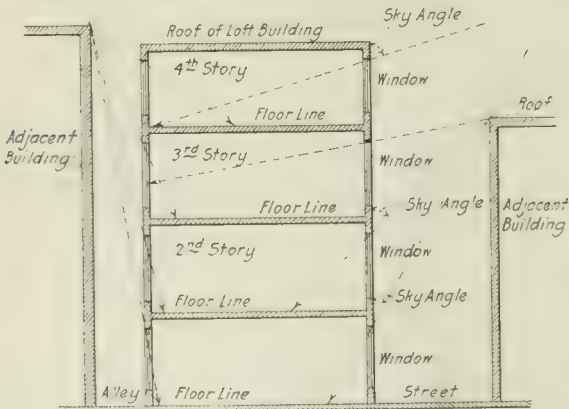


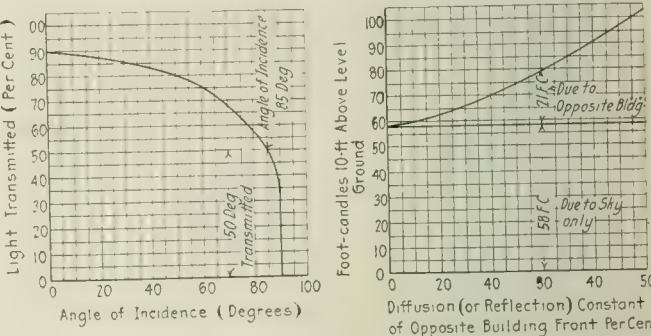
FIG. 1—NATURAL ILLUMINATION CUT OFF BY ADJACENT BUILDING

The term "inadequate" as here used is based on the minimum requirement of 5 ft.-candles, which is advocated in a government report based on the tests referred to above.

Another important finding in this investigation was

¹A bulletin containing the results of this investigation has been issued by the United States Health Service entitled "Studies in Vocational Diseases," by J. W. Schereschewsky and D. H. Tuck (May, 1915). Tables I, II and IV are taken from this report.

the marked prevalence of glare from artificial light sources. On 131 finishing tables, for example, employing 610 finishers, glare effects were noted in the case of nearly 98 per cent of the artificial sources which



FIGS. 2 AND 3—RELATION OF LIGHT TRANSMISSION THROUGH GLASS TO VARIOUS ANGLES OF INCIDENCE; AND ILLUMINATION IN A SIDE WINDOW 10 FT. ABOVE THE GROUND

In Fig. 3 are shown the proportions of total illumination due to the sky and due to possible diffusion (or reflection) from opposite buildings. Reflection from street surfaces is neglected. The upper curve corresponds to the first three diffusions (or reflections) from the opposite building.

were in operating condition. Again, at the basting tables, glare effects were present in 94 per cent of the artificial sources employed. The causes of glare noted were the use of bare incandescent lamps or flat gas burners, flat reflectors, lamps too large for the reflectors, and the close proximity of the lamps to the table surfaces, bringing the lamps frequently into the line of vision.

TABLE I—CASES OF ADEQUATE AND INADEQUATE ILLUMINATION* IN WOMEN'S GARMENT INDUSTRIES, NEW YORK CITY

Class of Work	Cases of Adequate Illumination in per Cent	Cases of Inadequate Illumination in per Cent
Manufacturing departments:		
Cutting tables	37.7	62.3
Machines	55.5	44.5
Basting tables	16.6	83.4
Finishing tables	49.7	50.3
Pressing boards	42.3	57.7
Buttonhole machines	45.0	55.0
Stairways	27.0	73.0
Designing departments:		
Cutting tables	62.5	37.5
Machines	93.8	6.2
Finishing tables	83.3	16.7
Pressing boards	62.5	37.5
General averages	47.4	52.6

*Based on a minimum requirement of 5 ft.-candles for all cases except stairways, the minimum requirement for the latter being assumed as 0.1 ft.-candle.

The reason for emphasizing at the outset this report on the lighting conditions in women's garment factories is to show that there is still much need for improvement in this branch of the lighting field. There is, however, no special reason for selecting this particular industry other than the existence of available data relating thereto which form a convenient basis for the

foregoing conclusions as well as for some of the notes in the following paragraphs.

EFFECT OF ADJACENT BUILDINGS

The presence of adequate daylight throughout normal day-working hours determines whether artificial lighting is to be required. While the ratio of window area

TABLE II—RANGE* OF SKY ANGLE FOR FRONT AND BACK WINDOWS AND FOR SIDE WINDOWS IN WORKROOMS OF THE WOMEN'S GARMENT INDUSTRIES IN NEW YORK CITY

Limits of Sky Angle, Deg.	FRONT AND BACK WINDOWS		SIDE WINDOWS	
	Number of Cases	Per Cent	Number of Cases	Per Cent
0 to 10	158	30.83	74	43.22
10 to 20	7	1.37	6	3.55
20 to 30	13	2.54	.....	.....
30 to 40	32	6.25	.....	.....
40 to 50	16	3.12	.....	.....
50 to 60	89	17.41	.....	.....
60 to 70	44	8.59	.....	.....
70 to 80	27	5.27	32	18.71
80 to 90	126	24.62	59	34.52
Totals.....	512	100.00	171	100.00

*Note that the sky angle is less than 10 deg. in about 30 per cent of the cases and less than 60 deg. in about 60 per cent, for the front and back windows.

to floor area is one way of specifying the natural lighting facilities, it is by no means a complete specification, because for a given window area the amount of natural illumination on interior working surfaces depends on a number of variable factors. Among these there may be mentioned the area of sky which is effective on the window surfaces. This depends on the sky angle as shown by Fig. 1, and it will be noted from this diagram that the sky angle depends on the height and proximity of the adjacent buildings and on the vertical dimensions of the given window, and it also varies considerably with the various floors.²

The significance of a large sky angle may be observed

TABLE III—ILLUMINATION* AND CORRESPONDING SURFACE BRIGHTNESS REQUIRED TO MAKE THREADS VISIBLE

Material	Illumination in Foot-Candles Required to Make the Threads Visible	Corresponding Surface Brightness in Foot-Candles
(Observer WCDW)		
(a) Very light blue calico.....	1.40	0.70
	1.65	0.90
	1.40	0.70
(b) Light blue calico.....	2.00	0.75
	1.70	0.70
(c) Full blue calico.....	4.80	0.63
	5.80	0.86
(d) Dark blue calico.....	12.00	0.62
	12.50	0.68
(Observer BPD)		
(a) Very light blue calico.....	1.00	0.64
	0.80	0.52
(b) Light blue calico.....	1.90	0.72
	1.30	0.50
(c) Full blue calico.....	4.00	0.52
	3.60	0.48
(d) Dark blue calico.....	10.50	0.60
	14.00	0.85

*Determined by gradually raising the intensity from a low value to higher values.

at the right-hand window for the third floor in Fig. 1, which indicates that the sky is visible from any point on the floor, and hence the natural illumination is effective

on the entire third-floor area (also, of course, on the fourth floor), because of the right-hand windows. On the first and second floors, however, the windows receive light from such a small portion of the sky that only a section of each floor receives light directly from the sky. Table II gives an idea of the range of sky angles for 512 front and rear windows and 171 side windows in workrooms of New York City. Note in this table the large percentages of windows for which the sky angle is very low.

Among the effects of small sky angles are, first, the reduced sky area which illuminates the interior floor space and, second, the large angles of incidence with which the light from the sky falls on the glass of the lateral windows. For the large angles of incidence the light transmitted through the glass may be greatly reduced as indicated by Fig. 2 for plain-glass surfaces. It is apparent from Fig. 1 that where very small sky angles occur, as in the lower floors, the interior of the building (principally on first floors) must depend largely for natural light on the reflection from opposite walls or from the street surfaces. Fig. 3 is therefore included to show the increase in natural illumination which may be expected for various diffusion or reflection

TABLE IV—REFLECTION COEFFICIENTS OF MATERIALS COMMONLY WORKED UPON IN WORKSHOPS OF THE WOMEN'S GARMENT TRADES IN NEW YORK CITY

Class of Goods	Reflection Coefficient in per Cent
Black velvet.....	0.37
Navy blue woolen cloth (dark).....	1.70
Black woolen cloth.....	1.90
Navy blue woolen cloth (light).....	2.20
Green, Russian woolen or cotton (dark).....	2.30
Brown woolen cloth (dark).....	2.30
Black cotton cloth.....	2.90
Black silk and mercerized cotton.....	4.50
Green woolen or cotton (light).....	5.40
Brown woolen cloth (light).....	10.90
Tango cloth, woolen or cotton.....	14.30
Light brown paper patterns.....	35.10
White cloth*.....	65.90

*Measured as a double thickness on a golden-oak surface.

tion constants of opposite building faces.³ This curve sheet is based on a distance between buildings of 80 ft. (24.3 m.) and a height of 140 ft. (42.7 m.) for the opposite building, the brightness of the sky being assumed as equal to 250 cp. per square foot (2690 cp. per sq. m.).

The curve in Fig. 3 makes it obvious that if the sky angle is very small and the opposite building surface is very dark in color, the natural lighting on the floor in question is likely to be very poor at all times, and unless some special provision is made to redirect the natural light from the sky more effectively to the interior—for example, by prisms—the work must depend largely on artificial illumination.

PREVALENCE OF GLARE

Two facts stand out as among those requiring greatest attention in this industry. One is that of inadequate intensities, and the other is that of annoying and harmful glare from bare and insufficiently protected light sources. The prevalence of glare in women's garment factories has been referred to already. The most apparent cause is the use of bare lamps without any shielding reflector, and hence the simple program

²Figs. 1, 2 and 10 are based on Public Health Bulletin No. 71 (May, 1915), by J. W. Schereschewsky and D. H. Tuck. Washington, D. C.: Government Printing Office.

³This curve is based on an article by L. B. Marks in the Johns Hopkins University lectures on illumination, page 665.

of effecting a more consistent use of reflectors may well be looked upon as important work for the immediate future.

One scheme which has been suggested for specifying

the angle of glare is represented by Fig. 10. From this diagram it may be seen that when the line of vision is not raised above the far (right) edge of the table, the angle of glare is then a minimum, that is, 0,



FIGS. 4, 5, 6, 7, 8 AND 9—EXAMPLES OF VARIOUS TYPES OF ILLUMINATION IN TEXTILE AND CLOTHING PLANTS

(A, B, top; C, D, middle; E, F, bottom)

A—Warping department of the Botany Worsted Mills, Passaic, N. J., where 400-watt gas-filled tungsten lamps, equipped with dome-shaped enameled steel reflectors, are mounted 14 ft. above the floor and about 26 ft. apart. The illumination intensity is 4.5 ft.-candles and the power demand 0.6 watt per square foot. B—Coat department of Rosenberg Brothers & Company's clothing plant, New York, in which 400-watt and 500-watt gas-filled tungsten

lamps equipped with reflectors and inclosing globes are mounted 14 ft. above the floor. The intensity is about 4.5 ft.-candles and the power demand 0.7 watt per square foot. C—Weave room of Seymour Woolen Mills, Seymour, Ind., equipped with 60-watt vacuum-type tungsten lamps, fitted with rippled-glass reflectors, 7 ft. apart and 8 ft. above the floor. In the aisles the lamps are 9 ft. 6 in. above the floor. D—Sewing-machine department of Wise Brothers Company, Baltimore, Md., where indirect fix-

tures fitted with 300-watt gas-filled tungsten lamps and rippled-glass reflectors are employed. The ceiling height is 12 ft. 6 in., and the distance from the top of the bowl to the ceiling is 36 in. Each outlet is controlled by a separate ceiling ratchet switch. The power demand is 1.68 watts per square foot. E—Portion of Racine Feet Knitting Company, Beloit, Wis., illuminated by mercury-vapor lamps. F—Section of the Newark (N. J.) Embroidery Works lighted by mercury-vapor fixtures.

and when the eye is directed at the near (left) edge, it is a maximum, namely, θ_2 . If θ_1 is greater than one-half of the visual angle, and the line of vision is toward the right edge of the table, no glare will result. Obviously, under such circumstances, glare will not result if the line of vision is toward the left edge of the table. For low mounting heights it is practically impossible to realize this condition unless the lamps are adequately protected by suitable reflectors. It should be noted that the difference between the intrinsic brilliancy of the objects viewed and that of the lamp filament or other cause for glare is also a decided factor in the effect that glare will have. In other words, the element of contrast has a considerable bearing on the glare problem. It is therefore evident that to avoid or to reduce glare the lamps should be well overhead and should be adequately inclosed by reflectors.

Some attention has been given by engineers to the

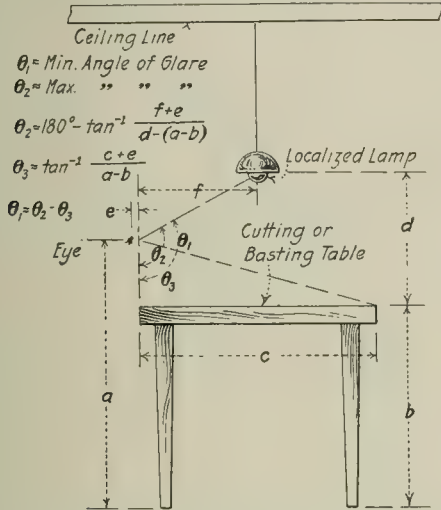


FIG. 10—METHOD OF COMPUTING ANGLE OF GLARE

variations in the requirements of illumination for dress goods of different colors and shades. The findings of the British factory lighting report (page 36) point to the following conclusions, which are based on the experimental results given in Table III:

- (1) That the illumination needed to make work possible on a very dark material may be ten times that required with very light material.
- (2) That, on the other hand, the requisite surface brightness is constant within the limits of experimental error.
- (3) That the average surface brightness needed to make threads of calico of different tints visible to one normal eye (WCDW) may be represented by 0.73, and to another normal eye (BPD) by 0.60.

Table IV gives the values of the coefficient of reflection (sometimes termed the "albedo") of materials commonly worked upon in the workshops of the women's garment industry in New York City.

Data published in the British report (page 34) show that when the illumination was increased gradually from low to higher values the intensity required for dark goods averaged about $5\frac{1}{2}$ ft.-candles, while for very light goods it was about $1\frac{1}{4}$ ft.-candles. These results are based on actual observations where sewing work was being performed. The following comment, found in the above report, is interesting because it gives an opinion on the comparison between direct and indirect lighting for sewing work:

"It was readily apparent that for equal ease in distinguishing detail a considerably greater illumination was required [with indirect lighting] than in the case of direct light. This is only to be expected, having regard to the fact that the shadows shown by indirect light are always far less intense than those given by direct light, and that the variation of illumination over a curved surface is also much less with diffused light. The superiority of direct light for sewing was insisted on by the seamstresses who worked in the experimental room under different illumination conditions."

The conclusions of the extended investigations as given on page 37 of the British report upon this industry are quoted herewith because they summarize the results in a concise and useful manner. It is to be remembered, however, that these conclusions are merely presented as those of a given committee which has presented these facts more or less as a preliminary report to further and more detailed investigation:

- (1) The illumination required for the perception of detail in materials having a low coefficient of reflection is greater than for those which reflect more strongly, and, other things being equal, is inversely proportional to such coefficient of reflection; that is to say, for equal visibility there must be constant surface brightness.
- (2) The visibility of detail in self-toned portions of fabrics, embossed paper and similar substances, depends on the unidirectional character of the light illuminating them. It follows and has been shown experimentally that the ability to distinguish detail in such substances is for the same illumination much greater by direct than by indirect light.
- (3) Work such as sewing may be comfortably performed on the darkest materials with an illumination of 5 to 6 ft.-candles (direct lighting). For white calico $1\frac{1}{4}$ ft.-candles was found sufficient, and intermediate shades were found to lie between these values.
- (4) The observations on the phenomena of glare have not as yet yielded definite numerical results. They have shown, however, that the presence of a bright lateral light, although causing a feeling of annoyance, does not actually diminish ability to distinguish detail unless the surface brightness of the object viewed is relatively low.

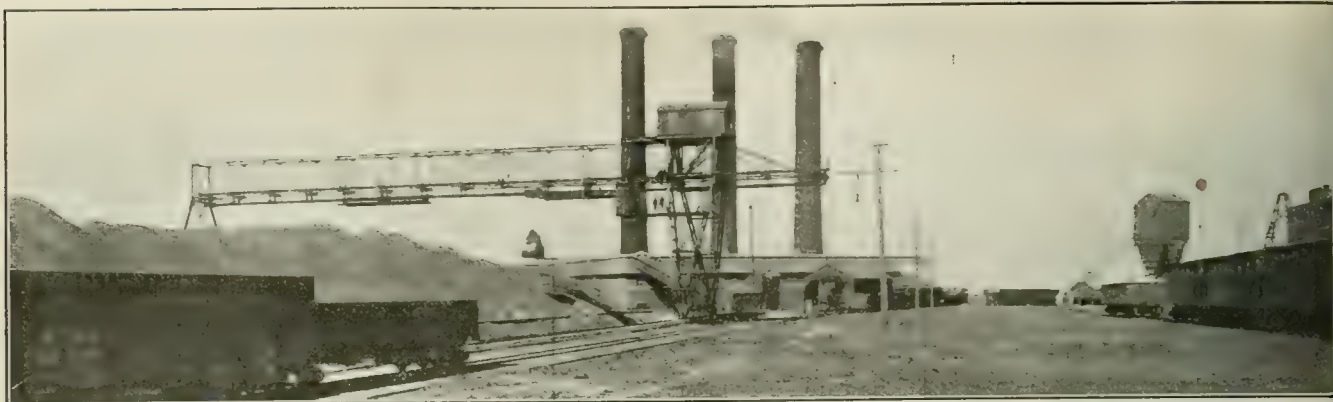
The Schereschewsky-Tuck report, referred to in the first part of this article, recommends a minimum of 5 ft.-candles for work in the women's garment industry.

ACTUAL CASES ILLUSTRATED

Figs. 4 and 5 give a good idea of the illumination results obtained in worsted mills with large tungsten lamps and steel dome-shaped enameled reflectors. Fig. 6 shows a coat department where 400-watt and 500-watt tungsten lamps are housed in Benjamin inclosing globe-type reflectors. Fig. 7, in contrast with the foregoing, is a good example of illumination with small lamps (60-watt tungsten), this being an excellent illustration of the use of X-ray reflectors where the lamps are mounted comparatively near the machines in a woolen mill.

The above examples all relate to direct lighting with Mazda lamps. Fig. 8, on the other hand, shows the use of indirect lighting where 300-watt tungsten lamps are mounted in X-ray 1321-M indirect fixtures. Fig. 9 is an example of mercury-vapor lighting. Special attention is directed to the technical data included in the captions of most of the illustrations. These data are useful in showing the standards which apply to this class of illumination at the present time in typical mills.

⁴It may be noted that in this country indirect lighting is beginning to be used quite extensively in textile-mill work.



A LARGE COAL SUPPLY IS INSURANCE AGAINST THE WINTER'S PROBLEMS

Central West Is Anxious About Coal

Alex Dow, President Detroit Edison Company, Advises Central Stations to Learn How Much Contract Coal They Will Get Next Winter and How Much They Will Need from Open Market—Apprehension Elsewhere

A SECTION of the Central West which was a heavy sufferer from coal conditions last winter is watching the progress of time toward the winter of 1917-18 with much apprehension. Central station operators in this district are asking whether they will have to bear as much anxiety regarding their coal supply and cost as they did last year. They are asking these questions of coal mine owners, of railroad officials, of their national association representatives.

A representative of the ELECTRICAL WORLD investigated conditions in a number of communities, and his report is published in part herewith. So far as interference from weather is concerned, railroad operating conditions have now the maximum advantage of the year. Undoubtedly the railroads are meeting the situation at present better than they did last winter. They have yet to face, however, the fall crop movement, and it is to be remembered that they are struggling daily with the greatest traffic movement in history, already a prolonged one but promising to be still heavier. Coal-mining companies are confronted by overwhelming demand and a potential runaway price situation.

It is between these two millstones that the central station is in great danger of being ground. So that the prudent operators are looking about to see what steps they can take to safeguard their supply and, if possible, prevent curtailment of service. For if they are unable to get their usual supplies of coal it will be necessary to restrict service to certain classes of consumers.

That, however, is not a contingency which the central station executive accepts except as a last resort. More attention is being given than ever before to the problem of fuel supply and cost. There will be developments in central station policy which will affect the companies permanently. These are based on growing realization of the fact that the coal situation will be altered for several years if not for all time.

MR. DOW ON DETROIT CONDITIONS

At present the coal situation in Detroit is a little better. Alex Dow, president and general manager of the Detroit Edison Company, said:

"The situation is better as to both supply and price than it was last winter or even in May. We are doing our utmost to prevent repetition of the conditions of last winter.

"Coal production is hampered by the same influences which hold back every other industry; that is to say shortage of labor and materials. The machinery most needed in mining cannot be bought for delivery in less than seven or eight months. If the government exempts the workers in coal mines from military service, that will tend to maintain production. Unquestionably both the operators and the committee on coal production of the Advisory Commission of the Council of National Defense will do all that they can to increase the output.

PROMPTER CAR MOVEMENT

"The next question is that of transportation, and that is more serious. If the dangers of last winter are to be avoided, it will be necessary to have more prompt movement of cars. What is needed is not more cars, but more locomotives to move cars, more trackage and more men to man the locomotives and switches. In order to move a given amount of coal to us last winter twice the number of cars were required en route from mine to destination that would have been used under normal conditions. More locomotives, more trackage, more men would have overcome the necessity of using so many cars and the surplus cars would have been released for service elsewhere. I believe that the problem of transportation of coal will be lessened during the coming winter by various arrangements which will accelerate car movements. The railroads are certainly working with one another in a fashion heretofore unknown—and heretofore even illegal; and that there will be much slack taken up, and less duplication of work and less fuss, is already very certain.

"As to price—it is lower at the moment. I think that it will be lower during the next winter than it was last winter. The action of the coal production committee in co-operation with the coal producers has undoubtedly had an effect in making prices easier. The

speculator who did so much to boost prices last winter will be eliminated. There may be evasions on one excuse or another of the maximum price of \$3 per ton agreed upon by the coal production committee; already there is one in an attempt to add the 25 cents per ton selling cost where there is no selling expense. All indications, however, go to show that average prices will not reach the abnormal level of last winter, although they will be substantially above the old normal figures and likely to continue so for two years or longer.

"It behooves every central station company first to find out how much coal it can depend upon getting from producers with whom it has contracts; second, to consider very seriously what part it can chance buying in the open market."

Mr. Dow is of the opinion that the experiences which public utilities have undergone will lead them to a more general adoption of the policy of owning interests in coal mines as a protection against the future.

Miss Sarah M. Sheridan, sales manager of the company, said that the volume of new business continues to be substantially above the level of last year. Notwithstanding the heavy demand from power consumers and the difficulties of coal supply, the company is meeting all demands for power and from all classes of consumers in the settled districts. It is not soliciting new business as aggressively as heretofore and, on account of the dearth of materials and the high cost, has had to restrict extension into new districts and rural lines.

General retail rates are covered by informal agreements with municipalities which have one year to run, and the only rates that could be adjusted were the wholesale rates for primary energy. Practically all of that business is done on three-year contracts, and an increase of approximately 10 per cent is effective on renewals of these as they elapse and of course on new business. It has not been considered desirable thus far to use a coal-cost rider because the offer of a stabilized rate for a definite term is part of the established selling policy.

GET SIX MONTHS' SUPPLY, SAYS F. R. COATES

Frank R. Coates, president Toledo Railways & Light Company, advises every utility company to try to get six months' coal supply in storage before winter.

One of the great obstacles with which this company is contending is that coal-mining companies claim they cannot hold labor because of lack of cars. Coal operators with whom the company has contracts state that they are unable to get empty cars for loading coal and therefore cannot keep miners at work continuously. Under these conditions the miners find other work and the contracts for coal supply are not kept.

The situation at this time is somewhat better than it has been, but the company faces the winter with much apprehension.

As the growth of demand shows no sign of stopping, the company is rushing construction on its large new generating plant. By overtime work, it is figured, the station will be completed on Dec. 1. The equipment will be ready before that date.

A. K. Young, new-business manager of the company, said that the organization of his department is being maintained at its full quota. Active solicitation is being continued in every direction, and in both energy

contracts and merchandise sales excellent results are obtained. Mr. Young says that no indication of reaction in business is apparent and that any decrease arising from the war will be overcome by increases due to greater activities in other directions on account of the war.

CLEVELAND MUNICIPAL PLANT LOADED TO CAPACITY

In the public office of the division of light and heat of the city of Cleveland the following notice appears:

Until the new extensions of the power plant are completed:

1. No applications for electric power can be considered.
2. Applications for electric light may be made, but service will be installed only as replacements occur in territory where no other service is available.

Commissioner William E. Davis said that unless the coal situation is controlled it will cause the ruin of many public utilities. He spoke of a hearing in Washington before a committee of the United States Senate appointed to consider coal conditions which he attended recently. At this hearing a telegram from a Canadian consumer to an American coal company was exhibited. It ordered 50,000 tons, "price no consideration."

"People are bidding against each other in a senseless way," said Mr. Davis. "If, for instance, a manufacturer gets a contract for the construction of aeroplanes and has a large profit in prospect, he does not care what he pays for coal. He orders as did the Canadian consumer whose telegram I saw, without regard to price. The coal dealer cuts off his contract customers to provide for the man whose profits are so high he does not care what he pays. This condition mitigates decidedly against public utilities whose selling prices are fixed by contract or franchise."

Mr. Davis thinks that utilities have great difficulties to overcome in getting adequate coal supplies at reasonable figures for the next winter. He said that coal producers did not deny that \$1.50 physical cost plus 25 cents per ton would yield them a good profit, but it is impossible to buy at that price.

SITUATION IN INDIANAPOLIS

Charles C. Perry, president Indianapolis Light & Heat Company, said:

"The present necessity is that the companies shall be able to meet the extraordinary demands upon them for energy. These demands are made greater by war.

"Unless the companies can overcome their heavily increased costs of operation by corresponding increases in rates they will be greatly hampered.

"In addition to meeting higher operating expenses, the companies have the heavy obligation of providing facilities for the increasing power requirements of the future. We are working hard to complete our new plant in order to be ready with greater capacity for the coming winter. It is costing us twice as much as it would have done under former normal prices. This means that not only do we have to find a market for double the securities, but that our lasting interest charge is that much more in proportion.

"We, however, are presenting the facts about increases in costs of all materials as well as labor in asking the commission for authority to make the temporary surcharge of 30 per cent while conditions remain abnormal.

"The coal situation is more serious than is generally realized."

Selling Appliances to Employees

An Investigation into Current Practice and Policy Tending to Show that
the Method of Charging Cost Plus Overhead and
Handling Finds Greatest Support

MORE than once in recent months the suggestion has been made that central stations would find it advisable to give electric appliances to employees gratis, especially to salespeople. The argument that is always advanced when this suggestion is made is that if they are familiar with the practical operation of the appliances sold salespeople will sell more appliances and sell them better. They will be able truthfully to point out the merits of each appliance. They will have a deeper and far more intimate knowledge of electrical appliances from experience gained by using them in the actual routine work of the home. Other employees, too, through the every-day use of electrical appliances in their homes are better able and more apt to recommend the use of appliances to their friends and neighbors.

The main object of these suggestions, of course, was not to get free appliances for employees, but rather to increase the knowledge of employees, especially salespeople, in the ways of electrical operation.

An investigation of the policy of central stations in different parts of the country on this subject has been made by the ELECTRICAL WORLD. Throughout the entire investigation, however, no case was found where appliances are given gratis. In fact, in most cases the executives were very much opposed to giving appliances away to employees not from the standpoint of cost but from that of results. It was repeatedly pointed out that what is obtained for nothing is held cheaply. It is a fact that the average human being is so constituted psychologically that he takes most pride in that for which the most was paid.

On the other hand, there was very little evidence of the companies making any profit out of the employee's purchase of appliances. In fact, an analysis of the policy of twenty-two representative electric lighting companies showed only one company that charged the full retail price to employees. No reason for this was given by the company in question, but later when asked why employees received a consideration in regard to lighting sales it stated that there was no reason, and in fact that it was a bad practice.

COST PLUS BASIS MOST POPULAR

Of the remaining twenty-one, three had special appliance rates for employees, one 20 per cent off, another 33 1/3 per cent off and the third merely a special rate. Seven companies made a practice of selling all appliances to all employees at the invoice cost to the company, while the remaining eleven had established a cost plus basis. This cost plus basis, which seemed to be the most popular, provided that the employee should pay the entire cost to the company. In other words, in addition to the invoice cost there was another cost for storing, handling and other overhead. This extra cost as a rule is made a flat 10 per cent of the invoice cost. Others add 15 per cent, while some add the exact cost of these items instead of a flat percentage.

In one instance where appliances are sold at invoice cost they have to be for the employee's own use. When they are purchased by the employee for gifts the company exacts an additional 10 per cent for overhead and handling.

It is interesting as a sidelight that while most of the companies not only gave employees lower retail prices, but also allowed from ten to twelve months or longer as occasion demanded in which to pay for the appliance, there were one or two that sold to employees at reduced prices only for cash.

PACIFIC COAST PRACTICE ON RANGES

On the Pacific Coast a situation with regard to range sales was revealed which was not found in any other section of the country. A number of companies that charge invoice cost plus overhead and handling on socket appliances charge only invoice cost on electric ranges. One company reported that it also installs free all ranges purchased by employees. This item of inside wiring is by no means a negligible amount. The company using this plan reports that approximately twelve employees have thus far purchased electric ranges.

One of the Pacific Coast companies selling ranges at cost reports that this practice, which has been in effect a little over a year, has so far resulted in the placing of about thirty ranges in the homes of employees.

Some companies make it a practice to merchandise second-hand appliances that have been received—those that have been exchanged for something else or returned appliances—to employees. One company leaves the sale of such appliances to district managers. Employees receive regular sales letters telling what equipment is available and the terms on which it is sold. Another company places this equipment before employees at certain definite intervals. In the latter case it has been found that employees are very glad to have the opportunity to obtain these appliances. In this case most of the appliances offered are shopworn or slightly damaged through handling. These are offered to employees at a very considerable saving in price.

This distinction in the matter of appliance prices to employees has been found to give the desired results. In practically every place where such a plan has been tried out a large number of appliances have been sold to employees and a great many employees once they have purchased appliances have become enthusiastic boosters.

It is generally believed that employees should be encouraged to purchase and use appliances, and in a large number of cases they are actually urged to buy. One company reported that thousands of dollars' worth of appliances have been sold to employees, and it is known that they are in general use.

In making this investigation it was thought to be advisable to disclose current practice regarding the policy of charging employees for energy, it being felt that there might be some connection between the two prac-

tices. In some cases this is certainly so, for the employee has been encouraged in every way to use appliances.

Most companies give some reduction in energy rates from regular charges. These run all the way from a flat discount of 50 per cent to special rates of 5 cents per kilowatt-hour. Some of the others make no charge for the first block and the same rate as to other customers or reduced rates for all further consumption. One company makes no charge for the first 10 kw.-hr.; this is the greatest concession. Another company makes a flat charge of 25 cents for the first 30 kw.-hr., and charges 3 cents per kilowatt-hour for all in excess of 30 kw.-hr.

Quite a number of the companies investigated make no distinction in rates in favor of employees. In most of these cases, however, the State Public Service Commission has expressly forbidden any such discrimination in favor of employees.

An effort was made to find out what it costs a utility to follow a plan of reduced prices and rates to employees. Since the practice, however, is generally to sell to employees at the cost of the company, including handling and overhead, the cost of such policy is very small or nothing. On the matter of rates it is probably true that the utility neither makes nor loses money. From the financial standpoint the utilities stand neither to lose nor to make money from commercial dealings with employees, or at any rate a very insignificant amount either way.

VALUE OF REDUCED-PRICE PLAN TO UTILITY

That the plan, however, is of profit or advantage in other less tangible ways is very evident. Favorable advertising and publicity, enthusiastic boosting, knowledge of appliances, employees' good will, etc., are some of the advantages cited. The following paragraphs are quoted in this connection from different commercial managers:

"The small cost to the company of thus encouraging employees to use electric service is believed to be recompensed many times by the advertising which the company gets."

"We note that the employees who do 'cook by wire' are able to speak with assured confidence, and a statement direct from them to the future 'prospect' in regard to their own range carries with it a great deal of weight."

"I believe our policy has been beneficial in assisting the advertising of appliances to the general public and in bringing us certain data. Such a practice is likewise, I think, good policy on the part of a central station in promoting good will among our employees."

"We have obtained considerable information relative to the advantages or disadvantages of certain appliances and information relative to the cost of using the same."

"The reason for this [reduced prices to employees] is that it is necessary for employees to be familiar with energy-consuming devices, and the best way to become familiar with them is to use them in their own homes."

"This method [cost price] has been of advantage to the employees in obtaining electrical appliances below market prices and to the company because of the energy used. The educational advantages have been tremendous, and it is impossible for us to put a valuation on them. We are firmly of the opinion that central

stations should make it easy for employees to obtain electrical appliances for personal use."

SUMMARIZING

1. It is a more frequent practice to sell appliances to employees at invoice cost plus an amount sufficient to take care of overhead and handling.

2. Most companies make a distinction in favor of employees in regard to lighting rates.

3. These plans have been found to work out very advantageously to utilities in such intangible ways as advertising, education and good will.

TESTS ESTABLISH DATA FOR LARGE MINE HOIST

**Inertia of Flywheel on Motor-Generator Set Used
Sufficient to Hoist Load 1500 Ft. with Energy
Supply Uninterrupted**

The results of a series of tests under operating conditions recently made on an Ilgner-Ward-Leonard hoist installation in the mines of the Elm Orlu Mining Company at Butte, Mont., were given in a paper by R. S. Sage submitted at the recent "war" convention of the American Institute of Electrical Engineers in New York City.

This is one of the two largest installations of this type in this country. As the energy charge is based on the maximum instantaneous demand, the flywheel inertia was made sufficiently large to completely equalize the maximum duty cycle met in balanced hoisting from the deepest level.

The hoist-motor speed and direction of rotation are controlled by varying the strength and reversing the polarity of the generator field. Between the motor and generator there is inserted an overload circuit breaker and a single pole-line switch. The arrangement of the control levers is extremely simple, there being but one power lever, a forward movement corresponding to one direction of rotation, and a backward movement, the reverse.

A Welch safety device compels slowing down at the proper rate and provides protection against overwinding and overspeeding. As an additional protection, limit switches actuated by the skips themselves are installed in the guides. These switches, as well as the Welch device, cause the direct-current circuit breaker to open, in addition to setting the hoist brakes. In general, any emergency which will cause the direct-current circuit breaker to open will cause the brakes to be applied.

The total energy in the flywheel at 94 per cent synchronous speed is 117,000 hp.-seconds, of which approximately 50 per cent is available for operating the hoist in event of the set being disconnected from the power supply, the limitation being the speed at which the direct-current exciter is no longer able to hold up its voltage. If required, a complete trip with a fully loaded skip could be made from a depth of 1500 ft. (457.2 m.) on the energy of the flywheel, and a load of men could be hoisted from the deepest level.

Hoisting "out of balance" can be carried on without causing excessive speed reduction of the set or necessitating a higher limit of demand from the power supply.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

SCHEME FOR INSPECTING TRANSFORMER INTERIORS

Telescoping Tube with Lamp Mounted at Lower End, Which Is Sealed with a Glass Disk, Is Used to Inspect Windings and Connections

Often it becomes necessary to inspect the windings or interior connections of oil-immersed transformers. To overcome the difficulties of using a lamp and trying to see through the oil, one Southern central-station company is employing a telescoping tube the lower end of which is sealed with a glass disk to prevent oil filling the tube and obstructing vision. A lamp is attached to the outside of the tube near the lower end so that the glare of the filament will not reach the user's eye. When the proper voltage is not available for operating an incandescent lamp, a flashlamp may be attached to the tube. The tube is made of five sections, each about 2 ft. (61 cm.) long. This device enables the men to inspect the interiors of oil-immersed transformers without getting into the oil as is sometimes necessary.

ELECTRICAL OPERATION FOR A CEMENT KILN

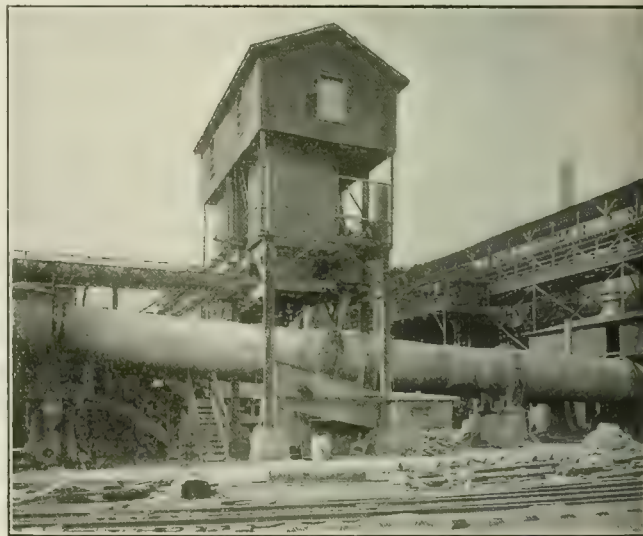
Reasons Given for Using Motor-Drive, Type of Motor Selected and Method of Control Employed

Since motor drive permits the most satisfactory kind of speed control and offers other advantages, such as simplicity and flexibility of arrangement, reliability, etc., it is especially desirable for rotary cement kilns. In the accompanying illustration is shown a view of a highly successful motor application of this kind. The kiln is 110 ft. (33.5 m.) long and 8 ft. (2.4 m.) in diameter. Ground rock is fed into the upper end of the kiln, which slowly revolves and works the charge downward. At the lower end powdered coal is blown into the kiln, where it burns almost instantly, producing the necessary high temperature for converting the mixture of limestone and shale into cement.

In burning cement the rock must be subjected to exactly the right temperature. If the temperature is too low the necessary chemical reactions will not take place, and if the temperature is too high an inferior product is obtained. The proper temperature can be obtained only when an exact relation exists between the quantity of rock supplied, the speed of its travel through the hot zone and the amount of fuel used. Constant attention is necessary to maintain this relation. Whenever the cement begins to burn improperly the kiln attendant can alter any one or all three of these variables, but it is obvious that the simplest and most satisfactory thing to do is to leave the rock and fuel feeds constant and correct irregularities by altering the speed of the travel

of the cement by changing the speed of the rotation of the kiln.

The latter method is employed at this plant. The motor driving the kiln is a 30-hp. Westinghouse slip-ring alternating-current 720-r.p.m. machine. It is mounted in an inclosed compartment under the kiln and is bolted to a gear that meshes with another gear mounted circumferentially on the kiln, the reduction being such that the speed of the kiln is about 1 r.p.m. An alternating-current motor is used because it can withstand the dust better than a direct-current motor. Dust-proof bearings are essential in this service, and the motor must not be dependent on small ducts for its ventilation, as these are liable to fill up and cause the motor to burn out. A slip-ring-type motor is used in order to provide speed control. Since a speed reduction of 50 per cent is sufficient and the torque is con-



MOTOR IS MOUNTED IN INCLOSED COMPARTMENT
UNDER THE KILN

stant at all speeds, the slip-ring motor's characteristics fit the drive suitably. This type of motor is also necessary to supply sufficient torque to start the huge mass of the kiln revolving.

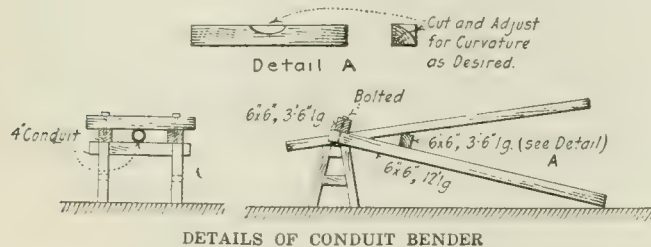
The kiln operator is stationed at the rear end of the kiln, where he is protected from the intense heat by a brick shield. He watches the burning of the cement through an aperture in the shield (using dark glasses to protect his eyes). From time to time he adjusts the kiln's speed of rotation by means of a conveniently located controller. Above this controller is an ammeter. Since the current taken by the motor will vary between definite limits under normal operation, erratic meter readings indicate trouble somewhere. Warning being thus given, repairs can frequently be made before the trouble has become serious enough to make necessary the shutting down of the kiln.

When the Interstate Light & Power Company of Galena, Ill., experienced squirrel trouble on a line which serves large power customers in the neighboring zinc fields it was unable to employ this method because the service could not be interrupted long enough to do the work on the poles. It was therefore decided to keep the squirrels from climbing the poles by annular disks of galvanized iron placed around each pole about 8 ft. (2.4 m.) above the ground. About 1000 poles between Galena, Ill., and Plattsville, Wis., have been equipped in this manner and results have been entirely satisfactory. The squirrels, nimble as they are, have been unable to pass the disk, and their pernicious activity has been checked.

OUTFIT FOR BENDING CONDUIT

Operation Performed by Inserting Conduit Between Cross Timbers and Bearing Down

Elaborate apparatus does not have to be employed for bending conduit if an outfit like the one illustrated herewith is constructed. The principal part of the outfit consists of two 6-in. by 6-in. (15.2-cm. by 15.2-cm.)



timbers 12 ft. (3.6 m.) long with a 3½-ft. (1.14-m.) timber of similar size bolted across the end as shown. This end of the frame is laid on a sawhorse or pile of bricks or stone, one end of the conduit to be bent being placed beneath the cross timber, and another cross timber, modified as shown in detail A, placed across the frame beneath the portion of the conduit which is to be bent. Downward pressure may then be applied to the free end of the conduit, causing it to bend over the unfixed cross timber.

MAKING BATTERIES AS AVAILABLE AS GASOLINE

How Details of Storage-Battery Compartment and Garage Truck Were Worked Out to Facilitate Quick Battery Change

In connection with a storage-battery rental and service plant for electric passenger vehicles, the Fashion Garage of Chicago has worked out a scheme to facilitate battery changing. Charged batteries in trays fitted with castors are kept in readiness on small trucks the top platforms of which are equipped with two sets of angle-iron tracks. When a battery is to be changed the battery-box leads are first detached. Then two angle-iron uprights which are hinged to the frame of



BATTERIES BEING EXCHANGED

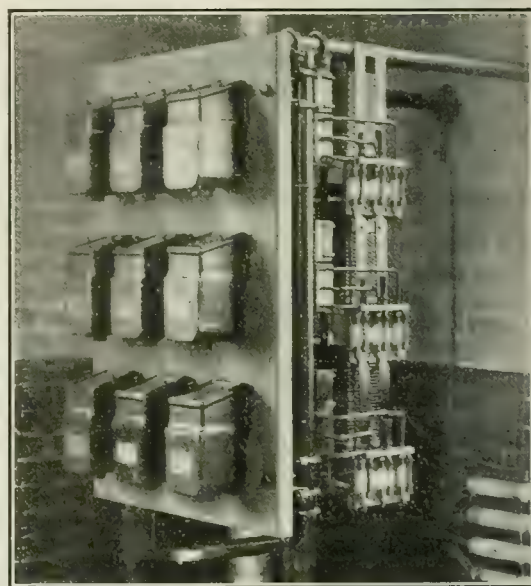
the car and which hold the battery in the car are released and swung down into a horizontal position where they form a link between the track in the battery compartment and the track on the garage truck. The battery in its tray may then be rolled out on the platform

of the truck. With this done the truck is moved over so that the charged battery is in line with the battery compartment and the fresh battery is rolled into the car. It is secured by means of the hinged track sections and the leads are connected. By the use of this plan batteries are changed in the light Milburn passenger cars in about two and one-half minutes, so that getting a new charge is accomplished as quickly as filling a tank with gasoline.

MOUNTING RELAYS SEPARATELY

Arrangement Which Makes Relays Accessible and Reduces Wiring on Main Switchboard

Instead of mounting relays separately on feeder panels and so close to the floor that their adjustment and maintenance cannot be performed with maximum convenience, the arrangement shown in the accompanying illustration has been adopted in a Maine substation.



RELAYS MOUNTED SO THEY MAY BE ADJUSTED AND MAINTAINED WITH CONVENIENCE

The relays are mounted on a single panel in a corner of the substation operating room and connected with their respective oil switches by leads carried in conduit. Space is provided at the rear for resistor units. The relay switches can be seen at the right. Inspection of relays is accomplished in minimum time with the arrangement shown. Furthermore, it provides maximum accessibility and also reduces the amount of wiring and equipment required on the main switchboard panels.

ENAMELED TAGS FOR POT-HEADS

Stenciling and Aluminum Tags Are Objectionable Because They Become Illegible

A Middle West company with a rather extensive underground system is changing its method of designating pot-heads in manholes. Enameled-letter tags are now being used to mark the pot-heads instead of stenciling or using aluminum tags. Stenciling is objectionable because the letters become covered with dirt and cannot be found. Aluminum tags are affected by gas and moisture so that they become illegible.

CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

VERY LITTLE EVIDENCE OF COMMERCIAL CURTAILMENT

**Most Companies Trying to Increase Departments'
Activities to Sell Household Devices, for Which
There Is an Economic Demand**

Since early spring there have been reports from here and there that central station companies were materially reducing their commercial departments. To find out to what extent this has developed the ELECTRICAL WORLD has carried out an investigation of actual conditions.

Very few companies, it was found, have taken any such step. No single reason can be given for those that have. One property found the present to be an excellent time for removing a lot of deadwood in its commercial organization; another found the station capacity all sold and decided to dispense with salesmen until further equipment could be secured. Two companies found it to be necessary that they economize in every way possible and picked out the commercial department as the place to start.

In a number of cases, of course, there have been reductions, but these have almost all been occasioned by enlistments.

Many properties have already laid plans for materially increasing their sales force. The economic conditions that exist to-day, particularly as affects household labor, have resulted in a much wider use of domestic electric appliances. Further to increase appliance sales and develop off-peak load has required more commercial men.

The feeling is very strong that the high cost of coal is sure to lead to increased popularity of electric cooking, especially in the use of smaller apparatus. Labor-saving appliances are being pushed more and more, and there is work enough for solicitors to do, especially in face of withdrawals for military service, past and prospective.

VALUE OF LOCAL TRADE IN PROMOTING RANGE SALES

**Western Company Encourages by Special Inducements Contractors and Dealers to
Boost Electric Cooking**

Whether or not the electrical dealer and contractor is a factor at present in the development of electric range sales is a much debated question. Generally it is believed by the manufacturers and central stations that contractors and dealers must wait until the pioneering is done. However, there is one property in the West that believes the dealer and contractor are valuable assets in promoting range sales and therefore encourages the local trade to be on the outlook for this class of business.

This company feels that special inducement should be given to electrical contractors and dealers and other electrical men in order to get them to boost the electric range or the idea of "cooking by wire." It has electric ranges on display in about eleven electrical contractors' and dealers' stores and gives the contractor or dealer \$5 commission on each electric range "prospect" he turns in when a sale is closed. The company feels that this helps it to a great extent, because it is estimated that approximately 5000 persons see these ranges on display and a large percentage of them inquire as to their feasibility, rates, etc. The electrical contractor recommends the electric range and assures inquirers that it is without doubt a success. A large number of the electrical contractors and dealers have purchased ranges themselves.

Recently this company invited the local electrical contractors' and dealers' association to hold its regular monthly meeting in its electric range store, inviting them to come at 6.30 p. m. Forty-three electrical men attended this meeting. The company served them with a very attractive electrical luncheon entirely cooked by electricity by its demonstrator.

The reason for the invitations to this luncheon was to get the trade to co-operate in boosting the electric range. This is the second luncheon of this kind that the company has had. After the regular business meeting, which was very short, talks were given on the electric range and how to promote its sale.

RETAIL DISTRIBUTION SHOULD BE ENCOURAGED

**Suggested Method Whereby Central Stations Can
Discourage Non-Electrical Dealers from
Selling Inferior Socket Appliances**

Milton Henoch of the appliance section of the Westinghouse Electric & Manufacturing Company, in a paper on the "Development of the Sale of Socket Appliances," read before the commercial men of the Indiana Electric Light Association at Fort Wayne, Ind., said in part:

"The dealer, the department store and the hardware store should be encouraged to sell socket appliances; this encouragement should come directly from the central station. The analyses of merchandising by this class of stores show that it is necessary for them to add an overhead of about 40 per cent, and naturally they will refuse to carry a line that does not show at least this percentage of profit. The result will be that they will stock inferior goods and will sell to the central station consumer, who naturally comes to the central station with his complaints. For this reason, together with the fact that the central station will profit continuously by the sale of appliances, I desire to recom-

mend that central stations encourage the practice of offering different classes of merchandisers a certain amount of cash upon presentation of a sales slip to the central station for the sale of a device on its lines.

"Assuming, for instance, the sale of a 6-lb. electric iron, the payment of 50 cents by a central station to the merchandiser would encourage the firm to conduct an electric department and carry a better class of socket appliances, for the reason that the cash assistance from the central station would permit him to buy a better class of goods."

Mr. Henoch also pointed out that after fifteen years of sales experience there seems to him to be no saturation point in the sale of electric appliances.

THE IMPORTANT DUTY OF MAKING FRIENDS

Upon the Management Is Placed the Double Responsibility of Having the Best Relations with the Employees and with the Public

BY WILLIAM E. KEILY

Perhaps no more important duty is laid upon the management of a public utility company than that of making friends for the enterprise. The art of making friends is very important in all avenues of life. It is very important in business—business of all kinds. But in no other field of activity is it more important to make friends than in the administration of public utilities.

MAKING FRIENDS WITH EMPLOYEES

This making of friends is a double function. First, the management of a public utility should make friends with its own people. The employees of the privately owned public utility company are expected, and often urged, to be loyal to the management. But it is always to be remembered that loyalty is strictly a "fifty-fifty" proposition. Those who expect loyalty must give loyalty. If the manager of a public utility organization desires the unswerving loyalty of the men under him—and what manager does not?—he must himself be thoroughly and deeply loyal to those men. He must advance their interests, consider their place in the scheme of things, plan so that they will get a fair proportion of the wages of the utility, and see to it that the deserving have opportunity for advancement. This spirit should be manifested by the heads of all departments. Every man or woman in the organization should stand in the attitude of a man with both arms outstretched, one hand reaching toward the man higher up and the other toward the man lower down.

This attitude should be typified throughout the whole organization. The stockholders may be considered as a body of men and women thoroughly loyal to the body politic and at the same time friendly to the utility corporation in which they have invested their money. The directors form the link between the stockholders and the president. The latter reaches up to the directors and down to his subordinate executives. These in turn have a helping hand for the heads of the departments, the latter for the subheads of departments, and so on. The men in authority must have interest in advancing the men beneath them and not confine their efforts to advancing their own interests.

In a recent issue of *Pearson's Magazine*, Guido Bruno has an instructive article on "Thomas Alva Edison: The Man." This article is headed by the following personal message from Mr. Edison: "The boys here work with me, not for me. All of us are co-workers for the prosperity of our country and for the world." In this article Mr. Bruno tells about an interview with Mark M. Jones, who has charge of the employment offices of the Thomas A. Edison laboratories and factories. The writer quotes Mr. Jones as follows:

"There are three words taboo in our factories—authority, welfare and employee. We have changed authority to responsibility. Even the man who sweeps the floor must feel the responsibility of his job, the urgent necessity of doing his work well, to enable all others to work in cleanliness. There is no such thing as welfare. It smacks of charity. We put betterment in its place. The lowest as well as the highest of us is seeking betterment throughout life. And employees? Co-workers sounds better and comes nearer to the real relation between ourselves and our men."

There seems to be food for thought in the foregoing statement.

MAKING FRIENDS WITH THE PUBLIC

It is obvious that it is also of the very first importance for the utility to make friends with the public it serves. Friendship is partly instinctive. Every person knows whom he likes and whom he does not like. We all remember Tom Brown's declaration in rhyme:

I do not love thee, Doctor Fell,
The reason why I cannot tell;
But this alone I know full well,
I do not love thee, Doctor Fell.

The utility does not want to be the "Doctor Fell" of its community. Antagonism is none the less dangerous, probably more dangerous, if it is ill-defined and unreasoning.

The conduct of the utility should be such that the general public, the great majority of the people, will have an instinctive feeling of friendliness, and not of unfriendliness, toward the utility. If the utility is the fortunate possessor of this feeling of general friendliness, it will have an asset of almost priceless value.

This friendliness must be deserved, of course. If the utility is for the people, the people will be for the utility. "By their fruits ye shall know them." The utility should seek confidence, should seek to be trusted, and should demonstrate to the average man that it is worthy to be trusted. It will not ever be able to please everybody; but it must be the exponent of the "square deal," and the people must have it borne in upon them that this is true.

Cultivating friendship must be done with the friendly desire to obtain friends. It will be of no lasting avail to assume a sham friendship for business expediency. A mock friendship deceives no one very long. What is needed is a deep, earnest desire for reciprocal friendship—a friendship that gives as well as takes—and the simple courage necessary to make that purpose known despite the possible sneers of the malicious and of the cheap-wits.

The utility that learns with honest helpfulness the art of making friends—making friends with its own people and with the public it serves—will have little to fear in performing its service for the public and in retaining a legitimate profit for doing that service.

OHIO PROGRESS TOWARD STANDARD VOLTAGES

Standard Voltage Statistics Compiled as of June Last
Show 78 per Cent of Stations Operating
on 110, 115 or 120 Volts

In the report of the committee on standardization of voltages, Ohio Electric Light Association, S. E. Doane, chairman, made at the recent convention, the situation in Ohio, with respect to the rest of the United States, was brought out. The progress of voltage standardization in Ohio is shown below in the comparison of the trend of Ohio stations with those of the remainder of the United States as of March, 1916, October, 1916, and June, 1917:

	Percentage of Central Stations Operating on Standard Voltage		Percentage of Population Served on Standard- Voltage Circuits	
	Ohio	U. S.	Ohio	U. S.
March, 1916	57	61	65	53
October, 1916	68	64	71	56
June, 1917	78	66	75	60

This seems to indicate that Ohio is somewhat ahead of the country in this standardization movement and that Ohio has made considerable progress in this direction since March, 1916. In these figures three voltages are considered as standard, 110, 115 and 120. Companies operating on one or the other are considered to be operating on standard voltages.

CENTRAL STATION VOLTAGES NOW PREVAILING

A further analysis, showing the voltages at which the Ohio central stations reporting are operating as indicated in June last, follows:

Voltage	Number	Station Percentage
100	2	0.5
104	2	0.5
105	3	0.7
106	1	0.2
107	1	0.2
108	4	0.9
110	202	45.6
112	29	6.5
113	9	2.0
114	5	1.1
115	134	30.2
116	4	0.9
118	12	2.8
120	9	2.0
122	1	0.2
125	2	0.5
170	1	0.2
220	20	4.6
225	1	0.2
230	1	0.2
Total	443	100.0

The following changes of voltage of Ohio central stations are indicated from October, 1916, to June, 1917:

Voltage	Number of Stations
108 to 110	2
110 to 112	1
112 to 115	4
113 to 115	1
110 to 115	1
114 to 115	1
116 to 115	2
115 to 110	3
125 to 112-115	1
Total	16

It is interesting to note that 65 per cent of the changes were from off voltages to standard voltages, and that there was only one change from a standard voltage to an off voltage.

GETTING READY FOR THE CHRISTMAS GIFTS

Many Companies in Different Parts of Country Co-operated in Preparation of N. E. L. A. Commercial Section Booklet

The Commercial Section of the National Electric Light Association has issued sample copies of its 1917 Christmas booklet.

F. D. Pembleton, chairman publication committee, writes that many companies in different parts of the country have co-operated in preparation of the booklet. This year, with constantly increasing costs of paper,



CHRISTMAS BOOKLET OF N. E. L. A. FOR 1917

printing, etc., Mr. Pembleton says that central stations will find the effective and practical booklet especially economical.

Shipments will be made well in advance of the Christmas season, insuring deliveries in ample time for early distribution to customers.

The price, f.o.b. New York, ranges from \$3.60 for 100 copies to \$16.50 per 1000 in quantities of 50,000 and over.

MANY FLAG RAISINGS IN THE MIDDLE WEST

Central Stations Conduct Patriotic Ceremonies in Which Employees Participate—Typical Program at Indianapolis

Throughout the Middle West central station officials and employees have been participating in flag-raising ceremonies. Power house roofs, tall office buildings and even special steel flagpoles are being used to float the flag above the entire community.

A typical ceremony was that at Indianapolis. Music was supplied by the Indianapolis police band. The address of presentation was made by Frederick L. Ray, superintendent of plants, and the 12.5-ft. by 25-ft. flag was accepted by L. G. Rothchild, special representative for the company. In addition to the officials and employees of the Merchants' Heat & Light Company, the employees of several other large industrial concerns were present, making a total of 600 people. The flag flies 132 ft. above the ground over one of the company power houses.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

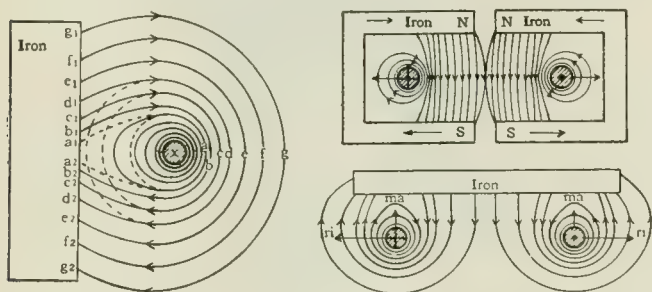
MECHANICAL STRESSES BETWEEN CONDUCTORS

Attraction or Repulsion Under Ordinary Bus Conditions Does Not Become Important Until an Amperage of 25,000 Is Reached

UNDER ordinary bus conditions, says K. C. Randall in the *Electric Journal* for July, when the conductors are rarely less than 12 in. (30.5 cm.) apart, the mechanical stress of attraction or repulsion does not assume important proportions until some 25,-

ration is involved. Eddy currents in the iron masses invariably increase the repulsion of the conductors, as their direction must be opposite to that of the conductor producing them.

Iron appears in the concrete structure as a reinforcement, and the usual disposition will not affect the normal forces between conductors. Even if in a position to increase the forces, the iron will not be in sufficient quantity to affect them materially. In the design of structures for conductors likely to carry large currents it is not advocated that iron in the proximity of the conductors be used in any formulas to reduce the calculated amount of stress between conductors. On the other hand, it is not believed that under the same circumstances an addition should be made to the calculated air value to allow for the presence of iron. Eddy currents in adjacent iron may add to or subtract from the repulsion between conductors, the effect being estimated as not exceeding 1 per cent of free air repulsion.



FIGS. 1, 2 AND 3—EFFECTS PRODUCED BY CURRENT-CARRYING CONDUCTORS IN THE PROXIMITY OF MASS OF IRON

000 amp. flows. With the exception of low-voltage plants, such a high current can be obtained only from large generating plants or networks, and then only near the stations, as the reaction or resistance of the circuit will limit the current. If, as shown in Fig. 4, the relative space occupied by the iron is large, the force of attraction due to it will be greater than the force of repulsion between the two conductors, and the latter will tend to close against the iron mass. The effect of the iron in Fig. 2 is to alter the distribution of the field surrounding the conductors and to attract the conductors to it as indicated, but the repulsion between conductors will not be materially changed from the value for free air. The author points out that wherever iron is interposed between conductors the tendency is to diminish the repulsion between them; and, conversely, whenever iron is placed above or below the con-

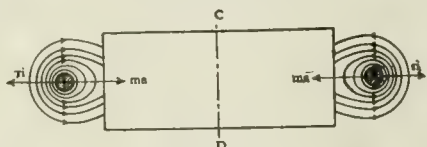


FIG. 4—FORCE OF REPULSION TENDS TO CLOSE AGAINST IRON

ductors, paralleling their plane, the effect is equivalent to diminishing the distance between the conductors, and hence they will repel each other with greater force than in free air.

The diagrams discussed in this article by the author show that the addition of the iron may cause a decrease or an increase in the repulsion between conductors. The result, it is pointed out, depends upon the distribution of the iron, and sometimes on the quantity, in case satu-

Lamps and Lighting

Some Observations on Office Building Lighting.—S. G. HIBBEN.—An important step can be made in office building lighting by the architect and engineer conferring regarding the location of outlets. Frequently the deciding factor in the choice of fixtures is the ease of cleaning and low maintenance cost. Quality of illumination and appearance of fixture are also important. The cleaning cost is one of the largest items of maintenance. However, the money is well spent, because where maintenance is not good an increase of illumination amounting to 30 per cent has been obtained when fixtures are cleaned. To facilitate cleaning attention should be given to the construction of the fixture and the relative positions of the bowl and lamp. In many offices there is a tendency to mount the lamps too low. It is usually good practice to employ no more than three sizes of bowls and no more than four sizes of lamps to simplify maintenance. Care in selecting the interior finish of a room is very important. For instance, the substitution of cream-colored for green walls will increase the desk illumination by 17 per cent. Substitution of ivory white for cream-colored walls will net an increase of 12 per cent in illumination, and the substitution of ivory-white ceilings and cream-colored walls for cream ceilings and green walls will net an increase of 32 per cent in illumination. With totally inclosed globes the substitution of cream colors for green walls increases the desk top illumination to 27 per cent.—*Transactions of Ill. Eng. Soc.*, June 11, 1917.

Traction

Spring Lake Marine Railway.—JACOB A. HARMAN.—Description of an electrically operated installation serving the same purpose as a marine lock, but costing less to install and operate. It is situated in the Illinois

River valley and connects the river with a lake shut off therefrom by a levee. In general, the marine railway consists of an inclined track leading up each slope of the levee to a turntable on the summit of the levee. A cradle, or boat carriage, is mounted on wheels so that it can be lowered on these inclines into the water to receive the boats, raised to the turntable, rotated thereon, and lowered to the water again on the opposite side of the levee, keeping the boat in its natural position throughout all of this operation. An electric hoisting engine for hoisting and lowering the boat carriage and an electric swinging engine for rotating the turntable are housed in a reinforced concrete building alongside the turntable.—*Gen. Elec. Review*, July, 1917

Electric Traction on the Great Italian Railways.—CARLO M. LERICI.—The Italian railways have been the first in Europe to make use of electric traction upon main lines. Electrification has been carried out upon mountain lines offering specially great difficulties from their profile and where steam had proved itself entirely inadequate even with the newest equipment. In this article the author enumerates the Italian lines where electric traction has been instituted. The chief of these are four in number—the Mont Cenis line, the line starting from the port of Savona, the old Giovi line, and the extension of the Giovi line. The first of these lines has the largest mountain section, the second is built over the most varied route as regards change of grades, the third includes the steepest ascent to be found on any great European line, and the fourth has the heaviest traffic in Italy. The system used is, the author says, typically Italian. It is three-phase, two phases being aerial and the third furnished by the rails, with a frequency of 16.7 cycles and a tension of 3700 volts. The locomotives are furnished with motors of the Gallileo Ferraris type with revolving field.—*Revue Gen. de l'Elec.*, April 28, 1917.

Installations, Systems and Appliances

Electric Drive for Cotton Mills.—J. E. MELLETT.—An account of a study of power requirements in different departments of cotton mills, with suggestions as to the best method of applying motors to different machines. Electrical installation costs are given for a number of cases, the figures being given for the motor equipment and distribution system. The cost of heating mills is also brought out. Advantages of central-station service are included, lower operating cost, improved quality of product and increased production being emphasized.—*Gen. Elec. Review*, July, 1917.

Granular Carbon Electric Furnace.—SAMUEL A. TUCKER.—Brief description of a furnace for maintaining temperatures considerably above those possible with wire-wound furnaces. It consists of a refractory receptacle somewhat larger than the body to be heated, the intervention space being filled with carbon granules. At four diametrically opposite points in the receptacle are inserted carbon electrodes.—*Met. and Chem. Engineering*, July 1, 1917.

Wires, Wiring and Conduits

Permissible Currents for Underground Armored Cables.—R. V. PICOU.—The chief factor influencing the stationary temperature attained by a buried cable is the nature of the surrounding medium. The author adopts the hypothesis that the isothermal surfaces are concentric circles with the cable as axis, and that at a

distance = $100 \times$ radius, the effect of the heating is negligible. The permissible current can be deduced from the equation—

$$i^2 = \frac{2\pi}{\rho} \frac{s\Delta\theta}{\sigma_1 \log_e N + \sigma_2 \log_e (R/r)},$$

where $N = R'/R'' = 100$ (by hypothesis), and σ_1 and σ_2 are the specific thermal conductivities of the soil and insulation. Kennelly, Teichmann and Humann have made experimental determinations of σ_1 ; of these Kennelly's are considered the more correct. For σ_2 account is taken of the values obtained by Melsom and Booth, Atkinson and Parker, and Powell. The permissible currents for single cables are calculated taking $\sigma_1 = 200$ (15 per cent moisture) and $\sigma_2 = 230$. For multiple cables, with n equal conductors, the term $\log_e R/r$ is replaced by $\frac{n}{2} \log_e \left(\frac{a}{nr} \frac{R^{2n} - a^{2n}}{R^n a^n} \right)$, where r and R

are respectively the radius of conductor and of lead sheath, and a is the distance between the axes of the cable and the conductors. The temperature rise allowed is 40 deg. C., which with a soil temperature of 10 deg. C. gives maximum temperature of 50 deg. C. Tables of permissible current are given for single, twin, three-core and four-core cables (10 to 250 mm.² cross-section), with different thicknesses of insulation, also factors to be applied when several cables are laid together. From these the author deduces a table of values which in practice can be considered as approximately correct up to 20,000 volts.—*Revue Gén. d'Élec.*, March 17, 1917.

Electrophysics and Magnetism

Convection of Heat from Small Wires in Water.—Results of an investigation to determine the laws of forced convection of heat from small wires moved transversely in water. When the velocity at which the wire was moved was in the range 6 cm. to 16 cm. per second and the temperature elevation of the wire not more than 23 deg. C, the linear heat dissipation was found to follow the law $P = 0.031 O\sqrt{V}$ watts per linear centimeter. In this equation O is the temperature elevation and V is the velocity of the wire in centimeters per second, taking into account a certain experimental virtual velocity $vo = 1.15$ when the wire is at rest, and explainable as a velocity of free convection.—*Journal of the Franklin Inst.*, July, 1917.

Miscellaneous

Reconstruction of Factories in Invaded Territory.—The French national committee for the reparation of damage caused by the war has published a pamphlet by its vice-president, Léon Francq, dealing with the laws passed and proposed by the French parliament for bringing about rapid reconstruction and remanning of destroyed factories by means of indemnities and credits. It is pointed out that it would be a mistake to rebuild structures that were not well situated for their purpose or to re-establish industries where they could not be made successful. Central stations, for instance, should not be rebuilt on sites where the distance from an economical source of coal supply or from water power rendered them unremunerative. The electrical industry, which is concerned with the operation of so many manufactories of all kinds, is vitally concerned in the application of similar rules to all industries that it is proposed to re-establish.—*L'Industrie Elec.*, June 10, 1917.

Taking Stock in Engineering

To the Editor of ELECTRICAL WORLD:

Sir: What would happen to a business employing upward of 100,000 men if it kept no books, took no inventory, balanced no accounts? You say it would fail. Probably so. Successful business must be able to answer the question, Does it pay? If not, why not? But to-day any business that is to continue to live must prepare to answer also the question, Does this business pay the employees? Upon the answer to this question depends the right of the business longer to exist.

One hundred thousand technical men, approximately, employed in engineering work in this country are now asking with regard to their work, Why does it not pay? With reference to their problem they are in the position of the business man who has no system for balancing accounts but who feels that he is failing. He knows in general that his particular line of endeavor is not bringing him personal success; he knows specifically that he can no longer pay his bills.

Several years ago systematic action was taken to induce technical men to take up the study of their relations to the engineering profession and of the profession to society, with a view of bettering both relationships. This action has been fruitful to the extent that technical men have turned their thoughts toward problems other than those having to do with bridges, buildings, machinery, steam and electricity. They are asking, "Why does engineering work not pay the men employed in it? Why does it not bring influence and respect?" They are taking an inventory of engineering; they are finding out why the business does not pay. At least they are considering some of the more conspicuous items of assets and liabilities. There are springing up throughout the country independent organizations of technical men having varied purposes, but each aiming to discuss the common question, "What is the matter with engineering work and what is the remedy?" These organizations are largely among employees. They are fair-minded. They are looking to the elevation of the engineering profession. They are also human and expect their work to pay them financially. They do not expect to take their pay from the employer, but from the ultimate consumer; but it must come through the industries, their employers.

To this problem are attached great individual interests, but it reaches farther than the individual. It concerns the profession; it concerns industry and business; it concerns our educational institutions.

What is to be done about it? Will the engineering profession act as a unit and employ such measures as will place it in a more estimable, economic and civic relation to things as a whole, or will the profession let the rank and file of employees solve the problem alone? If so, will they look first to

Readers' Views and Comments

the ethics and ideals of engineering, or will they join with organized labor in order to answer their question of bread and butter? The latter outcome might prove a calamity to engineering work. It would secure increased compensation for employees, but it would add another factor to the present condition of industrial intrigue, and it would split the engineering profession into two hostile camps.

There are in this country, say, 100,000 men engaged in engineering work. These men cannot all become employers without a proportionately larger number becoming employees. There must remain, therefore, as now, a large percentage of technical men in the employ of individuals, corporations and the government. Most of these men will do more or less routine and systematized work. They must be paid a wage that will enable them to live decently, keep their self-respect and raise a family. If these men continue to sell their services in the open market, they cannot hope to buy back at organization prices their pro rata of the products of organized labor, organized production and organized industry.

It certainly is no credit to the engineering profession that employees therein are not paid commensurately with organized labor. There would be no discredit attached to the profession if the welfare of employees were to be given due consideration.

The successful solution of this problem must be national in extent.

It must consider the interests of all parties—employers, employees, industry, civic activities and educational institutions.

It must include all branches of engineering.

It must provide sufficient compensation for engineering work to make it pay, attract better men and keep the best of those already engaged in it.

It must place engineers employed in public work in a more estimable position.

It must maintain high standards of professional ethics.

It must instill into engineers a sense of civic duty and equip them to perform that duty.

Such a solution can be approached only when all interests are represented. A commission of men from the great engineering societies of the country could be made representative of employers, employees, public work, industries and education. The work of this commission could be and should be financed by the engineering societies. It is to their interest that they should do so. As soon as the younger engineers realize that the national societies are injecting the idea of humanity into engineering work, they will feel that

the associations have something to offer to them which is worth while. They will give their support morally and financially. There will then be no need of separate organizations to fight out these problems. The profession will be a unit. C. E. SCHUTT.

Chicago.

Expansion of the Hydro-Electric System in Ontario

To the Editor of ELECTRICAL WORLD:

Sir: The negotiations which have been pending for some time past in regard to the acquisition of a power-producing plant by the Hydro-Electric Commission have culminated in its purchase of the assets of the Ontario Power Company of Niagara Falls. This purchase has been found necessary to render practicable the commission's project for the construction of a power development at Queenston. By no other means could there be secured for that development a share of the permissible diversion of water from the Niagara River.

The Hydro-Electric Commission has not heretofore produced much energy, but has purchased from the Ontario Power Company most of the electrical energy which it has been distributing through its transmission and transformation system to a number of cities and villages in the Niagara peninsula. The company has since 1908 provided the commission with power up to a total of 100,000 hp. at the very low price of \$9 per horsepower. The Ontario Power Company sold the rest of its plant capacity to other customers at much higher rates, which are understood to have been not less than \$12.50 and as high as \$16 in some cases.

The result of the purchase of this company's rights and business will be the eventual discontinuance of its plant at Niagara Falls and the diversion of the water to which it is entitled through a new line of conduit to Queenston Heights. The water which the power company was empowered to utilize is 11,180 cu. ft. per second. This flow permitted of a development of about 180,000 hp. on the fall of 160 ft. at Niagara. At Queenston Heights the same volume of water will have an increased fall and upon a total head of 310 ft. will develop about 390,000 water hp. or 300,000 electrical hp. The cost of the Queenston conduit and plant, it is stated, will be about \$15,000,000 or about \$50 per electrical hp.

If completed for this expenditure, it will be in itself a very economically developed source of water power. Such a moderate cost substantiates the policy outlined in "An Expensive Experiment," Chapter III, page 61, of eventual removal of all of the water-power developments from the falls and their replacement by others, making a larger and better utilization of the water diverted, at Lewiston and Queenston, below the rapids. But this removal does not relieve the new development from the investment in the existing plants, and in this case we can see in what position the Hydro-Electric

Power Commission will find itself as regards the cost of energy upon the completion of the Queenston plant.

The Hydro-Electric Commission purchased and sold in 1915 about 80,000 electrical hp. at the price of \$9, and was entitled to 20,000 hp. additional at the same figure. During 1916 it is stated that the demands for munitions factories increased the sales of the commission to a total of about 150,000 hp. Of this, 100,000 hp. cost \$9, and 50,000 hp. was taken from the Canadian Niagara Company at \$12 per horsepower, an average price of \$10 per horsepower.

The price at which the Ontario company's property and franchise has been acquired is \$4,230,000 less than its book value, and if it continued as a going concern with better prices for its output, it might be made to return a fair income. As it is, the company earned in 1915 only a gross revenue of \$2,396,277; its operating expense was \$894,924, or about 37 per cent, or \$4.90 per horsepower, leaving \$1,501,353 net income to meet all fixed charges.

The bonded indebtedness is \$14,669,000 the annual interest upon which is \$767,118, or about 5¼ per cent. Depreciation at 3 per cent absorbs \$438,000. These items would leave only a return of 2.96 per cent on the common stock. The bonds represent the approximate cost of the Niagara plant, which under the new conditions is to become a total loss. For the rest of the assets of the company, which include its water rights and \$10,000,000 of stock, the commission exchanges \$8,000,000 of provincial bonds which are now carrying interest at the rate of 5 per cent, and require the usual sinking fund on thirty years' amortization, at the rate of 1.8 per cent per annum. The business, if continued, would fail by \$248,000 to meet these charges.

The cost of the new development at Queenston must also be provided by the issue of more provincial bonds, and when completed must carry the expense of the purchase of the power company's business.

The property of the Ontario company has been taken over at a cost of \$126 per horsepower of capacity, and the cost of the Queenston project added thereto will bring the cost of developed power capacity, notwithstanding its increased scale, to about the same figure,

The total expense of the new scheme will therefore be close to \$38,000,000, and the accompanying fixed charges are such that the cost of the production of power will be increased rather than diminished by the new development. The interest on the bonded indebtedness taken over by the commission, and upon the provincial bonds issued for the purchase and for new construction, will amount to \$1,917,000 per annum, or upon the new development when completed \$6.39 per horsepower. If the sinking fund is applied to the provincial bonds at the thirty-year rate, it will add an annual expense of \$414,000, or \$1.38 per horsepower. Depreciation must include some suitable provision to wipe off the cost

of the abandoned plant at the Falls, and at the low figure of 5 per cent per annum on the bonds outstanding this would amount to about \$733,000 per annum. If depreciation on the new plant is provided at the rate of 3 per cent, the effect would be to add to the fixed charges \$3.94 per horsepower per annum.

The cost of operation and maintenance of the company's plant has been at about \$4.90 per horsepower, which, added to the fixed charges, will make the total cost \$16.57 per horsepower, which is greatly in excess of the price at which the commission has heretofore purchased its service.

The commission has doubtless been forced into this situation by the rapidly increasing demands for energy, due partly to the natural expansion of business in Ontario and partly to its unduly low prices. It has been selling energy at an average price of \$20 per horsepower, which is less than the full costs when purchased at an average price of \$10 per horsepower. Its political future is bound up with the maintenance of the low prices at which it disposes of the energy, and its situation practically compels it to find energy to meet any demands. Thus, as the capacity of the power companies at Niagara is insufficient to meet the growing demands, fostered by the commission's methods, the only recourse was the arbitrary means used last fall with the Canadian-Niagara Company of commandeering 50,000 hp. at a price lower than that company had contracted its sale. The other companies are fully occupied in producing energy for Toronto and Hamilton needs. The commission has therefore been compelled to buy out the Ontario Power Company and to find means of increasing its capacity. But thereby it loads the new venture with the cost of a disused plant. These political and commercial necessities of the situation appear to be the justification for the transaction which has just been concluded. From a financial standpoint its result can only be to increase the cost of production and advance the eventual necessity for raising the price of energy on the Niagara system of the commission.

REGINALD PELHAM BOLTON.
New York.

Keeping Copper in Full Service

To the Editor of ELECTRICAL WORLD:

Sir: An editorial article printed in your paper some time ago, under the heading "Engineering Aspects of the Copper Situation," suggested to me a possible solution of the problem of conserving the unconsumed electrical energy that is constantly going to waste during certain hours of the twenty-four. In a great measure it would do as you suggest, "keep copper in full service." It would help carry the peak load and equalize the system at all times. The answer is storage batteries.

In this Western country all the plants may be said to be hydroelectric with large investments in long trans-

mission lines. Would it not be perfectly feasible to install large-capacity storage battery plants near the consuming centers, thereby keeping the electrical charge on the transmission lines practically constant during the entire twenty-four hours? Of course, there are a number of related questions, such as voltages, direct and alternating currents, etc., that would require special treatment, but, leaving them out by presuming that they are all subject to satisfactory solution, is it not possible so to harmonize cost of storage battery installation with the other factors entering into the problem that it would pay to do this?

J. C. BROWN,
Ogden, Utah.

The Grate That Comes with the Boiler

To the Editor of ELECTRICAL WORLD:

Sir: In designing a boiler room of a power plant for generating steam one of the most important factors affecting combustion efficiencies in after days is that of the combustion chamber and boiler setting. The rational way to design the combustion chamber and boiler setting is upon the characteristics of the coal that is to be used. The coals in nearest proximity to the proposed plant, freight rates of the local railroads and other factors connected with cost and delivery of fuel are investigated. The coal best suited to the case on hand, upon a basis of minimum cost or maximum heating value, or sometimes both where severe peak loads may require two different grades of coal, is then decided upon. Knowing the characteristics of the coal to be burned, it is then possible to lay out the combustion chamber and boiler setting for the most advantageous use of heat and a minimum of smoke. It is not always feasible to resort to one grade of coal only, because of possible embargoes, inadvisability of depending upon one route, etc., and the settings and combustion chamber may then happen to be a compromise.

Not only the boiler setting and the furnace chamber alone effect combustion, but the grate plays a large part in efficient combustion and economical operation and low upkeep. Where a fine grade of coal is used with a coarse grate, the loss of carbon in the ash may be needlessly high. Losses due to wasted coal, unequal fires which may cause excess air and rapid deterioration of the grate bars are also items that the proper grate tends to prevent. Yet, notwithstanding this, the boiler manufacturers usually sell the grate as an integral part of the boiler, taking no cognizance as to the fuel to be used.

In the interests of the purchaser, of the manufacturer and of economy surely it would be better and more satisfactory to every one concerned if the boiler were not sold integral with the grate, but if instead the grate were available in different types for whatever grade of fuel was to be used.

Chicago. J. C. RUTHERFORD.

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

HAMPTON ROADS NAVAL BASE ELECTRIC LIGHT AND POWER

H. R. Palmer, General Superintendent Light and Power of Virginia Railway & Power Company, Tells Construction Requirements

H. R. Palmer, general superintendent light and power, Virginia Railway & Power Company, writes in answer to a letter of inquiry from the ELECTRICAL WORLD that the arrangements for lighting and power at the Hampton Roads naval base have not yet been completed. At this time the following material will apparently be required for outside construction:

- 40,000 ft. No. 4 weatherproof wire.
- 7,000 ft. No. 6 weatherproof wire.
- 3,000 ft. three-conductor No. 6 2300-volt lead cable.
- 3,000 ft. fiber conduit.
- 20 standard underground No. 4 outdoor cable pot-heads.
- 30 25-kw. transformers.
- 6 50-kw. transformers, primary 1100/2200, secondary 122/244.
- 3 300-kw. transformers, 11,000-volt to 2300-volt.
- 100 35-ft. poles.
- 150 cross-arms.
- 500 2300-volt insulators.
- 300 11,000-volt insulators.

In addition to the above, a transmission line approximately 5 miles (8 km.) in length, 11,000-volt, with submarine cable crossings, estimated cost \$20,000, will be required. The distribution from the transformers to the buildings and all wiring will be done by an electrical contractor. The contract for this work will probably be let in a few days.

GOVERNMENT SERVICE OF SAN ANTONIO COMPANY

W. B. Tuttle Outlines Plans for Supplying Energy for Light and Power at Camp Wilson and Camp Kelly

W. B. Tuttle, vice-president San Antonio (Tex.) Gas & Electric Company, writes in answer to an inquiry from the ELECTRICAL WORLD:

The San Antonio Gas & Electric Company has submitted a proposal to the United States government to supply electricity for light and power at Camp Wilson. This proposal has not been formally accepted. The company is, however, already supplying light and power at Fort Sam Houston, adjoining Camp Wilson, and it seems probable that we will supply Camp Wilson also.

We proposed to build a three-phase, 60-cycle circuit direct from our Villita Street power house to the camp. This circuit will be about 4 miles (6.4 km.) long and will operate either at 6600 volts or at 13,200 volts, depending upon the load required by the government. In the vicinity of the cantonments the line will be transformed down to 2300 volts, and it is recommended that the government construct three single-phase, 2300-volt circuits along the road running through the length of the three sections into which the cantonments are to be divided. From these primary circuits it is recommended that secondary lines run down to the center of each block, so that each secondary will supply two battalions. In case power is required a third wire

can be run into any point that may be necessary on any of the three single-phase circuits.

The company is already supplying electrical energy both for power and for light at Camp Kelly, the aviation post about 6 miles (9.6 km.) below the city. We have a three-phase line running out from our Concepcion Avenue station to this camp. This line is designed for operation either at 6600 volts or 13,200 volts, and we step down to 2300 volts before entering the reservation.

The water supply for Camp Kelly is furnished by an electrically driven pumping outfit.

ISSUE OF \$15,000,000 NOTES BY GENERAL ELECTRIC COMPANY

Three-Year Loan to Provide for Demands of Largely Increased Business—Inventories Are Larger

An issue of \$15,000,000 of three-year 6 per cent notes has been sold by the General Electric Company to J. P. Morgan & Company and Lee, Higginson & Company. The notes were offered for sale by the bankers at 99¾ and interest, yielding 6.10 per cent, and subscriptions are said to have aggregated \$80,000,000. They sold up to 100¾ on the curb afterward.

The company issued the following statement:

The General Electric Company, whose practice it has always been to maintain a strong position with respect to cash assets, has just arranged a loan of \$15,000,000 for three years to provide for the demands of a largely increased business.

The company expended nearly \$9,000,000 upon additional plant facilities during the year 1916, and like expenditures for the present year will be considerably greater. Apart from this, its inventories have naturally greatly increased, and the slowing down of collections in the existing unsettled conditions will result in a more than normal increase in its accounts receivable.

The quick assets of the company, as shown by its last annual report, excluding securities, amounted to \$97,000,000. Against this, it had indebtedness, excluding current liabilities, of \$12,000,000.

RIISING COSTS INFLUENCE THE CLEVELAND MUNICIPAL PLANT

Higher Wages Asked by Employees—Coal Estimated to Cost \$300,000, Compared with \$80,000 in 1916—Talk of Rate Advance

Employees of the Cleveland municipal light plant asked recently for an increase in wages amounting to about \$60,000 a year. Commissioner of Light W. E. Davis granted an increase of about 12 per cent to seventy-five employees, whose wages, he felt, had not been advanced in proportion to increased cost of living.

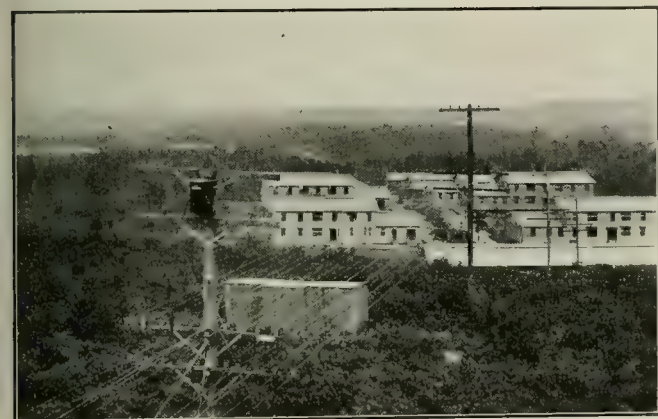
Coal for the plant cost \$80,000 in 1916, it was stated, but this year the coal bill will probably run to \$300,000. As the profits for 1916 are stated by the municipal plant authorities at \$156,000, Commissioner Davis fears that the rate will have to be raised.

ELECTRICITY IN THE LARGE CANTONMENT AT AYER, MASS.

**Extensive Application of Energy in the Camp for
37,000 Troops Near New England Power
Company Line**

The Ayer (Mass.) cantonment, which is being built at top speed by 5000 men to house 37,800 troops soon to be in intensive training, is one of the busiest spots in New England. Electricity is playing a prominent part in the construction. Through the courtesy of Capt. Edward Canfield, constructing quartermaster, U. S. A., in charge of the cantonment, the ELECTRICAL WORLD is permitted to outline some of the electrical features.

The cantonment, officially known as Camp Devens in memory of the distinguished Massachusetts soldier-jurist of the Civil War, is located southwest of Ayer village and about 2 miles (3.2 km.) from the junction of the Boston & Maine Railroad trunk lines serving all four cardinal points of the compass. The camp is



12,000-VOLT LINE FOR TEMPORARY ELECTRICITY SUPPLY AT
AYER CANTONMENT

roughly 40 miles (64.3 km.) from Boston and within comparatively easy reach of the 66,000-volt transmission lines of the New England Power Company in northern Worcester County.

To permanently serve the camp a two-circuit steel-tower line 8 miles (12.8 km.) long is to be built from the Leominster district to the outskirts of the cantonment, where a substation containing three 500-kva. General Electric transformers will reduce the potential from 66,000 volts to 2300 volts for local distribution. Lighting and power service for a total of 1118 buildings will be furnished from this substation. Of these structures, 622 are to be completed by Sept. 1, the remainder consisting of stables, gun sheds and other auxiliary buildings which can be completed more conveniently after the various regimental quarters are established.

About 2,000,000 ft. (609,600 m.) of wire ranging in size from No. 0 to No. 14 B. & S. will be installed, and it is estimated that 30,000 incandescent lamps of 25 to 200 watts rating will be required. At least 1000 chestnut poles, mainly 30 ft. (9.1 m.) long, are being erected, and already induction motors are performing service in sawing lumber for the buildings. Besides five saws driven by gasoline engines, nine saws are in service belted to 7.5-hp. motors, and it is stated that the electrically driven saws are turning out more work than their competitors. For intensive lighting around the

sawmill units 600-cp. to 1000-cp. General Electric "Novalux" lighting units are in service. A series incandescent lighting system will be installed in the camp streets as the work progresses.

A typical 7.5-hp. Westinghouse 220-volt, 1740-r.p.m. induction motor controlled by a Westinghouse starter and provided with a "Detroit" fuse and main switch cabinet is found in one part of the cantonment. This equipment drives a 12-in. (30-cm.) cross-cut saw by a short belt, the wiring being in armored flexible cable. The various saws recently cut up over 200,000 ft. (60,960 m.) of lumber in a thirteen-hour day. Lumber is delivered at the camp by rail, passed through the receiving yard or mill unit as required, and after sawing, it is hauled to the construction center required by United States Army motor trucks recently in service on the Mexican border. The sizes sawed ordinarily range from 2-in. by 4-in. (5.08-cm. by 10.16-cm.) to 3-in. by 12-in. (7.62-cm. by 30-cm.) spruce and hard pine.

One of the latest equipments to arrive at the cantonment is a lumber clipping machine equipped with a gang of eight saws and operated by a 50-hp. Westinghouse motor and three gasoline engines.

In the near future a sewage pumping station will be built not far from the camp and operated by a 100-hp. motor, and the water supply will require another pumping station equipped with two motors of 250-hp. and 150-hp. rating. This installation will be piped to the local fire service system so that either pump can be operated in case of fire for that service only. A well-equipped and motorized fire department is already a feature of the camp, and at the contractor's headquarters a fire observation tower equipped with telephone connections, binoculars, map, etc., is constantly manned. The camp is about 1.6 miles by 1.1 miles (2.5 km. by 1.7 km.) in extreme diameters. Besides the pumps above mentioned a 50-hp. motor-driven pump will be installed for standpipe service. Various motor-driven machine tools will also be required as the work progresses.

The New England Telephone & Telegraph Company estimates that a 100 per cent increase in the business of the Ayer exchange will follow the completion of the cantonment. There are two private exchanges on the camp grounds, one being required by the contractor and the other by the military authorities. The former consists of a two-position vertical board and a four-position order board serving about sixty-five local stations at present. From the contractor's headquarters ten trunk lines are run to Ayer, one to Springfield, Mass., and two to Boston. The military switchboard is housed in a telephone exchange building 20 ft. wide by 84 ft. (6 m. by 25.6 m.) long, equipped with the usual comforts of a standard city exchange and provided with storage-battery service and rectifier charging equipment. A twelve-position board of the latest type is installed.

F. A. Barbour is chief engineer of the civilian staff engaged in the cantonment construction, N. J. Neall of Boston being consulting electrical engineer. A. J. Hixon, Boston, is in charge of interior electrical installation work, and T. J. Daly of exterior distribution. The contractors for the camp as a whole are Fred T. Ley & Company of Springfield, Mass. R. R. Ringer of the latter organization is electrical purchasing agent.

DETAILS OF CONTRACT FOR SILVER LAKE CANTONMENT

Complete List of Electrical Material Necessary to Equip the 1054 Buildings That Will Compose the Army Structures Near Atlanta

The Silver Lake cantonment (Camp Gordon) is approximately 10 miles (16.1 km.) north of Atlanta, adjacent to the lake after which it is named. It is admirably situated with reference to climatic conditions, quick movement of troops and supplies, as well as to water supply, railways, good roads, power, telephone and telegraph facilities.

Contracts for the general construction of the cantonment camp have been awarded to Arthur Tufts of Atlanta, who in turn represents the electrical, street, sanitation and other contracting interests necessary for the successful completion of the camp in time to receive the recruits. Lockwood, Greene & Company are acting as engineers representing the government and are getting out specifications.

To take care of the passenger traffic between Atlanta and the cantonment it will be necessary for the Georgia Railway & Power Company to extend its trackage from the present terminus at Brookhaven. It has not been definitely decided whether this extension will be single-track or double-track.

A new rotary substation will be erected in the vicinity of Buckhead, and energy will be secured from the company's existing Morgan Falls 22,000-volt, 25-cycle transmission line about three-fourths of a mile (1.1 km.) distant. Substation equipment will include seven 185-kva., 22,000/430/287/143-volt, single-phase, 25-cycle transformers and two 500-kw., 25-cycle rotary converters. Trolley wire will probably be 3/0 copper, but the weight of this wire and the length of feeder cable have not been fully determined.

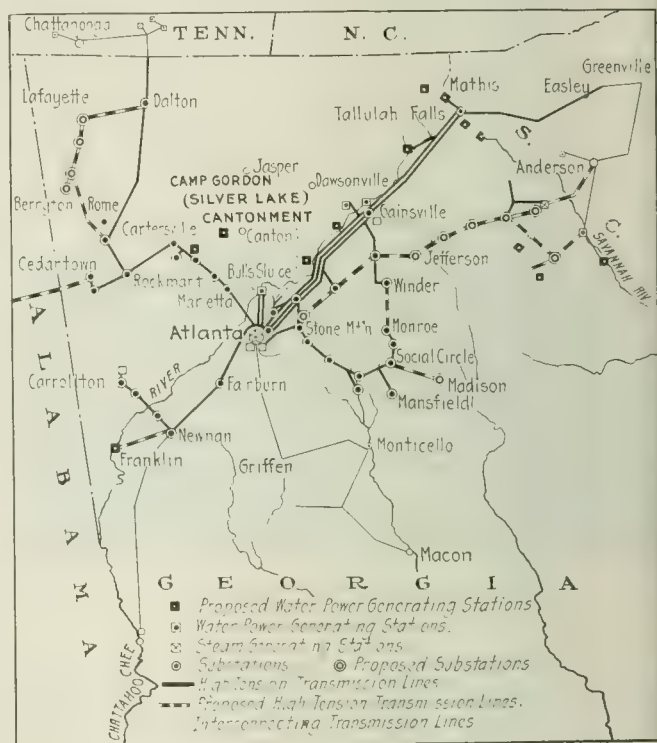
Light and power for all purposes will be supplied by the Georgia Railway & Power Company from its present Boulevard-Gainesville 22,000-volt, three-phase, 60-cycle transmission line. The line extension will be made on 30-ft. (9.1-m.) long-leaf creosoted poles, utilizing 1/4-in. (6.3-mm.) galvanized-iron wire, triangular spacing with 5-ft. (1.5-m.) centers. A branch of the company's private telephone line will also be extended to the transformer station. The transformer substation will be at the west side of the camp and of the company's standard outdoor fabricated-steel type, including three 250-kva., 22,000/2300-volt, single-phase, 60-cycle outdoor-type transformers. It is estimated that this equipment will be ample to take care of all requirements.

Light and power will be needed for the camp during the period of construction, and the power company will handle this situation temporarily with three 1000-kva., 22,000/2300-volt, single-phase, 60-cycle outdoor transformers.

The camp will require large quantities of water, and the city of Atlanta is laying a 9-mile (12.9-km.) main from the Hemphill pumping station to the camp. About 4000 ft. (1,219 m.) of this main has been laid up to the present time, and over 2000 ft. (609 m.) of ditch is opened, waiting for material to complete the job. Material is not arriving so fast as was expected, but the work will be completed in time. Water from the Atlanta main will be stored at the camp in five 200,000-gal. (757,066-l.) redwood tanks. A separate water

system of wood-stave pipe and cast-iron specials will be maintained. Normally 1600 g.p.m. (101 l.p.s.) will be required with a maximum requirement of 5000 g.p.m. (315 l.p.s.) during the stock-watering and shower-bath periods. Supplementing the Atlanta pressure, the following pumping equipment will be installed: one 300-g.p.m. (18.9-l.p.s.) and four 1200-g.p.m. (75.6-l.p.s.) centrifugal pumps direct-connected to alternating-current three-phase, 60-cycle, squirrel-cage induction motors. Neither the horsepower per motor nor the voltage to operate these motors has been definitely decided upon, as complete specifications have not been made up covering working heads.

A distinct fire department will be installed using combination gasoline fire trucks in connection with the regular street hydrants. The Western Union Telegraph Company is spending a large amount in extending its



MAP OF DISTRICT SURROUNDING CAMP GORDON IN GEORGIA

facilities to meet the requirements of the government. Special independent lines are being constructed and first-class operators will be provided.

Arthur Tufts, the general contractor, has awarded through the Atlanta Builders' Exchange to the Russell Electric Company a contract covering the entire electrical work to be done at the cantonment. This contract embraces the wiring of 20 miles (31.2 km.) of streets, the interior wiring of all buildings, the installation of motors, and placing and hanging of all fixtures.

In order to complete all electrical work on time, approximately 250 electricians will be required. The wages for electrical workers will be the same as now prevail in the city of Atlanta.

Wiring specifications will vary from time to time as work progresses, owing to the changes that will be made in the building arrangements, but the general requirements will be about the same, and it is estimated that the following list of material will be sufficient to do the work:

- 2,000 ball adjusters.
- 7,800 brass-shell key sockets.

9,500	cleat receptacles.
8,000	cleat rosettes.
1,800	combined switch and plug cut-outs.
4,000	Edison 100-amp. plug fuses.
1,000	Edison 6-amp. plug fuses.
600	lb. friction tape, ¾-in., black.
17,000	ft. lamp cord—No. 18 Standard N. E. C.
11,000	pr. porcelain cleats—glazed No. 10 single-wire.
190,000	pr. porcelain cleats—unglazed two-wire.
80,000	porcelain tubes—4-in. by 5/16-in. by 9/16-in. diameter.
1,000	plug cut-outs—two-pole, single-branch.
1,000	plug cut-outs—single-pole, main-line.
5,000	screws—round-head, blued globe, No. 8, 1½-in.
35,000	screws, wood—round-head, blued globe, No. 8, 1¼-in.
400,000	screws, wood—round-head, blued globe, No. 10, 2¼-in.
16,000	shades.
400	lb. solder strips.
2,000	wire lamp guards.
1,500,000	ft. wire, No. 14—rubber-covered, single-braid.
60,000	ft. wire, No. 10—rubber-covered, single-braid.
2,000	switches—single-pole snap with porcelain base.
20,000	40-watt Mazda lamps.

It is estimated there will be approximately 1054 buildings, divided between the various departments as follows:

Administration	16	Post exchanges	16
Barracks	212	School and assembly	16
Guardhouse	17	Shops	90
Hangars	12	Stable guard	23
Headquarters and supply	15	Stables	293
Lavatories	352	Stores	44
Medical	19	Wagon sheds	53
Officers	77		

Although specific plans are not ready covering all the electrical materials and load requirements, it is estimated that the following conditions will prevail and material as listed below will be ample to do the work, with the exception of changes that take place during construction:

Total maximum demand.....	750 kw.
Approximate lighting demand.....	300 kw.
Approximate power demand.....	400 kw.
Approximate series lighting demand.....	50 kw.

Although there will be more than 1000 buildings, it is estimated that 500 to 600 110/220-volt cut-ins will be sufficient.

It is probable that 400-cp. type C street lights will be used. The material required for street lighting, power and lighting service (exclusive of interior wiring) is listed as follows:

Two 24-kw. series lighting circuits, No. 6 wire, ft.....	115,000
Three-phase, 2300-volt power service, No. 1/0 wire, ft.....	30,000
Three-phase, 2300-volt power service, No 4 wire, ft.....	24,000
Single-phase, 2300-volt, two circuits, No. 6 wire, ft.....	28,000
110/220-volt secondary service, No. 6 wire, ft.....	105,000
Services—600, No. 8 wire, ft.....	120,000
Poles	800
Cross-arms, two-pin, for lamp leads.....	500
Cross-arms, four-pin, primary and arc circuits.....	1,100
Cross-arms, four-pin, secondary arc circuits.....	1,050
Cross-arms, four-pin, buck arms.....	200
Cross-arms, four-pin, transformer installations.....	250
Cross-arms, five-pin, three-phase, primary and series circuits	200
Cross-arms, braces complete with bolts, pairs.....	2,700
Throng bolts for double arms, ⅝-in. by 16-in.....	700
Throng bolts for single arms, ⅝-in. by 14-in.....	2,500
Square washers for through bolts.....	6,400
Locust pins, series lighting circuits.....	1,050
Locust pins, 2300-volt primary circuits.....	800
Locust pins, secondary circuits.....	1,200
Locust pins, drop leads to lamps.....	800
Locust pins, buck arms, etc.....	650
Brackets, 600 services	1,800
Break arms for street lights and tap lines.....	500
Deep groove insulators, on pins, brackets, break arms....	7,000
Glass knobs, No. 2.....	500
Wood screws, No. 18, 3-in.; primary plugs, knobs, gross..	4
Nails for 1800 brackets, lb.....	120
Porcelain tubes, ½-in. by 6-in., for primary and series leads	600
Friction tape, lb.....	100
Solder, lb.....	250
Ground rods with wood strips, lb.....	50

Lamp fixtures, goose-necks with radial wave reflectors....	400
Lamps, series, type C, 100-watt.....	400
Strain insulators	600
Steel cable for guy wire, 5/16-in., ft.....	5,000
Sectionalizing switches, 2/0 Johnson clamps.....	10
Sectionalizing switches, No. 4 Johnson clamps.....	20
Sectionalizing switches, No. 1/0 R. C. flexible cable, ft....	200
Sectionalizing switches, No. 4 R. C. flexible cable, ft.....	200
Transformers, distributing, 10-kva., 2300/110/220-volt....	20
Transformers, distributing, 5-kva., 2300/110/220-volt.....	10
Transformers, distributing, 3-kva., 2300/110/220-volt.....	3
Transformers, distributing, 1-kva., 2300/110/220-volt.....	2
Lightning arresters, 2300-volt, compression type.....	100
Ground rods, complete with wood strips.....	50

As nothing definite has been decided upon with reference to power for refrigerating, bakery, laundry and miscellaneous purposes, it is impossible to state definitely what kva. capacity will be required. The accompanying map shows the relative location of the cantonment to the Georgia Railway & Power Company's transmission system.

STANDING COMMITTEES OF ASSOCIATED MANUFACTURERS

Members of the Membership, Finance, Legal, Taxation, Tariff, Entertainment and Advisory Committees Are Named

At a recent meeting of the board of governors of the Associated Manufacturers of Electrical Supplies, held at the offices, New York, standing committees for the ensuing year were appointed as follows:

Membership Committee—W. C. Robinson, chairman, National Metal Molding Company, Pittsburgh; C. H. Bowen, Collyer Insulated Wire Company, Pawtucket, R. I.; Oscar Hoppe, American Circular Loom Company, New York; H. T. Paiste, H. T. Paiste Company, Philadelphia; W. S. Sisson, D & W Fuse Company, Providence, R. I.; W. D. Steele, Benjamin Electric Manufacturing Company, Chicago; J. H. Trumbull, Trumbull Electric Manufacturing Company, Plainville, Conn.

Finance Committee—Charles Blizard, chairman, Electric Storage Battery Company, Philadelphia; W. C. Bryant, Bryant Electric Company, Bridgeport, Conn.; Charles L. Eidlitz, Metropolitan Electric Manufacturing Company, Long Island City, N. Y.; R. E. Gallaher, New York Insulated Wire Company, New York; J. Nelson Shreve, Electric Cable Company, Bridgeport, Conn.

Legal Committee—D. C. Durland, chairman, Sprague Electric Works, New York; D. H. Murphy, American Conduit Manufacturing Company, Pittsburgh; Gerard Swope, Western Electric Company, New York City.

Taxation Committee—J. F. Kerlin, chairman, National Carbon Company, Cleveland; J. W. Brooks, Pass & Seymour, Inc., Solvay N. Y.; Oscar Hoppe, American Circular Loom Company, New York.

Tariff Committee—J. J. Gibson, chairman, Westinghouse Electric and Manufacturing Company, East Pittsburgh; L. Livingston, Edward F. Caldwell & Company, Inc., New York; J. E. Way, R. Thomas & Sons Company, New York; F. H. Chapman, Yost Electric Manufacturing Company, Toledo, Ohio; S. H. Blake, General Electric Company, Schenectady, N. Y.; E. F. Wickwire, Ohio Brass Company, Mansfield Ohio; R. C. Buell, Johns-Pratt Company, Hartford Conn.

Entertainment Committee—D. C. Durland, chairman, Sprague Electric Works, New York; LeRoy Clark, Safety Insulated Wire & Cable Company, New York; J. W. Perry, H. W. Johns-Manville Company, New York; Charles E. Dustin, general secretary, New York, and the president, ex officio.

Advisory Committee—LeRoy Clark, Safety Insulated Wire & Cable Company, New York; D. C. Durland, Sprague Electric Works, New York; J. W. Perry, H. W. Johns-Manville Company, New York; R. K. Sheppard, Simplex Wire & Cable Company, Boston; Charles E. Dustin, general secretary, New York.

WAR CONVENTION OF THE OHIO ELECTRIC ASSOCIATION

Conference on Questions of Central Station Policy
Supplants the Usual Large Meeting—
O. H. Hutchings Elected President

Modified by war conditions, with program and attendance restricted, the meeting of the Ohio Electric Light Association at the Deshler Hotel, Columbus, on July 19 was nevertheless a conference on central station policies and practices which was of much value to the members. It took the place of the large annual convention which was to have been held at Cedar Point during the week. The National Electric Light Association was represented by George B. Muldaur, field secretary.

ADDRESS OF PRESIDENT BECHSTEIN

President E. A. Bechstein, Sandusky, in the annual address of the president, expressed regret that the usual convention was not being held. A majority of the executive committee felt that a five-day gathering with attendant social activities when the country is at war would be in rather questionable taste and would involve expenditures that, under the circumstances, might be considered wasteful. He did not altogether share this view; he had always regarded the association as a working organization and its conventions as primarily devoted to the interests of the electrical industry, with social and pleasurable features as merely incidental. After the executive committee had acted, the letter from President Wilson was made public strongly urging associations of business and professional men to hold their conventions as usual. Mr. Bechstein regretted that the committee did not have the benefit of the President's views at its meeting.

President Bechstein said in part:

Our part in the war will be no small one. It will be our duty to supply the wheels of industry with power in order that those who are making the things needed for the men in camps and at the front may perform their work efficiently. We must also furnish a large part of the power to transport food, supplies, munitions and men to the places where they are needed. The constructive forces of the country are co-ordinating as they never have before, and the failure of even one part of the great industrial machine may cause delay and loss to all other parts.

From a small central station in Ohio to the battle lines of France and Belgium is a far cry, but the failure of even the smallest station to perform its duty at a critical moment may mean the loss of many lives and prolong the struggle in which we are engaged. So the year to come will call for greater efforts, greater vigilance, greater co-operation than ever before. The loyalty of the men of the industry has already been demonstrated in their liberal subscriptions to the Liberty Loan and Red Cross, and it will be demonstrated time and again as the calls of national necessity arise. But it is not enough to be merely loyal. We must work as we never worked before in order to "hold up our end" in the great struggle.

Near the beginning of the present calendar year the entire industry was thrown into a state of confusion by a sudden sharp advance in the cost of labor and materials. This came so unexpectedly that there was no opportunity to prepare for it; and for a time it was a serious question whether or not a considerable number of stations would be obliged to shut down. The advanced cost of fuel was particularly distressing, that essential commodity doubling in price almost over night. With the increased cost came a vexing uncertainty about deliveries. Many of us led a hand-to-mouth existence with regard to fuel for several months, and some of us did not know at times but that we might be

forced to suspend operations for lack of ability to get coal at any price. In some sections, also, it was next to impossible to procure and hold labor. This condition still exists, and one of the big problems ahead of us is to find a way to overcome this serious handicap.

There remain the problems of labor supply and deliveries of fuel and other essential supplies. As to the former, little can be done until the reorganization of all industries has made further progress.

As to deliveries of fuel, it seems to me that some means of insuring them to all central stations should be devised. We are providing a service of such vital importance to every other branch of industry, a service upon which practically the whole population of the State depends for employment, a service the interruption of which may be fraught with loss of individual health, comfort and efficiency, a service, in short, so essential to the welfare of every individual that it is perilous to leave us in any uncertainty in this respect.

Owing to the congested condition of all factories making electrical and other machinery, equipment and supplies, with the consequent delays in deliveries, some of the member companies have found it very difficult to keep pace with the increased demand for service. In some instances, I am informed, all advertising and solicitation has been suspended. I cannot help feeling that this policy, especially as it pertains to advertising, is risky. Where there is no occasion for commercial advertising it seems to me it would be a good idea to utilize newspaper space for educational work. I think, too, that sales organizations should be kept intact, as far as possible, for the reason that a sudden change of conditions, which no one can foresee, may make it desirable to have such an organization available for immediate use.

Secretary D. L. Gaskill, Greenville, in his report showing the effective work of the association during the year, said that in order to maintain the high standard it will be necessary for committees to co-operate actively.

NEW-BUSINESS CO-OPERATIONS

J. E. North, Springfield, presented the report of the committee on new-business co-operations. The committee recommended division into power and commercial sections and that in the next year the sessions of the committee be alternated between these sections. The executive committee had approved this plan.

METERS

The report of the committee on meters, A. H. Bryant, Cleveland, chairman, said that the aim is to continue the plan of the last year and broaden the scope of the committee meetings. Representatives of manufacturers take part in the afternoon sessions. A broader vision of their responsibilities and stronger bonds of co-operation are desired for the members. During the new year the committee will consider economy and greater efficiency.

ILLUMINATION COMMITTEE

S. E. Doane, Cleveland, reported for the illumination committee that the report on street-lighting specifications had been made to the executive committee. Mr. Doane said that nothing was more clear to him than that a committee gained by continuity of policy. He urged the policy of putting new men on committees, but of continuing some of the old members so that the work should be benefited by continuity of ideas.

Mr. Doane spoke of the development of a foot-candle meter, which will be of considerable value in illumination, and of the incandescent lamp for moving-picture theaters. The new lamp will supplant 75 per cent of the arc lamps now used for this purpose and will use

not over one-half of the energy of the arc lamp. The committee also considered floodlighting, said Mr. Doane, including the misuse of floodlighting. The State Commission on Industrial Lighting, of which Prof. F. C. Caldwell is chairman and Mr. Doane a member, proposes to establish minimum standards of light for industrial installations.

President Bechstein said that the establishment of new lighting standards for factories should receive the attention of the committee on new-business co-operations.

STATION OPERATING TROUBLES

Henry B. Dates, Cleveland, chairman, presented the report of the station operating committee. With the developments during the year caused by the severe industrial conditions, labor troubles and the coal situation, discussions at the committee meetings tended decidedly toward: (1) economies that can be effected in power stations; (2) handling and education of power-house labor; (3) introduction into the boiler room of such instruments as would assist in determining what are the economical points of operating boilers and how to maintain those points.

Among the leading points in the report are:

It is appreciated as never before that in the power house are possible savings of a magnitude unapproachable in other departments.

The matter of the education and training of power-house forces should receive great attention from the State and national associations.

"Results departments" are proving effective in determining sources of inefficiency and working out the improvements necessary.

TRANSMISSION AND DISTRIBUTION

The report of the transmission and distribution committee was presented by M. H. Wagner, chairman, Dayton. It called attention to the fact that the greater activities of the day demand a greater economy which leads to the generation of power at the mouth of the coal mine and the transmission of electrical energy to the center of activity, thereby following the methods employed in the development of water power. In the past year Ohio has added a steel tower transmission line of 110,000 volts which transmits energy from the generating station located at the mouth of a coal mine to various industrial centers. This has been a mark of progress in the activities in Ohio in the art of transmission of energy. Still greater development will be accomplished in the future.

The committee on standardization of voltages reported through S. E. Doane, chairman. An abstract is published on page 165 of this issue.

NEW OFFICERS

In reporting to the convention the nominating committee named President Bechstein for another year. Mr. Bechstein expressed his appreciation of the honor, but declined to accept the office again, holding that in such an association rotation in office should prevail. The following were elected: President, O. H. Hutchings, Dayton; vice-president, I. L. Oppenheimer, Pomeroy; secretary and treasurer, D. L. Gaskill, Greenville. The executive committee will be composed as follows: Robert Lindsay, F. H. Golding, C. H. Howell and E. A. Bechstein.

LOW ENERGY RATE IS ASKED IN CALIFORNIA

Prospective Consumer Wants Three Power Companies to Make Price of \$15 per Horsepower-Year

The California Railroad Commission has instituted on its own motion an investigation into rates, rules and practices of the Great Western Power Company, the Sierra & San Francisco Power Company and the Pacific Gas & Electric Company as applied to the proposed plant of the Pacific Electro Metals Company. The last-named company was organized recently to build and operate a five-hundred-thousand-dollar plant for reducing and refining metals on San Francisco Bay. Complaint was made to the commission that when the power companies were asked for rates on 9380 hp. two companies quoted \$36 per horsepower-year and one \$40 per horsepower-year. The Pacific Electro Metals Company asserts that a rate of \$15 is sufficient for this class of business.

In answering the complaint the power companies asserted that the commission has no jurisdiction to hear the proceedings because they are not signed by the proper governmental authorities or by twenty-five prospective purchasers of electricity as required by the public utilities act. The Pacific Electro company contends that it cannot secure signatures of the governmental authorities in the county where it intends to locate its plant because it is unable to decide upon the location until the commission establishes reasonable rates for the electricity it requires, and further that there are not twenty-five prospective consumers who will require electricity in the same quantity.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS

Annual Convention Will Be Held at Niagara Falls
Sept. 11 to 14—Exhibitors Will Be Given
Space Without Cost

The International Association of Municipal Electricians has decided to hold its annual convention at Niagara Falls from Sept. 11 to 14. President Robert J. Gaskill, Fort Wayne, Ind., has announced the following committees:

Committee on Exhibits—W. H. Flandreau, Mount Vernon, N. Y.; Charles S. Downs, Altoona, Pa.; Jacob Grimm, Buffalo, N. Y.; W. J. Lalonde, Ottawa, Canada.

Committee on Publicity—Clarence R. George, Houston, Tex.; Dr. Charles P. Steinmetz, Schenectady, N. Y.; Robert Moran, Memphis, Tenn.; William S. Boyd, Chicago.

Committee on Licensing Electricians—John Thomas, Scranton, Pa.; Frank K. Shinnin, Atlantic City, N. J.; F. S. Vincent, Grand Rapids, Mich.; R. C. Turner, Atlanta, Ga.; William Crane, Erie, Pa.

Representative to National Fire Protection Association—John Berry, Indianapolis, Ind.

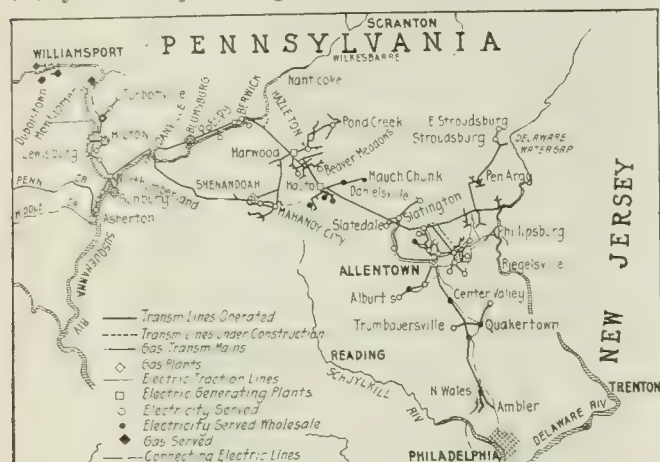
The committee of arrangements and the committee on exhibits have made it possible this year for all exhibitors to acquire space without cost, the only requirement being that such exhibitor shall become an associate member of the association.

Any one wishing to exhibit this year may get full information from members of the exhibit committee, President Gaskill or M. J. Donohue, chairman committee of arrangements, Niagara Falls, N. Y.

CONSOLIDATE AND CO-ORDINATE PENNSYLVANIA POWER PLANTS

Lehigh Power Securities Corporation Acquires Lehigh Valley Properties—Large Additional Investment to Develop the Business

The Electric Bond & Share Company of New York and Edward B. Smith & Company, Brown Brothers & Company and Henry & West of Philadelphia are about ready to carry through an important electric power



TERRITORY OF THE LEHIGH POWER SYSTEM

project in eastern Pennsylvania. The Lehigh Navigation Electric Company, the Lehigh Valley Transit Company and the Northern Central Company properties will be taken over by a new company to be called the Lehigh Power Securities Corporation.

The financial plan provides for a present issue of \$20,000,000 of ten-year 6 per cent notes to be offered to the public at 95 and interest with a 40 per cent stock bonus. The financial plan looks forward to large additional investment to develop the business properly. It is not intended to extend the present system much while construction costs are abnormally high as they now are, or until it is possible to get prompt deliveries of electric machinery, but it is known that existing power plants can be tied together and co-ordinated so as to enable them to perform much greater and more efficient service.

The management of the new corporation will be in charge of the Electric Bond & Share Company, of which Sidney Z. Mitchell is president. All the common stock of the Electric Bond & Share Company is owned by the General Electric Company.

UNUSUAL POWER AND LIGHTING OPPORTUNITY

While the Lehigh Coal & Navigation Company sells its generating station and distributing system, it will own an important interest in the new corporation. There is an unusual opportunity for development of power and lighting business in the coal regions and at Bethlehem and the other Lehigh Valley industrial sections served by the present plants. This combined with the adjoining regions provides an extensive market for energy.

There will be an immediate enlargement of the Lehigh Navigation plants at Hauto and Harwood, which together will have an aggregate development of 70,000 kw. These are to be tied in with the Lehigh Valley Transit plant now being enlarged to 30,000 kw., and other plants will be constructed as required to meet the

demands of the public. They will be located at points close to Lehigh Navigation coal, where water is available for condensing purposes.

CHICAGO MAKES ADDITIONS TO ITS PARK LIGHTING SYSTEM

**Addition of 8.75 Miles of Parkway and Boulevard Illumination in Chicago's South Side Parks
Notable for Unique Lanterns**

Three additions to the extensive boulevard and park lighting systems of Chicago are now being made that will cover 8.75 miles (14 km.) and cost according to estimates about \$116,000. On the 5 miles (8 km.) of Michigan Avenue which will be relighted, 320 double lanterns on cast-iron standards served from five 1-mile (1.61-km.) circuits will be erected. One of these standards is shown in the accompanying illustration. The plan of arrangement is to have four standards on the corners of each street intersection. Between the inter-

sections the lamps will be staggered on both sides of the streets so that it will be possible later to add to the system by placing intermediate lamps opposite those already installed.

The energy-supply equipment originally installed will be adequate to carry this additional load without changes. The typical block contains four lamps between intersections. In so far as possible the present 5000-volt cable will be used since it has been determined that the rubber insulation, although some of it has been in service since the World's Fair, is as good as new. It is said that the lighting standards, which cost \$40 cash when the contracts were let two years ago, could



NEW CHICAGO STANDARD

not be duplicated now for \$80 each. The standards which these units will replace are of the old World's Fair type. The lay-out and installation of this system are being carried out under the direction of W. I. Bell, mechanical and electrical engineer, and Frank Brueggeman, assistant mechanical and electrical engineer, for the South Park commissioners.

Bibliography of Submarines

A bibliography of the literature of submarines, mines and torpedoes has been compiled by David B. Rushmore, engineer power and mining department General Electric Company, assisted by William H. Lanman and Eric A. Lof. It was compiled with the hope that it might be of some assistance to those working on the problem of submarine detection and destruction. This bibliography will appear in the August *General Electric Review*, but is also published separately.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Increased Rates in Philippines.—The Philippine Islands Public Utility Commission has allowed an increase in steamship rates to prevent operation at a loss. It recognizes the high prices of materials for repairs and operation because of the European war, although the increase will work a hardship upon patrons by making living more expensive for them. The commission says: "It cannot be doubted that the permission of this increase in the rates will contribute to make living more expensive in the towns on the lines concerned, as alleged by the protestants; but this is the necessary result of the abnormal and difficult economical conditions that now prevail in this country, the burden of which should be equitably borne by all."

Distribution of Costs.—The Maine Public Utilities Commission, in a case affecting the Portland Water District, says: "Unless there is some controlling reason to the contrary, every consumer of the product of a public utility ought to pay his fair share of the entire cost of the utility. There is a constant effort to exempt or favor special classes for reasons which, in themselves, seem sufficient. Sometimes they are charitable; sometimes they are inspired by a belief that they promote the public good. These, in frequent instances, are justifiable. But, in the end, every favor granted to one class is paid for, not by the utility, but by the other consumers, either by immediate increases or a postponement of the day when the other consumers may get a reduction. The statute fixes the total revenue which the Portland water district shall receive. If the recipients of one class of service do not pay, others must."

Criticism of Corporation's Methods.—In denying the petition of the Cayuga Power Corporation for permission to construct a transmission system for furnishing electricity in certain parts of Tompkins County, the New York State Public Service Commission, Second District, with the exception of Commissioner Emmet, voices its opposition to allowing the Cayuga Corporation to exercise its franchises on the ground of the methods employed by that corporation in obtaining its charter, and also censures it for going ahead with its construction work without first obtaining the permission of the Public Service Commission at Albany as required by law. The commission charges that this last act of the Cayuga Corporation is a flagrant violation of law, which, it says, should not be tolerated. It developed at the hearing recently held in the matter that the corporation's excuse for this action was that the

scarcity of labor made it vital for the interests of the Cayuga Corporation to construct its system while labor was available. This excuse, however, is not regarded as being sufficient. In regard to the charter of incorporation it appears, the commission charges, that an attempt may have been made to evade the jurisdiction of the commission until a time when the corporation had carried out all of the necessary preliminaries free from any restraint or, in other words, the sudden transformation of a business corporation into a transportation corporation. For instance, when the application was brought before the commission the Cayuga Corporation was already a full-fledged corporation with capital stock and bonds issued and outstanding over which no supervision had been exercised by the commission in spite of the claim of the Cayuga Corporation that it was created under the provisions of the transportation corporation act. For this reason, acting upon the belief that the Cayuga Power Corporation is not legally incorporated to carry on the business which it is seeking to do, the commission has denied the application. The Cayuga Power Corporation sought approval to exercise franchises granted by the towns of Lansing, Dryden and Groton and the villages of Freeville and Dryden, all situated in Tompkins County. These franchises provided that the Cayuga Corporation shall construct an electric plant and furnish service in these municipalities. The commission does not dispute that such service is needed in these municipalities and refuses to issue a certificate of necessity solely on the grounds mentioned above. The sole appearance against the granting of the certificate of necessity to the Cayuga Corporation was made by the Ithaca Traction Corporation. This company claimed that should the Cayuga Corporation be permitted to exercise its franchises, a serious loss might be inflicted upon the traction corporation. The chief customer of the Ithaca Traction Corporation, which also engages in the business of selling power, is the Ithaca Gas & Electric Corporation. The commission is of the belief that it does not come within its duty to protect the interests of a corporation far in excess of the legitimate requirements of its business as in the present case. In addition, it maintains that there is no indication that the commission would permit another corporation to enter the city of Ithaca and compete with the traction corporation. The Cayuga Power Corporation, it is stated, did not seek to engage in the street railway business, while, on the other hand, the Ithaca Traction Corporation has no right to carry on an electric light and power business in the municipalities which granted franchises to the Cayuga Corporation. Commissioner Emmet, who dissents from the conclusions reached by his colleagues, is of the opinion that the advanced development of the Cayuga Corporation would justify the commission in granting it authority to exercise the franchises that belong to it.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Technical Terms in Contracts.—Technical terms in a contract may be given a non-technical meaning, relied upon by one party, where the other party had reason to suppose the former so understood them. An injunction may be granted to prevent a public service corporation from wrongfully cutting off a supply of electricity which it is under contract to furnish, the Supreme Court of Nebraska held in the case of Richey vs. Omaha & Lincoln Railway & Light Company.

Liability for Injuries to Experienced Employee.—Where the overseer of lines of a telephone company engaged in dismantling a line at the company's direction was injured when a telephone pole which he had climbed broke off at the ground because it was rotten, the telephone company was not liable for the injuries, since the employee was engaged in dismantling work, was experienced and in full charge, and determined for himself whether poles were sound or unsound, it was held by the Appellate Court of Indiana (116 N. E. 600).

Extension of Contract by Agreement.—The contract of an electric company for lighting defendant village's streets was not extended, the Appellate Division of the Supreme Court of New York held (165 N. Y. S. 247), in Northern Westchester Lighting Company vs. President and Trustees of Village of Ossining, by agreement, by the company, on the last day of the existing contract, after unsuccessful negotiations for a new contract, resulting in a resolution of the village board that the corporation's counsel apply to the Public Service Commission to adjust cost of lighting, writing the village president that till the village makes further agreement the company will expect it to pay the rate provided in the existing contract, and the letter remaining unanswered, or by bills for lighting thereafter presented being audited for the first four months. Under provision of the electric light company's franchise that it shall annually supply the village free with \$2,000 worth of light at such places as the village board may appoint, such appointment is a condition precedent. The purpose—light of a certain illuminating power—of provision of contract between electric lighting company and village that as to each incandescent lamp the company would furnish a current of 100 watts (a watt being the unit of power) was accomplished by a substitution of a subsequently invented lamp giving such light with a less number of watts of power than was required in the case of the lamp previously used.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Limitation of Imports of Electrical Equipment.—United States Consul General George H. Murphy, Cape Town, South Africa, says that the Cape Town Chamber of Commerce has received the following letter from the Secretary for Mines and Industries: "In view of the position in which the electrical industry of the United Kingdom is placed in regard to its export trade, owing to restrictions of manufacture and exportation involved by the war, it is desired to call the attention of your chamber to the desirability of deferring as far as possible the calling for tenders for electrical machinery and equipment for public contracts until the conclusion of hostilities."

Electrification of Swiss Federal Railways.—William P. Kent, United States Consul at Berne, sends the following: "Electrification of the Swiss federal railways has now emerged as a very practical economic question. The government has created a special department, attached to the direction of the Swiss Federal Railways. This department announces that it is prepared to consider proposals for sale and delivery of such electrical material as may be necessary for equipment in connection with this work, and that bids will be received from all countries. A statement by the management shows that large orders for copper wire already have been placed with certain firms in the United States."

The Successful Electric Vehicle.—A. Jackson Marshall, secretary Electrical Vehicle Section, N. E. L. A., writes: "If we were to eliminate from the gasoline car its ignition, the internal reciprocating combustion engine, its carburetor, its gears, the radiator and water jackets, the gasoline tank, etc., and leave its electric starting apparatus, we should have a small complete edition of virtually the entire propulsion equipment of an electric vehicle. Such process of elimination will give some practical idea of the remarkable simplicity of the modern electric vehicle and will account for its ease of operation and the long life insured by the absence of thousands of parts which wear and demand constant attention. When the well-nigh irreducible simplicity of the modern electric vehicle is associated with the highly developed storage battery—a distinct commercial success—which, by the employment of somewhat recently developed methods, may be speedily charged, we have a motor vehicle which for economy and simplicity of operation, dependability, long life, cleanliness and elegance of appointment represents the utmost in vehicular transportation."

Standard of Vehicle Service.—A booklet, "Standard of Service and Care in the Operation of Electric Vehicles," has been issued by the committee on standards of the Chicago Electric Vehicle Section of the National Electric Light Association, Chicago. It was published by courtesy of the Commonwealth Edison Company. It contains instructions on care and rating of storage batteries, a sample form for keeping a record of operation, and general recommendations for public garages. It also discusses central station service for electric vehicle users, shows how to estimate cost of electric power, and gives directions for reading meters and maps showing electric vehicle charging stations in Chicago and vicinity. An explanation of Chicago's parking service and a road map of Chicago and vicinity are also given. The booklet is being distributed to association members and interested car owners.

Helping to Settle the Coal Problem.—A letter from Blaine Gavett, secretary American Public Utilities Company, says: "For the last six months or more our company and subsidiaries have been doing everything possible to co-operate with the Federal Trade Commission, the coal committee representing the public utilities in the Middle Western States and local boards of trade and chambers of commerce with the view of helping increase the coal supply and induce mine owners to be satisfied with a reasonable profit. We believe the car supply is of great importance in this connection. We know that a vast amount of coal is available right now if cars can be obtained in which to move it. A practice of urging every one to unload cars with least possible delay and keeping after railroad agents and yardmasters to move empty cars promptly after unloading would be a great help in this direction. We should appreciate an effort on your part to increase activities along these lines."

Purchase of Energy in Juneau, Alaska.—The Common Council of Juneau, Alaska, has voted to enter into a contract with the Alaska Treadwell, Alaska United and Alaska Mexican Gold Mining companies for the purchase of electrical energy to supply the city. The energy will be resold to the inhabitants by the city at approximately 50 per cent less than is now being paid. The contract accepted at the meeting contains a proviso that if the city does not elect to install its own distributing system it may arrange with the Alaska Light & Power Company, now furnishing the energy, to use its distributing equipment, including lines. The three companies are to sell to the city of Juneau for ten years all the energy required for lighting, heating and power purposes. The municipality is to provide a distributing system. The rate of 2 cents per kilowatt-hour shall prevail except during such periods as the price may be advanced to 3 cents, under certain conditions, for certain months, when the cost of operating by the companies is increased. The city must not sell energy outside of corporate limits.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Rochester Section, A. I. E. E.—J. W. Morrison was elected secretary of the Rochester Section of the A. I. E. E. recently.

Fort Wayne Section, A. I. E. E.—At a recent meeting of the Fort Wayne Section of the A. I. E. E., R. B. Roberts was elected secretary.

Electrical Contractors' Association of New Jersey.—The annual midyear convention of the Electrical Contractors' Association of New Jersey was held at Pleasure Bay, July 14, with a large attendance from different sections of the State. A business session was followed by addresses and talks.

American Association of Engineers.—At the annual meeting of the American Association of Engineers July 13 the following officers were unanimously elected: President, Edmund T. Perkins, consulting engineer and president of the Edmund T. Perkins Engineering Company, Chicago; first vice-president, W. H. Finley, chief engineer of the Chicago & Northwestern Railroad; second vice-president, Isham Randolph, consulting engineer and president of Isham Randolph & Company, Chicago. The main provision of the new constitution is the enlargement of the number of board of directors from five to fifteen members, but the board may appoint five members to manage actively the affairs of the association. A clause to include associates is provided in the constitution. This membership pertains to men who are not necessarily engineers but interested in engineering affairs. They may be admitted up to 10 per cent of the certified membership.

California Association of Electrical Contractors and Dealers.—The eighth annual convention of the California Association of Electrical Contractors and Dealers was held at Santa Cruz, Cal., July 11 to 14. Among the papers that received particular attention were "Diversified Problems of Electrical Contracting," by C. F. Butte; "Retailing and Merchandising," by L. Levy; "Building a Newspaper Ad," by H. A. Lemmon, and "Business Phases of Electrical Contracting and Dealing," by H. C. Reid. The convention was notable for the attendance of representatives of all phases of the electrical industry, including manufacturers, jobbers, dealers, contractors, central station companies, electrical inspectors and the Board of Fire Underwriters. The spirit of co-operation that was manifest in the several meetings was taken as a most favorable sign. The registration was about 275. H. C. Reid of the Pacific Fire Extinguisher Company, San Francisco, was elected president for the ensuing year.

George H. Harries, for years prominent as a public utility executive and now in command of the Nebraska National Guard at Fort Crook, has been commissioned brigadier general by Governor Neville, and will be recommended by the War Department for similar rank in the regular army. General Harries since 1912 has been a vice-president of H. M. Byllesby & Company. He is also president of the Louisville Gas & Electric Company, the Omaha Electric Light & Power Company, the Arkansas Valley Railway, Light & Power Company, and an officer in a number of other large utility organizations. From 1900 to 1911 he was vice-president and general manager of the Washington (D. C.) Traction & Electric Company. For several months General Harries has been engaged in work for the Council of National Defense and War Department. Born in Wales in 1860, the son of an officer in the British army, General Harries came



GEORGE H. HARRIES

to the United States when a boy and served as a scout under Generals Miles and Crook in frontier wars with the Indians. He was a member of the government's commission settling the grievances of the Sioux Indians in 1891. In 1888 he went to Washington as a newspaper reporter, later becoming president of the Metropolitan Railroad Company in that city. From 1897 to 1917 General Harries as brigadier general was in command of the military and naval forces of the District of Columbia, retiring as major-general May 26 of the latter year. During the Spanish-American War he served as colonel of the First District of Columbia Infantry, United States Volunteers, participating in the siege of Santiago, Cuba. He has been a member of the War Department board on the promotion of rifle practice since organization. His utility association activities have been very wide, he having been president of the Association of Edison Illuminating Companies, president of the American Street Railway Association and an officer and member of the public policy committee of the National Electric Light Association. He is a past national commander of the Order of Indian Wars, composed of army officers.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

F. D. Nims, formerly engineer and assistant general manager of the Olympia Power Company of Port Angeles, Wash., has become connected with the Northwest Electric & Water Works of Montesano, Wash., with offices in Seattle. This property recently was acquired by Warner Marshall of Boston, Mass.

Gresham Thomas, formerly of the Georgia Railway & Power Company, Atlanta, Ga., is now purchasing agent of the Mill Power Supply Company. Seventeen years ago Mr. Thomas began his work with Ford, Bacon & Davis, engineers in charge of building the railway system in Atlanta and changing overhead wires in the downtown district to the present underground system. He continued with the railway and power company in various departments up to the time of his resignation to take up his new work. Mr. Thomas has charge of purchases, through the Mill Power Supply Company, for the Southern Power Company, the Southern Public Utilities Company and allied companies, these having no purchasing department but conducting their buying through a separate company.

Fred Allison, who was recently elected a fellow in the American Institute of Electrical Engineers, is electrical engineer for the Ford Motor Company at Detroit, Mich. Mr. Allison, who was born in Lapeer, Mich., in 1881, attended the Detroit schools and before entering college spent a few years in gaining practical experience. He was employed by the Michigan Auxiliary Fire Alarm Company for a period of two years or more on apparatus design. Having gained a knowledge of storage-battery operation, he entered the employ of the Detroit Edison Company in this work. After having installed and supervised the installation of different storage-battery plants and other power apparatus he became connected with the Electric Storage Battery Company at Philadelphia, where he was engaged in research work during the early experimental stages of the "Exide" type of battery used in electric vehicle construction. He next was employed by the Commonwealth Edison Company, Chicago, to design controlling apparatus for the special vehicle which the company was about to use in its service. Upon completion of this work Mr. Allison promoted and established what was believed to be the first and at that time the largest vehicle garage in the United States, known as the Automobile Equipment & Maintenance Company of Chicago. Mr. Allison is now associated with the Ford Motor Company, serving in the capacity of superintendent of

power and chief electrical engineer of all power equipment of the Ford Motor organization throughout the world. During his connection with this company he has designed and installed power plants aggregating a total of 100,000 kw. or more. Some of this equipment is in the main plant of the Ford Motor Company, which has the largest direct-current installation in the world. Mr. Allison has designed many new features of plant operation, besides originating or co-operating with others in the origination of numerous devices. Among these are the light-weight electric vehicle which Alexander Churchward and he were largely instrumental in producing, electric welding and tempering devices, a special direct-current motor design, combination 20-hp. to 40-hp. motor-operated starters now being produced by the Westinghouse company, numerous automatic-control devices and recording devices, electric furnaces of high temperature, and also graphicizing



FRED ALLISON

development, electric cleansing of producer gas by ionization, many electrolytic processes in steel tempering and many safety devices. He was concerned also with the advancement of magneto and ignition design. Mr. Allison has contributed considerably to electrical literature.

Obituary

Prof. Kristian Birkeland, whose name is well known because of his work with Dr. S. Eyde on atmospheric nitrogen fixation through the Birkeland-Eyde process, died in Tokyo, Japan, on June 18. Professor Birkeland was born in December, 1867. He received his education at the University of Christiania, Norway. In 1898 he was appointed professor of physics at this university. In 1903 he began his study of nitrogen production from the air and together with Dr. Eyde developed the Birkeland-Eyde process, which is now largely used for producing nitrogen in Norway. Professor Birkeland was a frequent contributor to physical literature, and was an honorary member of several societies whose achievements have an international reputation.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

FAN MANUFACTURERS ARE LOOKING AHEAD TO 1918

Conditions in Market for Raw Materials and for Labor Such that It Is Doubtful if Much Development Work Will Be Undertaken

So far as can be learned the supply of fans in the wholesale market has been completely wiped out. Retail distributors, having cleaned their shelves last season, were eager purchasers this year. The situation which now confronts the industry is next year's market.

Up to the present week fans have not moved from retail stock very fast. In fact, in the greater part of the country the sales so far this year are below normal. Therefore, unless more seasonable weather comes along shortly, retailers will probably carry over large stocks of fans. In this case, of course, the manufacturers would not make up such a large supply as they did this year.

However, the raw materials market is in such a condition that the manufacturer feels he wants to place his orders as soon as possible. Some manufacturers have done so already, but not all of them. The extent to which fans find their way into the hands of the public in the next two or three weeks will be the determining factor in many instances.

It is doubtful if the 1918 fan will be any different from the 1917 model. Labor is high and scarce and will be more so, while the condition of the raw-materials market has already been touched upon. For these reasons it is very doubtful if much development work will be done this year. There may be a tendency to standardize on types by cutting down on the number of different models, but it is not likely that there will be more than one or two new models on the market next year.

GUIDING PURCHASES OF CONTRACTORS AND DEALERS

By Selling Balanced Stock, Supply Jobbers May Lower Credit Liability of This Class of the Trade

Small contractors and dealers, it has been pointed out time and time again, constitute the greatest credit risk to electrical supply jobbers. Efforts are being made by the jobbers to cut down the risk from this class of buyers. It was thought for a while that the trade acceptance plan was the solution, but it was found to have its limits. Trade acceptances, it has been found, are all right so far as they go, but they do not prevent the contractor from failing.

Something else must be found, it is felt, not so much as a substitute for the trade acceptance plan where used, but as another cog in the credit machinery. As is well known, a contractor or dealer wishing to branch out for himself goes to the jobber and orders a certain stock. His purchases are probably limited to his ability to pay. The point is, however, that he picks out what he will buy and the quantity within the limit of his pocketbook.

The chances are that he has had only a limited experience in buying stock or in estimating the amount of each part of the stock required. In fact, it is very doubtful if a majority of the smaller contractors and dealers actually in business have a very definite idea of what constitutes a balanced stock. It is probably more than likely that they buy what the salesman sells them.

It becomes evident, therefore, why there is so high a

mortality among contractors and dealers. Aside from the fact that a knowledge of costs and merchandising methods is so often lacking, the most serious trouble, if the quick failures are carefully analyzed, will probably be found to be too much slow-moving stock. The contractor or dealer might be a thoroughly competent and industrious person, but if he has invested heavily for him in slow-moving stock, he not only loses the return which he might have on a more productive investment, but he also loses the use of capital which might have permitted an expansion in a more productive direction.

The loss of this latter business of course falls on the jobber as well. Furthermore, should the contractor fail the jobber loses again. He may have been paid up, but he has lost a customer. It is apparent, therefore, that the jobber must take the contractor and dealer under his wing, and when one of this class wishes to open a store must guide his purchases in such a way as to give to the new business a stock of the required value, balanced in all directions.

The idea itself is not new. One of the largest hardware jobbers in the country has a plan of this nature in use. Standard stocks have been made up corresponding to certain investments. A person with \$500 to spend gets stock A, \$1,000 stock B, \$2,000 stock C, etc. Other trades have worked in much the same direction, although on plans generally narrower in scope.

Thus, if a dealer wishes to buy flashlamps, he can get a standard stock for say \$5 a month, one for \$10, etc. The same is true for certain kinds of incandescent lamps and also for certain of the cheaper lighting fixtures. In other words, it has been found that certain sizes and articles move faster than others in a certain ratio. Therefore it is reasonable to assume that the best stock would be that in which these ratios were closely followed.

THE WEEK IN TRADE

GENERAL good business marked last week. Deliveries are getting better. There was little or no price fluctuation, although some advances are expected shortly. Labor conditions around Chicago and the Northwest are registering their effect on the market. Collections generally seem good.

NEW YORK

While normally this season of the year is rather slow and quiet, buying activities generally show but little abatement from previous months. Where the demand is dependent entirely upon building operations, the volume of business has shown a falling off. Wire manufacturers report decreased sales in the neighborhood of 20 per cent, with the bulk of the buying from industrial plants, excepting, of course, the orders from the government. Fixture sales, which are dependent almost entirely upon non-industrial building operations, have dropped away below normal. Lamp sales are also low.

There were no evidences of any price changes during the week. After two years of continuous change in price the present rather stable condition of prices is very noticeable. To a large extent this stability is owing to the uncertainty regarding the action the government is going to take on the price question.

CONDUIT.—Although there have been many rumors that higher prices would come shortly, the prices remain unchanged. Stocks generally are low, and deliveries remain unchanged, with no immediate prospect of betterment. The demand keeps up in volume with no change in channels of distribution.

FIXTURES.—Business is virtually at a standstill. There is so little building of apartment houses, hotels, residences, etc., that the volume of business has fallen away below normal. Both the expensive and the inexpensive types are affected. Prices show no change, and fixture houses state that there is no immediate prospect of any change.

GLASSWARE.—A sharp advance in price of glassware is predicted by manufacturers. Prices for the season which is about to open, it is thought, will be anywhere from 25 per cent to 100 per cent higher than last year. Demands were made this week by workmen for higher wages. Practically every line of glassware is affected.

WASHING MACHINES.—Owing to the condition of the market for raw materials, particularly galvanized and copper sheets, it is anticipated by the trade that prices will advance during the next few days. An advance of 5 per cent is expected on galvanized washers and 10 per cent on copper washers.

HEATING APPLIANCES.—The sale of flatirons holds up well. Department stores which a few weeks ago had curtailed buying indefinitely are now again purchasing irons and toasters freely.

FANS.—Owing to more seasonable weather the retail movement of fans was better this past week than in any previous week. Wholesale distributors are sold out, but the trade is having difficulty in disposing of its stock to the public. Sales so far this year are below normal. A few really scorching days would, of course, do much to dispose of the fans on hand, but otherwise a large carry-over is expected. A note of warning was sounded by one large distributor. He pointed out the uncertainties of the market for materials and the consequent uncertainties of the 1918 fan supply. For that reason he was of the opinion that retailers would be making a mistake to dispose of stocks on hand at sacrifice prices in order to clean up the shelves.

RANGES.—Electric range sales have been very large this year in the New York territory outside the metropolitan limits. Within New York City high rates have a deterrent effect on range sales. In a large part of New Jersey the same condition is found. Where low rates are in force the sale has been tremendous. One distributor has so far this year booked 172 per cent more electric range business than during the first seven months of 1916. Ranges are selling very well in small towns.

WIRE AND CABLE.—Stocks of standard sizes rubber-covered wire are in good shape. In fact, they were sufficient recently to take care of a large government cantonment order without putting any additional burden on the factories. Deliveries are now being made at from six to eight weeks on large orders. There is no stock on hand of weather-proof wire. The greatest delay is experienced in underground cable, which is never stocked. Some factories are so far behind now in deliveries that they are accepting no new business for the remainder of the current year. Demand has fallen off somewhat. Most of the domestic business, excluding government orders, now comes from industrial plants. For residence, church, apartment, hotel, etc., construction there is very little demand for wire. Standard small-size rubber-covered wire demand is very small, therefore, and manufacturers are not receiving large orders except from jobbers. There is, however, a very heavy demand for power cable. The majority of manufacturers are quoting on a 37-cent base, although some are quoting as high as 40 cents.

BELLS AND GONGS.—The demand is very good both in the cheaper and in the more expensive lines. Deliveries are still behind. Prices remain unchanged, and although there are no rumors of advances in the near future it has been intimated that higher prices may be expected.

LAMPS.—Sales to the trade are keeping up with past summers. There has been a very marked deferment in buying by central stations, but this slump will be made up

before long. Just at present the government is buying practically all of the available miniature lamp output. Deliveries have become much better and manufacturers are again putting lamps into stock. Local stocks are in excellent shape. Some jobbers now have more than a normal supply on hand.

CHICAGO

There has been little change in the general business situation in the Chicago territory the past week. Warm weather in the last few days of the week brought optimism to the retail fan sellers, although not a great deal of business developed owing to the lateness of the season. The electricians' strike is still in progress and seems to promise to be a long-drawn-out affair. The employers' association is backing the contractors. An inquiry was recently made by a large Ohio industrial plant for 10,000 kva. of synchronous condensers in six units for power-factor correction within the plant. Copper prices were weaker, and prices of porcelain were withdrawn awaiting announcement of a new advance.

ELECTRIC RANGES.—Practically all of the jobbing houses at Kansas City are seriously considering the range question. The city is blessed with a favorable electric situation and at the same time finds the gas situation critical. Jobbers are planning campaigns on these devices.

SECOND-HAND MACHINERY.—A large second-hand machinery house in Chicago reports that in June it sold practically every motor rated at between 2 hp. and 100 hp. which it had listed for sale. This means that at present the concern is turning over its capital every thirty days.

SYNCHRONOUS MACHINERY.—The Electric Machinery Company of Minneapolis has instituted what is called a progressive bulletin service. This is designed to assist consulting engineers and other buyers and specifiers of machinery in practical solutions of power-factor correction problems.

HEATING DEVICES.—Some of the larger heating-device companies are figuring on supplying to the government heating equipment which may be used by the soldiers in trenches.

BOSTON

Jobbers are experiencing a moderate reduction in the volume of business, due in part to seasonal conditions and apparently affected somewhat by high prices and a feeling of uncertainty as to the future. It is not believed that there will be any serious slump in business as a result of the draft, although in some quarters this is looked upon as a disturbing influence. Readjustments in manufacturing and commerce are continually taking place as the war advances. Credits and collections are reported as poorer this week, and one prominent jobber states that never in his relations with electrical contractors were collections in such bad shape. A healthy demand for appliances continues to be felt, one large central station having sold 2700 flatirons in the last month. The gross business of this company in appliances totaled \$238,000 for the year ended July 1, compared with \$117,000 the previous year. Work is progressing with great speed at the Ayer (Mass.) cantonment, officially to be known as Camp Devens. About 5000 men are now employed at this point, where 37,800 troops will be quartered, and the electrical requirements include about 2,000,000 ft. of wire, 3000 kva. in transformers, 30,000 lamps and 1000 poles. A telephone exchange building, 84 ft. long and 20 ft. wide, is to be opened this week and plans are completed for the immediate construction of an 8-mile, two-circuit steel tower line which will deliver energy at 66,000 volts to the cantonment from the New England Power Company's system.

Prices show little change compared with last week, and advances are not anticipated in many lines at present, though there is some expectation of further increases in floodlights and sockets.

LAMPS.—Prices remain as usual on domestic lamps. Deliveries on common sizes of tungsten units continue to improve and immediate shipments can now be made on many of these. One large manufacturer has a stock of more than 1,000,000 lamps in his Boston warehouse.

APPLIANCES.—The volume of trade is well maintained. Fans began to move very rapidly the first of the week on account of the hot wave, with the prospect that stocks would in many cases be exhausted by the end of the season. The vacuum cleaner trade shows a slight falling off. Washing machines are enjoying a steady sale.

MOTORS.—Motors are very active, both in alternating-current and direct-current types. In general deliveries are not so good except where manufacturers' stocks permit prompt shipment. The transportation problem has been solved for motors of one prominent make entering New England by marine shipments from the New York City district. Given the motors required, delivery is a matter of two or three days only.

TRANSFORMERS.—Business is somewhat lower in volume than heretofore, the demand for equipment for residential service being less and the market for industrial transformers being pretty well sold out. Even for military use, some difficulty has been experienced in obtaining transformers of large capacity within desired time limits.

SMALL GENERATORS.—Long deliveries, at least four to six months, discourage buying for isolated-plant service.

ARC LAMPS.—The demand is about normal for this season. There is no certainty that existing prices represent the maximum in this department.

FLOODLAMPS.—Business is still above normal, although the volume of trade in these equipments is somewhat less than immediately after the entrance of the United States into the war. Well-informed opinion is that prices may rise in the future, though no immediate schedules of increase are in hand.

WIRE.—A fairly steady demand is to be seen, with prices holding at current bases. No serious advance is expected in the general wire market at this time.

IRON CONDUIT.—Jobbing authorities report conditions as very bad in this department, with quotations demoralized.

LABOR.—The scarcity of labor, already serious in many localities, will be increased by the draft. Jobbing interests are looking for competent sales material in some instances. As a straw showing the direction of the wind, women bootblacks have begun work in Boston, and there is no question that in the utility and commercial branches of the electrical industry women will be called upon to an increasing degree as the war continues. Labor relations with electrical employers appear good at present.

ATLANTA

Specifications covering work for cantonments are rapidly reaching definite shape, permitting the trade to prepare and meet the abnormal requirements. It is reported that each camp through the local quartermaster will place orders for its quota of material in the proper quantities to be shipped as the work progresses. Approximately 300 electrical wiremen will be required for each camp to complete the interior wiring, street-lighting circuits, primary and secondary distributing systems in the proper time. While these men will be drawn mostly from the local industrial section, it is not expected that the labor situation will be very much disturbed, as wages will be about the same as now prevailing and the work will have to be completed in a comparatively short time.

The letting of large government contracts creates prosperous conditions, but exclusive of this feature general business is excellent and there is no visible indication that this condition will change materially very soon. Prices in all lines are firm with no marked advance.

Atlanta jobbers have an investment in stocks 50 per cent in excess of those carried on the same date a year ago. The contractors are not buying in large quantities. There is a slight tendency to hold up building on account of high prices and scarcity of material.

APPARATUS.—Although buyers are cognizant of the raw-material situation and shipment promises, the manufacturers are receiving numerous inquiries for large equipment and the volume of business continues strong.

CABLE.—Deliveries on varnished cambric are improving. The market for heavy power cable is good, and

promises of four months are being given. Stocks of the lighter cables are in very good condition.

DRY BATTERIES.—Climatic conditions are having a considerable effect on the volume of sales. The prevailing good weather at coast ports, however, has accelerated buying for marine purposes. There has been no advance since July 1. A sufficient supply is on hand.

FANS.—The demand has slackened during the week owing to rainy weather and lower temperatures.

DOMESTIC APPLIANCES.—Fairly steady demand is shown for irons, but the market for other household appliances continues dull.

CORDS AND PORTABLES.—There are practically no local stocks excepting standard No. 18 cotton-covered. Shipments on all other types are long, with no prospect for early relief owing to scarcity of raw materials.

METERS.—No let-up is noticed in demand for standard sizes. Shipments on high-tension types show no improvement.

POLE AND LINE MATERIAL.—Demand for all classes of this material is very strong. One large manufacturer reports good deliveries on large order for past week. The market for porcelain products is stronger than last week, in the face of 10 per cent increase July 11. No promises are being made, however, on deliveries.

WIRE.—Stocks of smaller sizes of solid conductor, both rubber-covered and weather-proof, are in very good condition. All stocks of standard conductors are practically depleted, with no prospects of early replenishment, as deliveries are slow.

WIRING DEVICES.—Demand is excellent. Local stocks are in good shape with reasonably prompt factory shipment.

TRANSFORMERS.—The demand is increasing and deliveries are improving.

ST. LOUIS

Conditions in this territory are, on the whole, exceedingly satisfactory, although there is some complaint as to inability to obtain certain materials, notably those involving iron in their construction. The industrial demand is tremendous. The interests interviewed report sales for the six months just past greatly in excess of the sales for the corresponding period last year.

Utilities appear to be buying sparingly, and only where absolutely necessary, although the aggregate of their purchases is very large.

There are still complaints of high prices and slow deliveries, but on the whole deliveries are improving. The jobbing trade appears to be in a particularly satisfactory condition, although stocks are low.

Collections are good in spite of the fact that money is tighter than it has been. While the prices for electrical supplies in this territory are stiff, they are not, it is claimed, so high as might be expected, considering the difficulty that is encountered in obtaining stock. Considerable quantities of supplies were purchased last fall at relatively low prices, and some of the concerns which have this material in stock are disposed to sell it at prices based on its actual cost rather than on the market prices now prevailing.

WIRING SUPPLIES.—There is a stiff demand for industrial plant wiring supplies for the new plants and installations which are now under construction. On the other hand, the construction of buildings for residential and rental purposes is rather slack, due to the high cost of all labor and materials. This is particularly true of buildings which are contemplated solely as real estate investments. Promoters of a large hotel endeavored to cancel the contracts after the foundations had been made because of the high cost of all materials. The demand for knob-and-tube wiring supplies is very poor. Jobbers find some difficulty in obtaining supplies which incorporate iron in their construction. The deliveries on most brass materials are fairly good. Substantial orders for wiring supplies for the United States Army encampments at Little Rock, Ark., and Fort Riley, Kan., have been filled from stock in this territory.

WIRE AND CABLE.—While this territory has not as yet felt the effect of the recent large government orders for insulated wire, it is expected that this will be a factor in future deliveries. Some of the large jobbers now have fairly good stocks of wire, but they are constantly decreasing, and it now may be accurately stated that stocks in general are depleted.

POLE-LINE HARDWARE.—Jobbers are having more difficulty in obtaining this material from the manufacturers, and some construction has been abandoned, temporarily at least, because of the very long deliveries quoted.

WROUGHT-IRON CONDUIT.—The demand is very good, but in most cases stocks are very low. Some jobbers are asking and getting card prices for immediate delivery. Deliveries from the manufacturers are very slow.

MOTORS.—Good sales are reported. Motors of popular ratings are taken out of branch house and jobber stocks about as fast as they are received. The business for the first six months of the year has been excellent in spite of the fact that deliveries generally are very poor. There is a big demand for motors for oil pumps in the Kansas and Oklahoma fields, and many motors are being sold in Arkansas for water pumping for rice fields.

INCANDESCENT LAMPS.—Business is most excellent, showing very material increases over the corresponding period for last year. Some stocks are low, while, on the other hand, other stocks are reported as being practically up to normal. It has been predicted that it is not unlikely that the demand for lamps will be strong a few months hence, and not improbable that the stocks may be depleted because of the cantonment orders and because of the fact that so many factories are operating on twenty-four-hour shifts. The central stations have been placing very large orders.

CENTRAL STATION SUPPLIES.—One concern reports an astonishingly great demand for staples, such as watt-hour meters, distributing transformers and switching and metering equipment in general. This is assumed to be due largely, though in a measure indirectly, to industrial activity.

FAN MOTORS.—From the manufacturers' standpoint the business has been very satisfactory, but in view of the almost uniformly low night temperatures which have been recorded over the country recently in the principal fan-using centers, it would not be surprising if sales should not continue to hold up. The sales on fans in Kansas and Oklahoma have been particularly good because of the heat waves which have passed over portions of those States.

MINING EQUIPMENT.—Mining electrical equipment is in great demand, particularly that for coal mining. This condition has been created by the fact that labor is scarce.

CEDAR POLES.—There are indications that Western and Northern cedar poles will be very scarce in the immediate future. In fact, there is now a noticeable shortage of the larger poles, those 50, 55 and 60 ft. long. Last winter the producers were unable, owing to the scarcity of labor, to get sufficient men to go into the woods for cutting.

SAN FRANCISCO

Practically no changes in prices occurred during the week, and there was a notable lull in electrical trade generally. The lull is accounted for partly by the large advance orders recently placed by firms engaged in construction or extension of plants and partly by a decrease in building activity. Credits and collections continue to be unusually good. The condition of stocks generally is very good, in spite of the poor and uncertain delivery that has obtained of late, and this is believed to be because the larger coast buyers have been well educated on the subject of advance orders.

INCANDESCENT LAMPS.—The lamp situation is critical and insufficient to supply demand.

FANS.—Fans are in great demand and orders cannot be filled.

WASHING MACHINES.—The market is very active and the demand is expected to increase.

BATTERIES.—Batteries have come into prominence with the recent activity in gas engine plants, and the slow delivery is causing some complaint.

MOTORS.—Motors are being supplied in larger quantities than ever before; nevertheless, only in sizes up to 10 hp. can the stock be kept abreast of demand. From 10 hp. to 20 hp. the demand slightly exceeds supply, and above 20 hp. the demand is far in excess of deliveries.

SEATTLE

The electrical jobbing business in the Northwest—Seattle and contiguous territory, especially—is feeling the effects of strike conditions which prevail to an alarming degree. The street railway lines in both Tacoma and Seattle are tied up by a trainmen's strike and station men in various power plants are expected to strike immediately in sympathy. A large proportion of the mills and logging camps, from the Gray's Harbor country and southwestern Washington to the Canadian boundary, are virtually closed down. The employees are holding out for an advance in wages and an eight-hour day. As the major portion of electrical jobbers' business is coming from lumber and shingle mills and shipyards, the prospects for immediate future activities are not alluring, especially if the shipyard strike materializes.

New construction is at very low ebb. Prospective builders prefer waiting until prices on building materials decrease. The amount of small work being done in any city in the Northwest is negligible. Freight conditions are about the same as reported in past weeks. Buying is very light, being just enough to supply demand. Dealers say they will make no attempt to replenish stock until a decrease in prices comes. Demands from shipyards and the government continue brisk. Credits and collections are very good.

COPPER.—Quotations remain unchanged. Demand shows slight increase while stocks are low. Conduit prices are unchanged. It is believed there will be an early advance and that the demand will be hard to supply. At present the demand is increasing.

MOTORS.—The demand is decreasing owing to labor troubles in important lines of industry. An increase is expected, however, when present difficulties are adjusted.

LAMPS.—There is a steady demand and stocks are comparatively easy to obtain.

APPLIANCES.—The market is normal and considered satisfactory for domestic appliances. Good prices are received.

FANS.—A slight increase in sale of fans due to prevailing warm weather has been noticed, and demand is considered unusual.

METAL MARKETS CONDITIONS

Price of Electrolytic Copper Falls to 26½ Cents in Stagnant Market

For some time there has been virtually no market for metals, and last week simply bore this out further. Neither buyers nor sellers are showing any activity. Prices are down somewhat, especially copper. Electrolytic fell to 26½ cents. It is doubtful, however, if any quantity could be purchased at this price.

Electrolytic copper was quoted in New York on Monday nominally as follows: July, 26.5 cents; August, 25.75 cents; third quarter, 25.5 cents; fourth quarter, 24.25 cents.

NEW YORK METAL MARKET PRICES

	July 16			July 23		
	£	s	d	£	s	d
Copper:						
London, standard spot	130	0	0	130	0	0
Prime Lake	29.00		30.00*	28.00		29.00*
Electrolytic	28.75		29.25*	26.25		26.75*
Casting	27.75		28.25*	25.00		25.50*
Wire base	36.00		37.00*	35.00		36.00*
Lead, trust price		11.00			11.00	
Nickel, ingot		50.00			50.00	
Sheet zinc, f.o.b. smelter		19.00			19.00	
Spelter, spot	8.75		8.85	8.55		8.67½
Tin, Straits		62.00			62.50	
Aluminum, 98 to 99 per cent.	52.00		54.00*	51.00		53.00*

OLD METALS

Brass, heavy	15.00		15.50	15.00		15.25
Brass, light	12.50		13.00	12.00		12.50
Heavy copper and wire	25.50		26.00	23.50		24.00
Lead, heavy	8.75		9.25	8.50		8.75
Zinc, old scrap	6.00		6.25	6.00		6.25

*Nominal.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor	
B. & S. Size	List, per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor	
No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE PER 1000 FT.—NEW YORK

Single-Conductor	
No. 14 solid:	
Less than coil.....	\$54.90 to \$61.00
Coil to 1000 ft.....	48.80 to 59.17
No. 12 solid:	
Less than coil.....	63.90 to 71.00
Coil to 1000 ft.....	56.80 to 68.87

Twin-Conductor	
No. 14 solid:	
Less than coil.....	\$78.00 to \$104.00
Coil to 1000 ft.....	75.00 to 80.00
No. 12 solid:	
Less than coil.....	121.50 to 135.00
Coil to 1000 ft.....	108.00 to 130.95

CHICAGO	
Single-Conductor	
DISCOUNT	
Less than coil.....	+10%
Coil to 1000 ft.....	-10%

Twin-Conductor	
Less than coil.....	+10%
Coil to 1000 ft.....	-10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	+12% to 10%
1/5 to std. pkg.....	10% to 20%
Std. pkg.....	24% to 44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+10% to 12%
1/5 to std. pkg.....	10% to 20%
Std. pkg.....	34% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 30.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28	.29

BATTERIES, DRY—Continued CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 30.....	.35	.35
50 to barrel.....	.31 to .31 3/4	.32 to .32 3/4
Barrel lots.....	.28 to .28 3/4	.29 to .29 3/4

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5 1/8.....	250	\$5.00
3/4.....	250	7.50
1.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less than Coil	Coil to 1000 Ft.
3/8-in. single strip.....	\$67.50 to \$75.00 \$60.00 to \$68.75
3/8-in. double strip.....	73.75 to 75.00 63.75 to 72.00
1/2-in. single strip.....	90.00 to 100.00 80.00 to 93.00
1/2-in. double strip.....	95.00 to 100.00 85.00 to 96.00

NET PER 1000 FT.—CHICAGO

Less than Coil	Coil to 1000 Ft.
3/8-in. single strip.....	\$75.00 \$63.75
3/8-in. double strip.....	78.75 71.25
1/2-in. single strip.....	100.00 85.00
1/2-in. double strip.....	105.00 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List, per Foot	Size, In.	List, per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
3/4.....	.15	2.....	.55
1.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—		
\$36.67-\$55.00	\$24.50-\$27.50	\$21.50-\$24.75
1/4-in.—		
\$40.00-\$60.00	\$27.00-\$30.00	\$23.50-\$27.00

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—		
\$36.67-\$55	\$25.50-\$27.50	\$23.10-\$24.75
1/4-in.—		
\$40.00-\$60.00	\$30.00	\$25.20-\$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List	Elbows, List
1/4.....	\$0.05 \$0.19
3/8.....	.06 .19
1/2.....	.07 .19
3/4.....	.10 .25
1.....	.13 .37
1 1/4.....	.17 .45
1 1/2.....	.21 .60
2.....	.28 1.10
2 1/2.....	.40 1.80
3.....	.60 4.80

DISCOUNT—NEW YORK

1/4 In. to 1 1/4 In.	3/4 In. to 3 In.
Less than 2500 lb. 6% to 8%	8% to 10%
2500 to 5000 lb. 9% to 11%	11% to 13%
(For galvanized deduct six points from above discounts.)	

DISCOUNT—CHICAGO

Less than 1/4 In. to 1/2 In.	3/4 In. to 3 In.
2500 lb. 3.8% to 5.8%	5.8% to 7.8%
2500-5000 lb. 6.8% to 8.8%	8.8% to 10.8%
(For galvanized deduct six points from above discounts.)	

FLATIRONS NEW YORK

Net.....	\$3.50
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CHICAGO

List.....	\$5.00 to \$6.00
Discount.....	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38% to 39%

FUSE PLUGS	
3-Amp. to 30-Amp.	
NEW YORK	
	Per 100 Net
Less than 1/5 std. pkg.....	\$5.75 to \$6.30
1/5 to std. pkg.....	4.50 to 5.25
Standard package, 500.	List, \$0.07.

CHICAGO	
	Per 100 Net
Less than 1/5 std. pkg.....	\$6.25
1/5 to std. pkg.....	5.25
Standard package, 500.	List, \$0.07.

LAMPS, MAZDA	
105 to 125 Volts	
	List.
Regular, clear:	Std. Pkg. Each
10 to 40-watt—B.....	100 \$0.27
60-watt—B.....	100 .36
100-watt—B.....	24 .65
75-watt—C.....	50 .65
100-watt—C.....	24 1.00
200-watt—C.....	24 2.00
300-watt—C.....	24 3.00
Round bulb, 3 1/4 in., frosted:	
15-watt—G 25.....	50 .50
25-watt—G 25.....	50 .50
40-watt—G 25.....	50 .50
Round bulbs, 3 3/4 in., frosted:	
60-watt—G 30.....	24 .72
Round bulbs, 4 1/2 in., frosted:	
100-watt—G 35.....	24 1.05

DISCOUNT—NEW YORK	
Less than std. pkg.....	Net
Std. pkg.....	10%

DISCOUNT—CHICAGO	
Less than std. pkg.....	10%
Std. pkg.....	10%

LAMP CORD	
Cotton-Covered, Type C, No. 18	

NEW YORK	
	Per 1000 Ft. Net
Less than coil (250 ft.).....	\$30.00 to \$35.17
Coil to 1000 ft.....	21.00 to 26.73

CHICAGO	
	Per 1000 Ft. Net
Less than coil (250 ft.).....	\$37.84 to \$38.16
Coil to 1000 ft.....	28.38 to 28.62

LAMP GUARDS, WIRE	
Standard packages from 50 to 150.	

NEW YORK	
Net per 100.....	\$18.00 to \$29.00

CHICAGO	
Net per 100.....	\$14.17 to \$30.00

OUTLET BOXES	
	List.
Nos.	per 100
101—A, A1 1/2, 4 S.C., 6200, 320.....	\$30.00
102—B.A., 6200 S.E., 300, A.X. 1 1/2,	
4 S.....	30.00
103—C.A., 9, 4 R, B 1 1/2.....	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.....	20.00

DISCOUNT—NEW YORK	
	Black Galvanized
Less than	
\$10.00 list	33% to net list 27% to list
\$10.00 to \$50.00 list	42% 37%

DISCOUNT—CHICAGO	
	Black Galvanized
Less than	
\$10.00 list	40% to 43% 35% to 37%
\$10.00 to	
\$50.00 list	50% to 53% 40% to 48%

PIPE FITTINGS	
DISCOUNT—NEW YORK	
Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	30%

DISCOUNT—CHICAGO	
Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	30%

PORCELAIN CLEATS—UNGLAZED	
2 and 3 Wire	
NEW YORK	
	Per 1000 Net
Less than 1/5 std. wire.....	\$14.00 to \$20.00
1/5 to std. pkg.....	13.00 to 15.00
Standard package, 2200.	List per 1000,
\$20.	

CHICAGO	
	Per 1000 Net
Less than 1/5 std. pkg.....	\$14.00 to \$18.20
1/5 to std. pkg.....	13.00 to 16.90
Standard package, 2200.	List per 1000,
\$20.	

PORCELAIN KNOBS	
NEW YORK	
	5 1/2 N.C.—Nail-It—
	Solid N.C.
	Std. Pkg. Std. Pkg.
	3500 4000
Per 1000 Net	
Less than	
1/5 std. pkg.....	\$10.50 to \$24.30
1/5 to std. pkg.....	9.75 to 12.15

CHICAGO	
	5 1/2 NC.—Solid Nail-it—N.C.
	Std. Pkg. 3500 Std. Pkg. 4000
Per 1000 Net	
Less than	
1/5 std. pkg.....	\$10.20 to \$18.00 \$20.75 to \$28.00
1/5 to std. pkg.....	9.00 to 9.75 16.30 to 21.50

SOCKETS AND RECEPTACLES	
	Std. Pk. List
1/8-in. cap key and push	
sockets.....	500 \$0.33
1/8-in. cap keyless socket.....	500 .30
1/8-in. cap pull socket.....	250 .60

DISCOUNT—NEW YORK	
Less than 1/5 std. pkg.....	Net list
1/5 to std. pkg.....	15% to 20%

DISCOUNT—CHICAGO	
Less than 1/5 std. pkg.....	Net
1/5 to std. pkg.....	15%

SWITCHES, KNIFE	
250-Volt, Front Connections, No Fuse	
High Grade:	List
30-amp. S. P. S. T.....	\$0.80
60-amp. S. P. S. T.....	1.20
100-amp. S. P. S. T.....	2.25
200-amp. S. P. S. T.....	3.48
300-amp. S. P. S. T.....	5.34
30-amp. D. P. S. T.....	1.20
60-amp. D. P. S. T.....	1.78
100-amp. D. P. S. T.....	3.38
200-amp. D. P. S. T.....	5.20
300-amp. D. P. S. T.....	8.00
30-amp. 3 P. S. T.....	1.80
60-amp. 3 P. S. T.....	2.68
100-amp. 3 P. S. T.....	5.08
200-amp. 3 P. S. T.....	7.80
300-amp. 3 P. S. T.....	12.00
Low Grade:	
30-amp. S. P. S. T.....	0.42
60-amp. S. P. S. T.....	0.74
100-amp. S. P. S. T.....	1.50
200-amp. S. P. S. T.....	2.70
30-amp. D. P. S. T.....	0.68
60-amp. D. P. S. T.....	1.22
100-amp. D. P. S. T.....	2.50
200-amp. D. P. S. T.....	4.50
30-amp. 3 P. S. T.....	1.02
60-amp. 3 P. S. T.....	1.84
100-amp. 3 P. S. T.....	3.76
200-amp. 3 P. S. T.....	6.76

DISCOUNT—NEW YORK	
Less than \$10 list.....	5% to +5%
\$10 to \$25 list.....	11% to 16%
\$25 to \$50 list.....	14% to 24%

DISCOUNT—CHICAGO	
Less than \$10 list.....	5% to +5%
\$10 to \$25 list.....	11% to 16%
\$25 to \$50 list.....	14% to 24%

SWITCHES, SNAP AND FLUSH	
5-Amp. and 10-Amp., 125-Volt Snap Switches	
	Std. Pkg. List
5-amp. single-pole.....	250 \$0.28
5-amp. single-pole ind.....	250 .32
10-amp. single-pole.....	100 .48
10-amp. single-pole, ind.....	100 .54
5-amp. three-point.....	100 .56
10-amp. three-point.....	50 .76
10-amp., 250-volt, D. P.....	100 .66

SWITCHES, SNAP AND FLUSH—Cont'd	
10-Amp. 250-Volt Push-Button Switches	
	Std. Pkg. List
10-amp. single-pole.....	100 \$0.45
10-amp. three-way.....	50 .70
10-amp. double-pole.....	50 .70

DISCOUNT—NEW YORK	
Less than 1/5 std. pkg.....	Net list
1/5 to std. pkg.....	16%
Std. pkg.....	28%

DISCOUNT—CHICAGO	
Less than 1/5 std. pkg.....	Net
1/5 to std. pkg.....	15%
Std. pkg.....	30%

SWITCH BOXES, SECTIONAL CONDUIT	
	List.
Union and Similar	Each
No. 155.....	\$0.34
No. 160.....	.60

DISCOUNT—NEW YORK	
	Black Galvanized
Less than	
\$2.00 list	23% to list
\$2.00 to \$10.00	
list	23% to 20%
\$10.00 to \$50.00	
list	23% to 30%

DISCOUNT—CHICAGO	
	Black Galvanized
Less than	
\$2.00 list	25% to 50% 15% to 40%
\$2.00 to \$10.00	
list	25% to 50% 20% to 40%
\$10.00 to \$50.00	
list	25% to 64% 20% to 52%

TOASTERS, UPRIGHT	
NEW YORK	
Net price	\$3.15 to \$3.50

CHICAGO	
List	\$4.00 to \$4.50
Discount	25% to 30%

WIRE, ANNUNCIATOR	
DISCOUNT—NEW YORK	
No. 18, less than full spools.....	52%
No. 18, full spools.....	48%

CHICAGO	
	Per Lb. Net
No. 18, less than full	
spools	\$0.65 to \$0.6885
No. 18, full spools	0.5285 to 0.55

WIRE, RUBBER-COVERED, N. C.	
Solid-Conductor, Single-Braid	
NEW YORK	
	Price per 1000 Ft. Net
	Less than 500 to 1000 to
No. 500 Ft. 1000 Ft. 5000 Ft.	
14 ...	\$15.00-18.00 \$12.00-14.50 \$11.50-12.50
12 ...	21.06-27.05 18.96-22.85 18.01-20.95
10 ...	29.60-39.27 26.64-33.66 25.31
8 ...	42.40-51.44 38.16-48.42 36.25
6 ...	72.19-89.57 64.98-76.80 61.73

CHICAGO	
	Price per 1000 Ft. Net
	Less than 500 to 1000 to
No. 500 Ft. 1000 Ft. 5000 Ft.	
14 ...	\$18.00 \$16.00 \$14.00
12 ...	29.89 25.62 21.35-23.48
10 ...	41.51-42.28 35.58-36.24 29.65-33.22
8 ...	51.54-60.13 47.25-51.50 42.95-47.25
6 ...	74.80-82.20 68.00-75.35 60.50-61.20

WIRE, WEATHER-PROOF	
Solid-Conductor, Triple-Braid, Sizes 4/0 to 8 Inc.	

NEW YORK	
	Per 100 Lb. Net
Less than 25 lb.	\$40.25 to \$45.00
25 to 50 lb.....	39.25 to 42.00
50 to 100 lb.....	\$38.00

CHICAGO	
	Per 100 Lb. Net
Less than 25 lb.....	\$45.00 to \$45.50
25 to 50 lb.....	44.00 to 44.50
50 to 100 lb.....	43.00 to 43.50

NEW APPARATUS AND APPLIANCES

*A Record of Latest Developments and Improvements in Manufacturers' Products
Used in the Electrical Field*

Magnet-Type Battery Meters

Pocket battery meters of the permanent magnet type are made by the Harvard Electric Company, 525 West Van Buren Street, Chicago. The meters are light, nickel-plated and of convenient pocket size, being $2\frac{1}{4}$ in. (5.2 cm.) in diameter, $\frac{5}{8}$ in. (15.9 mm.) thick and 4 oz. (113 gr.) in weight. The makers claim that they are accurately calibrated and guaranteed for two years. Neither the temperature nor the weather affects their accuracy, it is pointed out. They may be read in any position, with or without the use of the flexible cable. The ammeters are used for testing dry cells, indicating the direction of current as well as its strength, and are nearly deadbeat. A flexible cable accompanies each instrument so that the total effect of the battery may also be easily determined.

Laboratory Rheostat with Sliding Contact

A rheostat in which the line and load terminals are completely differentiated and appropriately labeled is being made by James G. Biddle, 1211 Arch Street, Philadelphia, Pa. This rheostat, which was designed by Prof. H. L. Dodge of Iowa State University, has been made as nearly fool-proof as possible. Referring to the accompanying illustration, the left-hand pair of binding-posts is for the line connection, and the right-hand pair is for the load connection. Each pair is plainly marked, so that there can be no legitimate excuse for wrong connection. When the knife switch is open, the load and rheostat are connected to the line in series. By closing the switch the rheostat is placed across the line and the load arranged as a shunt around the rheostat. In either case the current in the load will be varied by moving the sliding contact in the usual way. If the switch is open with the



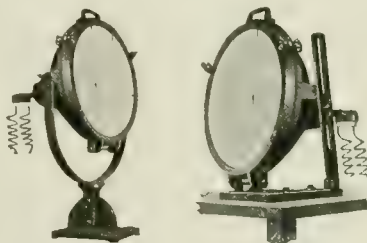
MAXIMUM RANGE OF REGULATION ALWAYS AVAILABLE

slider at the "all-in" position, the current will be cut to its lowest value on the series connection for a given load and voltage. To decrease the current below this point, the switch is closed. It then becomes possible because of the

shunt connection to decrease the current in the load down to zero. All connecting wires are open so as to be readily traced. These rheostats may be used on the voltage for which they are rated, with a load of any resistance, and are always capable of providing any current value in the load between zero and the maximum current rating for the rheostat. Consequently, in every case the maximum range of regulation is available.

Floodlight Projector with One-Piece Body

Floodlight projectors that have one-piece bodies, made of either cast iron or aluminum, which form the housing for the reflector, have been developed by the George Cutter Company, South Bend, Ind. The body serves as an adequate protection against denting and abuse to the reflector, which must re-

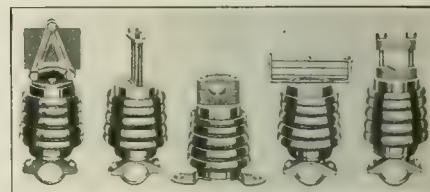


LIGHT CAN BE PROJECTED IN ANY DIRECTION

tain a true parabolic shape for correct projector lighting. In designing the metal body provision was made for changing of reflectors when it is desired to change the distribution of light. The unit can be adjusted to project the light rays in any direction, it being possible to rotate the body of the lamp through 360 deg. in any plane. Besides permitting further directional adjustment, the mounting plate lends itself readily for mounting the unit on a pipe standard, platform or pole, or it may be suspended from a ceiling or wall. Although designed particularly for the new 200-watt and 400-watt projector lamps, other lamps having concentrated filaments may be used in the unit. The socket is designed for adjustment to change the focus, the spread of the beam being altered to suit any particular condition. There are no openings in the body. The lamp is cooled by the circulation of air between the reflector and body within the parabola, the air being cooled by radiation from the body. The hinge door is fitted with sectional wire glass. It is held in place with wing nuts and may be locked with a padlock to prevent theft of the lamp.

Standardized Busbar Supports

Standardized busbar, bus-wire and bus-tube supports to meet a wide range of requirements have been brought out by the General Electric Company of Schenectady, N. Y. The insulators are



BUS SUPPORTS THAT MEET WIDE RANGE OF REQUIREMENTS

divided into two classes—one for use up to 3500 volts and the other from that voltage up to 16,500 volts. The only difference is in the two sizes of insulators to meet different voltage requirements.

Interchangeable iron caps are fastened permanently to each end of the insulators. Then to the cap which is to form the top of the insulator are fastened various supporting fittings on which bus wires, bus tubes or busbars are mounted. To the lower cap one of three different fittings, for supporting respectively on $\frac{3}{4}$ -in. or $1\frac{1}{4}$ -in. (1.90-cm. or 3.31-cm.) pipe, or flat surfaces, is fastened by two bolts. The construction of each fitting fastened to the bottom of the insulator is such that the insulator can be turned through an arc of 90 deg. parallel to its base and locked in any desired position by the holding bolts.

The support on the left is used for busbars on edge which must be clamped in place. This support is used also in bus compartments when provided with fitting for flat surface mounting. One part of the bus clamp is bolted to the insulator cap, the other part of the clamp to the first part. The next support is used for busbars on edge when it is desired to hold the bars in place against vertical movement, or when in bus compartments it is necessary to use a stay insulator and sectionalizing switches. The link across the top of the upright pins will hold the bus in place vertically and horizontally.

When there is no need of guard against vertical movement of the bars the uprights, nuts and cross link shown are omitted and in their place are used two uprights threaded only on the lower ends.

The third support is used for round busbars, either tube or solid. This support can be mounted upright, hori-

zontally or in an inverted position. Bare conductor is generally used with the support. This support is built for busbars of three different diameters— $\frac{3}{4}$ in., $1\frac{1}{16}$ in. and $1\frac{5}{16}$ in. (1.9-cm., 2.4-cm. and 3.3-cm.).

The fourth support from the left is used when busbars are placed on side. The number of horizontal cross-pieces used with this type of support will depend upon the number of busbars it is desired to support.

The support on the right is made in two sizes, one for supporting $1\frac{1}{4}$ -in. (3.2-cm.) and the other for $1\frac{5}{8}$ -in. (4.1-cm.) bus wire. This support can be mounted upright, horizontally or inverted. The upper part is made of two fiber parts which are held in place by bolts running through the fiber into the insulator cap. The wire for use with this support is usually insulated.

Various other styles of top fittings are available, but the above description will serve to indicate in a general way the extent of this particular line. Ventilation is obtained by spaces between the bus lamination. When these spaces are not provided by the connection bars from breakers or switches, spacers are inserted between the bus laminations.

Switch with Current Tap

A combined outlet and light switch from which current may be tapped for the usual electrical appliances is being manufactured by the Bryant Electric Company of Bridgeport, Conn. In connecting this combination device into the circuit, the line wires may be attached to either end of the device. When the wires are tapped on the switch end the switch controls the receptacle member of the combination as well as the outgoing circuit from the switch proper. If the wires are connected to the receptacle end of the device, current may be taken off through the receptacle irrespective of the position of the switch. The switch will then control only its own outgoing circuit. In the type of switch illustrated, which has but one button, the position of the switch is indicated by the words "on" or "off," as the case may be, which show through an aperture in the end of the button. The type "O" switch unit of this combination is provided for double-pole connections only. Any of the several

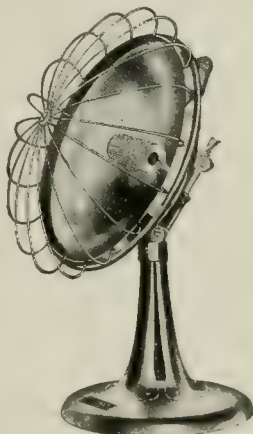


COMBINED SWITCH AND CURRENT TAP

different forms of plugs and attachment caps, either reversible or non-reversible, polarity types, can be used for plugging into this receptacle. This device is one of the Spartan receptacles and plugs made by the Bryant company.

Electric Heater Built Like Portable Lamp

A portable electric heater for home use is being manufactured by the Hot-point Electric Heating Company of Ontario, Cal. The outfit is substantially constructed of pressed steel, on the principle of the portable lamp, care being taken to bring about lines which are symmetrical and which are pleasing to the eye. A steel reflector $9\frac{1}{2}$ in. (24.1 cm.) in diameter is connected to the top of the pedestal by a hinged joint which is adjustable to numerous positions from horizontal to diagonal, upward. This reflector, which is of a special parabolic design, is heavily plated with a triple coat of highly polished copper. The back of the reflector is finished in black enamel. Wire protecting guards over the heating element are attached to a copper-plated rim. These guards may be easily removed for cleaning the reflector or changing



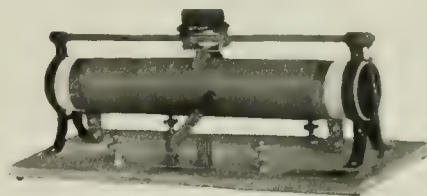
PORTABLE ELECTRIC HEATER

the heating element, which is also easily and quickly detachable. The heating element consists of a composition core 1 in. (2.54 cm.) in diameter, around which is wound high-resistance wire. The wire is first wound into a small coil and then wound around the composition core, giving a large amount of resistance material in a small area. This coil will attain a temperature of about 1200 deg. The base of this heater is made of steel, nickel-plated, and is weighted so that should the heater be accidentally tipped over while the current is on it will assume a position with the heating element pointing upward.

Laboratory Rheostat with Substantial Mounting

The design of the Dodge laboratory rheostat provides a system of wiring whereby a rheostat may be connected either in series with the load or as a shunt across the line, the change being made simply by closing a single-throw switch. By means of the slider the resistance may be varied from zero to the maximum of the rheostat. When connected in series with the load, this variation of the resistance produces a variation of the voltage across the load, the minimum of which is limited by the ratio of the load resistance to

the total resistance of the circuit. The current through the load is varied in the same proportion. By closing the switch and thereby shunting the rheostat across the line, a potentiometer effect is secured by means of



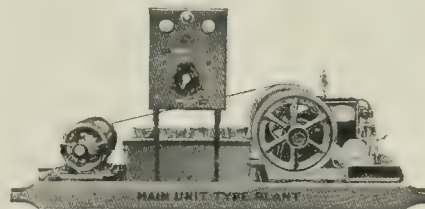
RESISTANCE OF THIS RHEOSTAT PROPERLY WORKED OUT BY MAKERS

which the voltage and current may be varied from zero to a maximum amount which is the same as the minimum of the series connection.

With this rheostat, it is claimed, it has been possible to make the voltage and current the determining characteristics. The resistance is purely incidental from the standpoint of the user. With the resistance properly worked out by the manufacturer, in relation to the other factors, resulting current capacity is the greatest which can be had with a given voltage, and within these limits every value of the voltage and current down to zero can be secured, no matter what the load. The user is thus able to choose a rheostat by voltage and current capacity. This rheostat is made by the Central Scientific Company at Chicago.

Compact Lighting and Power Plant

A compact lighting and power plant, designed for dealers to use as a demonstrator, that can be placed on a truck and transported from place to place and demonstrated at will, has been developed by the Main Electric Company of Pittsburgh, Pa. The entire plant is contained on one set of rails, including the engine, storage battery, dynamo and switchboard. The small-size switchboard used with this plant folds over, permitting the complete plant to be shipped in one box all set up, battery charged, all connections made, ready for immediate use on its arrival. This type of portable unit plant is built in sizes designed for



POWER PLANT THAT IS EASILY TRANSPORTED

25, 40, 50 and 75 lamps. All wiring is in conduit. The engine contains a waterproof built-in magneto, the batteries are inclosed, of the portable type, and the whole outfit is made for all-round usage.

Trade Notes

THE STANDARD UNDERGROUND CABLE COMPANY, Perth Amboy, N. J., is building a new extension to its plant.

THE CUTLER-HAMMER MANUFACTURING COMPANY announces the removal of its New Haven office to 962 Chapel Street.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, will build an extension to its plant at Nineteenth Street and Allegheny Avenue.

HERBERT C. LAW announces that he has resigned from the Brookfield Glass Company to accept a position with the American Jobbers' Supply Company, 1122 Woolworth Building, New York City.

A. C. CORNELL, who has been house-goods specialist in the St. Louis branch house of the Western Electric Company, has been appointed sales manager of the Denver (Col.) branch house of that company.

THE BLAW STEEL CONSTRUCTION COMPANY and the Knox Pressed & Welded Steel Company have consolidated under the name of the Blaw-Knox Company. The personnel of the two organizations will remain unchanged.

L. S. WASHINGTON, formerly a member of the transformer sales division of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, has recently been transferred to the St. Louis office of that company as supply salesman.

THE GENERAL ELECTRIC COMPANY will soon commence the construction of a one-story and two-story reinforced-concrete addition, 135 ft. by 250 ft., at its Edison Lamp Works, Harrison, N. J., to cost about \$200,000. Bids for erection have been received.

THE SANGAMO ELECTRIC COMPANY of Springfield, Ill., has established a service station on the Pacific Coast for recalibration and repairs of Sangamo meters for territory west of Salt Lake City. The service station is at the factory of the Western Electro-Mechanical Company in Oakland, Cal.

ROBERT E. RAE, for many years with the Western Electric Company and for the last four years sales manager for Stanley & Petterson, New York City, jobbers and manufacturers, has resigned from the latter firm. Mr. Rae's plans for the future are unsettled, but he will doubtless continue along the selling line and in organizing and executive work.

THE LEEDS & NORTHRUP COMPANY, Philadelphia, announces that its factory was closed from Aug. 6 to Aug. 18. During that period practically the entire force of the company took its vacation and all production work was stopped. The new factory addition, which will double the floor space, is nearing completion, and the company expected to move into it during the vacation period.

THE GEORGE CUTTER COMPANY, South Bend, Ind., announces the addition to its sales organization of J. H. Lynch, who will operate from the company's branch office in New York City. For fifteen years Mr. Lynch has been associated with the electrical industry as a central station man, contractor and salesman. During the last five years he has been connected with the Buffalo office of the Westinghouse Electric & Manufacturing Company and has made many friends in the electrical trade in the Eastern territory.

F. H. TACKABERRY, the general agent of the American Steel Export Company, sailed from New York City on Saturday, July 7, on the Lamport & Holt steamer Vestris for South America. Mr. Tackaberry will cover a large portion of the Latin-American countries, visiting the following important cities: Rio de Janeiro, Sao Paulo, Buenos Aires, Montevideo, La Plata, Rosario, Valparaiso, Santiago, etc. Primarily, the reason of Mr. Tackaberry's trip will be to collaborate with the company's various agents throughout South America, lending every possible aid and acquainting them more thoroughly with the facilities available at the home office, and also with the market conditions in this country for iron and steel and engineering and contracting.

THE GENERAL ELECTRIC COMPANY, to meet the growth and increasing variety of applications of electric heating to the industrial field, has concentrated production of this material in a new building at the Schenectady plant. Manufacturing facilities will be increased by the exclusive use of this building, which has approxi-

mately 20,000 sq. ft. of floor space and has no dark corners. Many of the machines are developed especially to meet the unique requirements for machining, assembling and testing which occur in the production of industrial heating devices. Output of the new shop ranges from the smallest heating unit to complete equipments for industrial ovens for core baking, Japan baking and for baking and drying miscellaneous materials and complete ovens for sherardizing and air tempering. In addition, the shop also produces melting pots for lead and tin alloys and many other devices for applying electric heat to the industries.

Trade Publications

INSULATORS.—The R. Thomas & Sons Company of East Liverpool, Ohio, has prepared catalog No. 16, descriptive of transmission-line insulators for all voltages.

LIGHTING SERVICE.—I. P. Frink, Inc., Twenty-fourth Street and Tenth Avenue, New York City, has issued a twelve-page booklet on "Lighting Service for Hospitals."

EXPANSION JOINTS.—Crosshead-guided expansion joints are illustrated and described in a folder now being distributed by the Ross Heater & Manufacturing Company, Inc., 753 Bird Avenue, Buffalo, N. Y.

CHARGING OUTFITS.—Special outfits for recharging ignition and lighting batteries are illustrated and described in a leaflet now being distributed by the General Electric Company of Schenectady, N. Y.

TABLEWARE.—The Hotpoint Electric Heating Company of Ontario, Cal., has prepared a bulletin descriptive of Hotpoint tableware. This bulletin takes in percolators, grills, toasters, chafing dishes, teakettles and teapots.

RHEOSTATS.—James G. Biddle, 1211 Arch Street, Philadelphia, is distributing bulletin No. 870, descriptive of its "Jagab" laboratory rheostats. This bulletin describes sliding-contact tube rheostats, Dodge design rheostats and compression carbon rheostats.

PROJECTORS.—The National X-Ray Company of Chicago and New York is distributing a red, white and blue circular on twenty-four hours of daylight. This circular describes the X-ray projector No. 51, for use with 200-watt Mazda "C" lamps, and the Mogul No. 90 X-ray projector, which can be used with any size standard Mazda lamp having Mogul base.

STEAM SPECIALTIES.—Bulletin No. 106, descriptive of steam specialties made by the John E. Angell Steam Specialties Company, Inc., 64 West Randolph Street, Chicago, is now being distributed. This bulletin includes information on steam water heaters, ammonia separators, oil separators, steam separators, turbo-type steam separators and water-softening systems.

CIRCUIT BREAKERS.—Bulletin No. 47-419, descriptive of small-capacity industrial oil circuit breakers, is now being distributed by the General Electric Company of Schenectady, N. Y. These oil circuit breakers are for use on three-phase induction motors at 10 hp. or less. This company is also distributing a bulletin descriptive of its type CR 9510 solenoid brakes for alternating-current or direct-current motors from 1 hp. to 300 hp.

BUREAU OF MINES PUBLICATIONS.—The following publications have been issued by the United States Bureau of Mines: Bulletin 124, "Sandstone Quarrying in the United States," by Oliver Bowles; Technical Paper 82, "Oxygen Mine-Rescue Apparatus and Physiological Effects on Users," by Yandell Henderson and James W. Paul; Technical Paper 135, "Bibliography of Recent Literature on Flotation of Ores, January to June, 1916," compiled by D. A. Lyon, O. C. Ralston, F. B. Laney and R. S. Lewis; Technical Paper 140, "The Primary Volatile Products of the Carbonization of Coal," by G. E. Taylor and H. C. Porter; Technical Paper 143, "The Ores of Copper, Lead, Gold and Silver," by C. H. Fulton; Technical Paper 160, "The Determination of Nitrogen in Substances Used in Explosives," by W. C. Cope and G. B. Taylor; Technical Paper 166, "Motor Gasoline, Properties, Laboratory Tests and Practical Specifications," by E. W. Dean. These publications should be ordered by number and title. Applications should be addressed to the director of the Bureau of Mines, Washington, D. C.

New Incorporations

THE WILLIS ELECTRIC COMPANY of Cleveland, Ohio, has been incorporated with a capital stock of \$15,000 by Willis W. Hale and others.

THE SPRINGFIELD (Ohio) ELECTRIC COMPANY has been incorporated with a capital stock of \$2,500 by Allen H. Frost, Kirk L. Bly, Edson S. Hineine, Ralph E. Wheeler and Roscoe C. Lorentz.

THE STANDARD TUNGSTEN CORPORATION of Newark, N. J., has been chartered with a capital stock of \$100,000 by G. Dazet and R. T. Rodger to manufacture lamps and tungsten specialties.

THE GROTON (N. Y.) ELECTRICAL DEVICES COMPANY has been incorporated by D. J. Watrous and B. and J. Conger of Groton, to manufacture electrical machines for heating and drying.

THE ACME ELECTRIC & MACHINE COMPANY of Cleveland, Ohio, has been incorporated with a capital stock of \$15,000 by Edward Younger, Samuel Friedman, L. M. Sewell, A. C. Teare and C. A. Ninan.

THE DUQUESNE ELECTRIC & MANUFACTURING COMPANY of Pittsburgh, Pa., has been incorporated with a capital stock of \$50,000 to manufacture electrical machinery, etc. E. A. Casey is treasurer.

THE ELECTRIC MOTOR & REPAIR COMPANY of Akron, Ohio, has been chartered with a capital stock of \$10,000 by S. W. Sweet, Henry Kish, R. S. Whitright, W. A. Heffelman and Mead Chamberlain.

THE LONG LIGHT LENS COMPANY of Kokomo, Ind., has been incorporated with a capital stock of \$25,000 to manufacture auto and vehicle headlights. The directors are: Maurice E. Louth, Fred L. Trees and Earl B. Barnes.

THE SUNLIGHT ELECTRIC MANUFACTURING COMPANY of Warren, Ohio, has been chartered with a capital stock of \$50,000 by C. H. Mills, C. H. Sadler, C. L. Wood, B. B. Nick and D. R. Estabrook.

THE ROBERT A. BUCHER COMPANY of Philadelphia, Pa., has been incorporated with a capital stock of \$10,000 to manufacture vacuum cleaners, etc. The incorporators are: John G. Bucher, Walter F. Eyrich and Frank A. Fisher.

THE MONROE LAMP COMPANY of New York, N. Y., has filed articles of incorporation with a capital stock of \$100,000 to manufacture lamps and fixtures. The incorporators are: George Tiernan, F. H. Parcels and J. B. Purcells.

THE PETERSON STORAGE BATTERY COMPANY of Hempstead, N. Y., has been incorporated by Christian Petersen, John Petersen and Andrew Petersen. The company is capitalized at \$10,000 and proposes to deal in storage batteries and operate a garage.

THE T. A. GILLESPIE COMPANY of Gillespie, N. J., has been incorporated by Thomas H. Gillespie, H. S. Morrow and R. A. Johnston of New York, N. Y. The company is capitalized at \$500,000 and proposes to do a general contracting and electrical engineering business.

THE W. J. SMYTH CORPORATION of New York, N. Y., has been incorporated by R. J. Smyth, A. A. Notzen and S. M. Louis, 51 Chambers Street, New York City. The company is capitalized at \$20,000 and proposes to deal in dynamos, machinery, foundry and factory supplies.

THE JESSEMERIE CONSTRUCTING & CONTRACTING COMPANY of New York, N. Y., has been chartered with a capital stock of \$100,000 to do general construction, contracting and electrical work. The incorporators are: A. Hallow, S. W. Weber and R. S. Davidson, 227 Riverside Drive, New York City.

THE CARROLL COMPANY of Larksville, Pa., has been incorporated by John A. Carroll, Thomas J. Bremen and R. J. Walsh, all of Larksville. The company is capitalized at \$25,000 and proposes to install and operate an electric-light plant in Larksville and erect electric transmission lines to nearby towns.

THE INDUSTRIAL ELECTRIC FURNACE COMPANY of Indianapolis, Ind., has been incorporated by Charles B. Sommers, Charles B. Fletcher, F. von Schlegell, F. T. Snyder and S. A. Fletcher. The company is capitalized at \$500,000 and proposes to construct electric furnaces and iron and steel products. The factory will be located in Indianapolis, Ind., and offices will be maintained in Chicago, Ill.

New England States

PORTSMOUTH, N. H.—Arrangements have been made whereby the Rockingham Light & Power Company is to furnish energy to operate the system of the Portsmouth & York Street Railway Company.

ST. ALBANS, VT.—The St. Albans & Swanton Street Railway Company has purchased two 650-kw. generators to be installed at the Fairfax plant of the Public Electric Light Company. George A. Murch is general manager.

FISHERVILLE, MASS.—Howard G. Ramsey of Uxbridge has been awarded the contract for wiring and fixtures in 123 houses for the Fisherville (Mass.) Manufacturing Company. Work will begin at once.

FITCHBURG, MASS.—A plan for a uniform lighting system throughout the city, and the installation of heavier units in the business section is under consideration. It is proposed to replace the arc lamps now in use with incandescent lamps of various candlepower with strong reflectors. The Fitchburg Gas & Electric Company has the contract for street-lighting.

LENEX, MASS.—The Lenox Electric Company has awarded a contract for laying 8000 ft. of underground cable and 40,000 ft. of overhead wire between Lenox and Lenoxdale, to the Rogers Electric Company of Lenox.

MARLBORO, MASS.—Work has started by the Marlboro Electric Company on the installation of the ornamental lighting system on Main Street.

QUINCY, MASS.—Contract has been awarded by the Fore River Shipbuilding Corporation of Quincy for the construction of a machine shop, 135 ft. by 250 ft., one story, and a boiler house, 72 ft. by 150 ft., one story.

READING, MASS.—The town of Reading has adopted all the recommendations of C. W. Whiting, consulting engineer, and will retain and improve the municipal electric-light plant. The voters have authorized an appropriation of \$55,000 to carry out the plan.

WORCESTER, MASS.—The Worcester Electric Light Company has applied to the Board of Aldermen for permission to construct conduits in Crystal, Madison, Grafton, Franklin, Garden and Main Streets.

HARTFORD, CONN.—The stockholders of the Hartford Electric Company have voted to increase the capital stock from \$4,500,000 to \$6,000,000, the proceeds to be used to take care of the growing business and for improvements under way at the Dutch Point plant, where a 10,000-kw. turbine is being installed, to be followed by another.

SEYMOUR, CONN.—The joint petition of the Seymour Electric Light Company and the Beacon Falls Electric Light Company to the Public Utilities Commission for the approval of a lease by the Seymour company of the rights and privileges of the Beacon company has been withdrawn.

Middle Atlantic States

BINGHAMTON, N. Y.—Preparations are being made by the Binghamton Light, Heat & Power Company for the installation of new equipment at its power house extension now under construction. Foundations for machinery are now being built and settings for new water-tube boilers. This plant is under the management of W. S. Barstow, 50 Pine Street, New York City.

BROOKLYN, N. Y.—The plans for the new hospital building, to be erected at Troy Avenue and Crown Street by the Carson C. Peck Memorial Hospital, provide for a new power house. C. S. Meerbaard, 230 Fulton Street, is representative of hospital; Ludlow & Peabody, 101 Park Avenue, New York City, are architects.

BUFFALO, N. Y.—The International Traction Company, the holding company of the International Railway Company, has purchased a coal mine in the Pittsburgh district and will now be able to furnish its New York State railway lines with adequate coal supply. The International Railway Company is now receiving about 75 per cent of its power from the Niagara Falls hydroelectric power plants. This does not provide for the entire peak loads and the company has to supplement its water-power supply by its own generating plants.

CHATHAM CENTER, N. Y.—Steps have been taken by residents of Chatham Center to secure an electric-lighting service for the town. It is proposed to ask the Chatham (N. Y.) Electric Light Company to extend its lines here.

FRANKFORT, N. Y.—Plans have been prepared by the Savage Arms Corporation,

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

Savage Avenue, Frankfort, for four new additions to its plant, to consist of three machine shops, two four stories, 50 ft. by 280 ft., and 50 ft. by 220 ft. respectively; one one-story, 35 ft. by 270 ft., and a two-story office building; an electric power house will also be built. Contract for construction of buildings, it is reported, has been awarded to John G. Brown, Witherpoon Building, Philadelphia, Pa. F. R. Phillips is assistant manager.

LANCASTER, N. Y.—The Public Service Commission has granted the Depew & Lancaster Light, Power & Conduit Company permission to issue \$45,000 in capital and \$100,000 in bonds, the proceeds to be used solely for extensions and improvements to its system.

NEW YORK, N. Y.—The Central Park West Civic Association is considering the installation of an ornamental lighting system in Central Park West district.

NEW YORK, N. Y.—The American Light & Traction Company has purchased the properties of the White Star Coal Company in Harlan County, Kentucky. This mine is now being developed and will supply several subsidiaries with fuel.

NEW YORK, N. Y.—The Long Island Lighting Company has petitioned the Public Service Commission for permission to issue \$130,000 in bonds and \$100,000 in capital stock, the proceeds to be used for reconstruction equipment and working capital.

NIAGARA FALLS, N. Y.—The City Council has granted the International Railway Company of Buffalo permission to erect overhead cables along Twenty-fourth Street to its new substation.

ROCHESTER, N. Y.—In connection with the rebuilding of the new power station No. 5 of the Rochester Railway & Light Company at the foot of the lower falls of the Genesee, it is proposed to carry the power cables that cross to the west side of the river in a groove cut in solid rock at the brink of the falls. This groove will be large enough to accommodate forty-eight 4-in. ducts. On the west side of the river the cables will be carried to a subway now building in Hastings Street.

SHERMAN, N. Y.—The Board of Trustees has applied to the Public Service Commission for authority to establish and operate a municipal electric-light plant in Sherman.

SOLVAY, N. Y.—An extension will be built to the boiler house of the Solvay Process Company to provide space for the installation of two additional units. The present boiler capacity is about 12,000 hp.

ALLENHURST, N. J.—The Atlantic Coast Electric Company of Asbury Park is building an extension to its power station at Allenhurst.

BAYONNE, N. J.—The City Commission is negotiating with the Public Service Electric Company for the extension of the ornamental street-lighting system on Broadway from Fifth Street to Eleventh Street, in accordance with its contract with the city.

BAYONNE, N. J.—Plans have been filed by the Electric-Dynamic Company of Bayonne, N. J., for the construction of an addition, 160 ft. by 120 ft., one story, to its plant at Avenue A and North Street. Contract has been awarded to John W. Ferguson, 152 Market Street, Philadelphia, Pa.

BORDENTOWN, N. J.—The Council is considering the installation of a new fire-alarm system.

CALDWELL, N. J.—Bids will be received by the committee on public buildings of the Board of Chosen Freeholders of Essex County, Essex County Court House, Newark, N. J., until Aug. 1 for furnishing material and labor in connection with the electrical work in the power house and tunnel at the Essex County Penitentiary at Caldwell. Plans and specifications may be seen at the office of Runyon & Carey, consulting engineers, 845 Broad Street, Newark, N. J.

NEWARK, N. J.—Bids will be received by the Board of Freeholders until Aug. 2 for extensions and improvements to the power plant at the Essex County Hospital at Overbrook. Runyon & Carey, 845 Broad Street, Newark, are consulting engineers.

NUTLEY, N. J.—The installation of a new fire-alarm signal system is under consideration by the Town Commission.

TRENTON, N. J.—The Trenton & Mercer County Traction Corporation is considering an extension of its system to the heart of Trenton Junction.

TRENTON, N. J.—The Public Service Electric Company is planning to remove its aerial lines on a number of the city streets, to be paved, and will place its wires in underground conduits.

TRENTON, N. J.—Permission has been granted the Eureka Power Company, a subsidiary of the New Jersey & Pennsylvania Traction Company, by the Public Utility Commission to erect an electric transmission line along the River Road from Ewing Township to Hunterdon County boundary line. The lines will be extended from Washington Crossing to Titusville and Pennington.

VENTNOR CITY (P. O. ATLANTIC CITY), N. J.—The City Council is considering the installation of a new street-lighting system in Ventnor City. It is proposed to replace the arc lamps now in use with incandescent lamps.

ALTOONA, PA.—The Public Service Commission has granted the Penn Central Light & Power Company permission to issue \$271,000 in bonds for extensions and improvements.

ERIE, PA.—The Erie Light Company has received authority from the Public Service Commission to issue \$1,650,000 in bonds, the proceeds to be used for improvements, extensions and other purposes.

GETTYSBURG, PA.—The Public Service Commission has authorized the Gettysburg Electric Company to issue \$55,000 in bonds, the proceeds to be used for extensions and improvements.

MOUNT CARMEL, PA.—The property of the Edison Electric Illuminating Company has been acquired by interests represented by Chandler & Company of Philadelphia. The Edison Company operates in Mount Carmel, Marion Heights, Connorsville and vicinity.

PHILADELPHIA, PA.—Plans have been prepared by the Philadelphia Electric Company for the erection of an addition, 33 ft. by 95 ft., one story, to its power station on Kensington Avenue, for which bids have been asked.

PHILADELPHIA, PA.—The Department of Public Works has awarded a contract for electrical work in the new public library building at Nineteenth Street and the Parkway to L. K. Comstock & Company, 30 Church Street, New York, N. Y., at \$44,700. The building complete will cost about \$2,650,000. Former contract awards were annulled, owing to technical errors.

PHILADELPHIA, PA.—The property of the Lehigh Navigation Electric Company, a subsidiary of the Lehigh Coal & Navigation Company, the Northern Central Company and the Lehigh Valley Transit Company has been acquired by the Electric Bond & Share Company, 71 Broadway, New York, N. Y. The companies will be merged and extended through the district, which includes a large coal-mining area affording possibilities for electric power service.

PHOENIXVILLE, PA.—The City Council is considering the installation of a municipal electric-light plant.

QUAKERTOWN, PA.—Bonds to the amount of \$45,000 have been authorized for the reconstruction of the municipal electric-light plant and the installation of new machinery.

ROCKWOOD, PA.—Work has been started on the construction of an electric power plant in Rockwood by the Penn Electric Service Company of Somerset. The plant will be located on the Casselman River and will furnish electricity for mining operations in the Berlin, Myersdale and Blackfield districts and as far west as Ohio, and also for the new signal system being installed on the Baltimore & Ohio Railroad between Cumberland and Connorsville.

SCRANTON, PA.—The Public Service Commission has granted the Scranton Electric Company permission to issue \$77,000 in bonds for improvements and extensions to its system.

WILKES-BARRE, PA.—The City Council is planning for an early contract award to the Wilkes-Barre Lighting Company for street-lighting service in accordance with permission granted by the Superior Court for this new organization to enter into competition with the Wilkes-Barre Company, which furnishes the local service. The new company has submitted a bid to the city for street-lighting service on a five and seven-year contract, which would result in a saving of \$33,000, and \$7,000 on

standards and special public square lighting.

YORK HAVEN, PA.—Work has begun on the erection of a large dam in the Susquehanna River, between the Three-Mile Island and the Dauphin County shore, near York Haven, for the York Haven Power Company. The dam will be 800 ft. long and will cost from \$15,000 to \$20,000.

RICHMOND, VA.—The Virginia-Carolina Company is planning to equip its proposed new plant at Washington, N. C., for electrical operation. H. C. Bragaw is plant superintendent.

North Central States

DETROIT, MICH.—Extensions and improvements, involving an expenditure of about \$2,000,000, are being made by the Detroit Edison Company. The work will include the installation of the initial unit of a heating plant being erected at Congress Street and Cass Avenue at a cost of \$1,000,000, and an addition to its Connors Creek power plant.

GRAND RAPIDS, MICH.—Plans are being considered for increasing the output of the municipal electric-light plant.

GRAND RAPIDS, MICH.—The construction of a building, to cost about \$20,000, on the west side canal, is under consideration by the Eastern Michigan Power Company. Machinery will be purchased.

GRAND RAPIDS, MICH.—Deeds have been filed by the Consumers' Power Company for a right-of-way from the Grand Rapids city limits through Alpine and Sparta townships to the Ottawa County line, to be used for a railway and transmission system.

MONROE, MICH.—An extension, it is reported, will be erected to the power station of the Detroit, Monroe & Toledo Short Line Railway Company in Monroe and an additional generating unit installed.

MOTTVILLE, MICH.—Bids will be received at the office of Gardner S. Williams, consulting engineer, Cornwell Building, Ann Arbor, until Aug. 6 for construction of a reinforced concrete and brick power house, concrete multiple-arch spillway, Tainter gate sections, earth embankment and tail-race excavation for the Mottville plant of the St. Joseph Power Company on the St. Joseph River, at Mottville. For details see Searchlight Section.

PONTIAC, MICH.—Bids will be received at the office of the secretary of the board of education of Pontiac Union School, Pontiac, until Aug. 1, for furnishing an electric generator and engine equipment at the High School. Plans and specifications may be obtained from Perkins, Fellows & Hamilton, architects, Straus Building, Chicago, Ill., or Fisher Brothers, architects, Pontiac.

RED JACKET, MICH.—The municipal conduit system for electric wires, which is leased by the Houghton (Mich.) County Electric Light Company, has been so badly damaged by sinking ground that it will be necessary to rebuild it, at a cost of about \$20,000; otherwise the company will erect pole lines.

BOWLING GREEN, OHIO.—Bids will be received at the office of the auditor of Wood County, Bowling Green, until Aug. 6 for furnishing material and installing electric wiring, lamps and fixtures in the Wood County Infirmary buildings near Bowling Green. Plans and specifications may be obtained upon application to S. P. Stewart & Sons, architects, Bowling Green. R. S. Gillespie is county auditor.

CANTON, OHIO.—Plans are being considered by the County Commissioners for remodeling the lighting system in the county court house, at a cost of from \$3,000 to \$4,000.

CANTON, OHIO.—The city service director has notified the City Council that rewiring of the auditorium according to requirements of the Ohio electrical wiring code is necessary. The cost of the work is estimated at \$8,000.

CINCINNATI, OHIO.—The City Council has authorized extensions to four of the Cincinnati Traction Company's lines, which will require an expenditure of more than \$250,000 before the end of the year.

CINCINNATI, OHIO.—An estimate of the cost of extending the ornamental lighting system to the suburban streets has been submitted by Service Director Barlow to City Manager Waite. The erection of 1066 additional poles would require an expenditure of \$38,376, of which the city would bear \$6,143 and the property owners the remainder.

CINCINNATI, OHIO.—The Union Gas & Electric Company is planning to erect two substations to provide for the increasing demand for electrical service in the suburban districts. A contract has been awarded

for a new building, 50 ft. by 115 ft., in Elmwood, and a building has been leased in Evanston for five years for use as a substation, although it will be used as a warehouse for the present.

CLEVELAND, OHIO.—Steps have been taken by property owners in the Lorain Avenue district to install an ornamental lighting system on Lorain Avenue from West Twenty-fifth Street to West Fifty-eighth Street. The Lorain Avenue Business Men's Association has raised \$6,000 to pay for the system.

COLUMBUS, OHIO.—Plans are being prepared for the erection of three new buildings at the Ohio University, to cost about \$430,000. A new power house, to cost about \$200,000, is included among the proposed improvements.

ELYRIA, OHIO.—The Elyria Telephone Company is considering the erection of a new telephone exchange building, to cost about \$50,000.

NELSONVILLE, OHIO.—The Hocking-Sunday Creek Traction Company is contemplating the construction of a substation, to cost about \$10,000.

WADSWORTH, OHIO.—The city authorities are considering the construction of a municipal ice plant, to utilize exhaust steam at the municipal electric power plant.

ASHLAND, KY.—Bids will be received by the city of Ashland until Aug. 6 for the installation of an ornamental street-lighting system. F. W. Geslang is city engineer.

HELLIER, KY.—The Greenough Coal Company, recently organized by Thomas J. Mitchell of Uniontown, Pa., and associates, is reported to be considering the installation of an electric power plant on its coal properties here.

JACKSON, KY.—The electric-light and power plant of the Day Lumber & Coal Company has been taken over by Lewis Hays, Jr., Ryland C. Musick and M. G. Center.

LOUISVILLE, KY.—The United States government has awarded the Louisville Gas & Electric Company a contract to supply electricity (1000 kw.) for the new army cantonment being erected south of Louisville. About 17,000 40-watt lamps will be used for buildings, and the pumping load will require about 100 kw.

OWINGSVILLE, KY.—The local electric-light plant has been purchased by James M. Richards and E. V. Brother. The new owners, it is understood, will erect a new plant, to be driven by a 75-hp. engine.

SYRACUSE, IND.—The property of the Syracuse Power & Light Company has been sold to the Hawkes Electric Company of Goshen, for \$70,000. The plant furnishes electricity for lamps and motors in Syracuse, Milford, Benton, Lake Wawasee and points in this section of the State.

CHICAGO, ILL.—Plans have been approved by the engineering staff of the Sanitary District Board for operating the proposed Calumet pumping station by electricity. The Sanitary District Board authorized a committee to negotiate with Frank I. Burnett, commissioner of public works, for turbine engines and other apparatus to be taken over from the city and used for street-lighting, at an estimated saving of \$70,000 per year.

FREEPORT, ILL.—The Rockford & Interurban Railroad Company of Rockford is contemplating the construction of a station and extending a loop around the city.

LINCOLN, ILL.—The property of the Lincoln Water & Light Company has been sold to W. W. Levering of Philadelphia, Pa., and Chester Snyder of Easton, Pa.

APPLETON, WIS.—The local power house of the Wisconsin Traction, Light, Heat & Power Company was recently damaged by fire, causing a loss of about \$5,000.

APPLETON, WIS.—Contracts, it is reported, will soon be awarded for the construction and equipment of an addition to the boiler house, 40 ft. by 60 ft., at Appleton College, to cost about \$20,000 complete. Van Ryn & DeGelleke, Caswell Block, Milwaukee, are architects.

LANCASTER, WIS.—The State Railroad Commission has granted the Mid-Continental Utilities Company, successor to the Lancaster Light & Power Company, permission to issue \$275,000 in capital stock and \$650,000 in bonds.

MILWAUKEE, WIS.—Extensions and improvements involving an expenditure of approximately \$1,000,000 during the next few months are under consideration by the Wisconsin Telephone Company. About \$342,343 will be expended on the local system and \$643,548 for additions and repairs throughout the state.

MONTICELLO, WIS.—The proposal to issue \$5,650 in bonds for improvements to the municipal electric-lighting system is under consideration.

RACINE, WIS.—Preparations are being made by the Racine Rubber Company to enlarge its steam generating plant. New equipment, it is understood, will be purchased, including an engine, generator, boiler and automatic stoker.

RIPON, WIS.—A site has been purchased by Libby, McNeill & Libby of Chicago, Ill., upon which they propose to erect a milk condensing and refrigerating plant, to cost about \$50,000.

CLOQUET, MINN.—The General Light & Power Company of Cloquet, which operates plants in Cloquet, Carlton, Scanlon, Pipestone, Willow River and Floodwood, has sold \$175,000 in bonds, the proceeds to be used to pay for the Pipestone plant and to make new extensions and improvements.

GRAND RAPIDS, MINN.—Bids will be received by the Commissioners of Itasca County Court House, Grand Rapids, until Aug. 6, for construction of a hospital building, including general construction, electric work, heating, plumbing, elevator, hospital, laundry and kitchen equipment, etc., to be erected at Grand Rapids. Bids will be received for the entire work or separately. Plans and specifications may be obtained at the office of F. H. Mosse & Company, architects, Rochester, Minn., upon deposit of \$10. Copies of plans and specifications may be seen at the offices of the county auditor, the architects, and the Builders' Exchanges of St. Paul, Minneapolis and Duluth, and the Minneapolis Builders' Material Exhibit.

RICE, MINN.—A special election will soon be held to vote on the proposal to install an electric-lighting system in Rice.

DES MOINES, IOWA.—The Iowa Telephone Company, 1006 Grand Avenue, is planning to install a telephone system at Camp Dodge.

DES MOINES, IOWA.—A new turbine will be installed at the power house of the Des Moines City Railway Company, doubling the capacity of the plant. A substation will be erected south of South Park to increase the carrying capacity of the Fort Des Moines line; another substation is being built at East Second and Walnut Streets to take care of the east side, and still another is being completed at West Fourteenth Street to supply the interurban and part of the city lines. A new station will also be constructed at Polk Boulevard and Chamberlain Avenue, for the west lines.

MUSCATINE, IOWA.—Preliminary plans have been prepared for equipping the Muscatine, Burlington & Southern Railway for electrical operation within the next few months. The cost is estimated at about \$200,000.

SAC CITY, IOWA.—At an election to be held Aug. 3, the proposal to issue \$60,000 in bonds for a municipal electric-light plant will be submitted to the voters.

STATE CENTER, IOWA.—The Iowa Railway & Light Company of Cedar Rapids is reported to be contemplating the erection of a high-tension transmission line from Marshalltown to State Center.

BERNIE, MO.—The Lasswell & Coble Electric Company is contemplating the construction of an electric plant in Bernie to cost about \$5,000.

COLUMBIA, MO.—Interests connected with the Illinois Traction System of Champaign, Ill., it is reported, contemplate erecting electric transmission lines to supply electricity to several towns in the north-eastern part of the State, as far south as Columbia and possibly Jefferson City.

BOWMAN, N. D.—The local electric-light plant is reported to have been purchased by the Dakota Utilities Company, which operates a number of plants in South Dakota.

KENSAL, N. D.—The Kensal Electric Light & Power Company, recently organized, is planning to erect an electric plant here, to cost about \$6,000.

NEW ROCKFORD, N. D.—The General Utilities Corporation will in the near future have in service about 50 miles of electric transmission line and will serve the towns of Amery, Clear Lake, Clayton, Turtle Lake, Almena, Comstock, Joel, Little Falls and Cumberland, all in Wisconsin. At present it has one small water power developed and is engaged in developing another in which a 500-kw. generating unit will be installed. It also has another power site upon which can be developed more than double the combined capacity of the two present plants. W. R. Haney is local manager.

RUGBY, N. D.—The local electric-light plant has been taken over by the Northern States Power Company of Chicago, Ill. Energy to operate the system in Rugby will be supplied by the Minot division.

ABERDEEN, S. D.—The Aberdeen Light & Power Company is installing an additional 256-hp. Stirling boiler and a 1000-kw. General Electric turbo-generator set in its power house.

ABERDEEN, S. D.—Bids will be received by the Regents of Education of the State of South Dakota, Aberdeen, until Aug. 13, for construction of the proposed ladies' dormitory, including general contract, electric wiring, heating and plumbing, to be erected on the campus of the Northern Normal and Industrial School at Aberdeen. Plans and specifications may be seen at the office of the secretary of the school and at the office of George Fossum, architect, Aberdeen.

AGRA, KAN.—Preparations are being made by the city of Aggra for the installation of an electric-lighting system for which \$8,000 in bonds were recently voted. Energy for operating the system will be obtained from the electric plant in Phillipsburg, 12 miles distant. The plans provide for an ornamental lighting system, consisting of one-lamp standards erected in the center of the street. D. L. Strongquist of Abilene, Kan., is supervising engineer.

BUNKERHILL, KAN.—The installation of a municipal electric-light plant in Bunkerhill is under consideration.

COLDWATER, KAN.—The Municipal Water and Light Department is contemplating, in the near future, the installation of a deep-well motor-driven pump of about 150 gal. per minute capacity, and would like to communicate with manufacturers of pumps. L. A. Baldwin is superintendent.

CONCORDIA, KAN.—The Concordia Electric Light Company, it is reported, is contemplating the erection of an electric-transmission line through Haddam, Agenda, Cuba, Morrowville and Washington. The towns are to vote bonds to build the lines; the bonds are to be retired by the company in ten years.

FULTON, KAN.—The Council has passed an ordinance granting the Pleasanton (Kan.) Electric Power Company a franchise to furnish electricity in Fulton for a period of 20 years.

HIAWATHA, KAN.—Improvements to the street-lighting system are under consideration by the Community Commercial Club.

LEONORA, KAN.—At an election held recently the proposal to issue bonds for the installation of an electric-light plant in Leonora was carried.

PAOLA, KAN.—An election will soon be called to vote on the proposal to grant the Paola Electric Company a new franchise.

SALINA, KAN.—The United States Automatic Fire Alarm Company, which was recently granted a franchise to operate in the city, is planning to erect a building and install a system at a cost of about \$40,000.

SALINA, KAN.—The Salina Light, Power & Gas Company has submitted a proposal to the City Council offering to replace the arc lamps now in use with ornamental lamps. It is proposed to remove one-third of the lamps each year, completing the work in three years.

WETMORE, KAN.—A movement is under way to secure an electric-lighting service for Wetmore. It is proposed to tap the transmission line of the Holton (Kan.) Light Company which serves Circleville.

Southern States

MOCKSVILLE, N. C.—The City Council is considering issuing bonds for the installation of an electric-light plant and water-works system.

FLORENCE, S. C.—Extensive improvements are being made by the Carolina Central Electric Company to its local plant and system, involving an expenditure of about \$90,000. The company is also erecting an electric transmission line to Marion to supply electricity there and to the towns of Timmons-ville and Darlington. It has recently closed a contract with the Pee Dee Brick Company to operate the machinery in the brick plant.

FLORENCE, S. C.—The properties of the Carolina Central Electric Company, which owns and operates lighting plants in Florence, Darlington, Marion, Timmons-ville and Summerville, has been taken over by the Yadkin River Power Company of Rockingham, N. C., a subsidiary of the Carolina Light & Power Company. Arrangements are being made by the local company to install additional equipment to furnish energy to its subsidiary plants in Darlington, Marion, Mullins and Timmons-ville from the local power station.

GREENVILLE, S. C.—The Southern Power Company of Charlotte, it is reported, contemplates the erection of an electric transmission line to the army cantonment near Greenville, to cost about \$30,000.

ATLANTA, GA.—The Atlantic Steel

Company is planning to install new hoop mill machinery, and has placed orders for one 550-hp. alternating-current and one 250-hp. direct-current motor. Energy will be secured from the Georgia Railway & Power Company.

ATLANTA, GA.—The contract for electrical work for the army cantonment at Silver Lake has been awarded by Arthur Tufts, Candler Annex, Atlanta, general contractor for the army cantonment at Silver Lake, to the Russell Electric Company of Atlanta. The work will include wiring over 90 miles of streets, interior wiring of houses, erection of power plants, installation of generators, transformers, motors, electric fixtures, etc.

AUGUSTA, GA.—A franchise has been obtained by R. J. Edenfield of Augusta, Ga., and W. E. Moore & Company of Pittsburgh, Pa., engineers, who, it is said, propose to construct a hydroelectric plant near Augusta.

MARIETTA, GA.—The Marietta Mining Company has closed a contract with the Georgia Railway & Power Company for energy to operate machinery in getting out pyrites. The mines are located about 2½ miles east of Marietta.

MOULTRIE, GA.—The Moultrie Packing Company is contemplating extension to its plant (doubling the output), at a cost of about \$300,000. It is proposed to enlarge and remodel power plant, 100-ft. extension to main building; four-story addition, 80 ft. by 80 ft., for meat storage, and enlarging other departments. E. L. Brooks is manager.

PORT WENTWORTH, GA.—Plans have been prepared for the erection of a model town at Port Wentworth, a few miles outside of Savannah, for William Morris Imbrie & Company, who have financed several industrial concerns located at this point. The proposed city will have its own water supply, lighting plant and sewerage system. Charles W. Leavitt, landscape architect and engineer, will have charge of the project. Port Wentworth has not a post office.

JACKSONVILLE, FLA.—The City Commission is considering the purchase of a new alternator for the municipal electric-light plant.

ORLANDO, FLA.—The city of Orlando is contemplating the installation of an electric-light plant and water-works system.

CHATTANOOGA, TENN.—Plans are being considered by the Tennessee Paper Company, recently incorporated, for equipping its proposed new mill for electrical operation. The cost of the mill is estimated at \$150,000.

CLARKSVILLE, TENN.—The Young Men's Club of Clarksville has begun a campaign to raise funds for the installation of an ornamental lighting system in the business section of the city, to cost about \$5,000.

MEMPHIS, TENN.—Plans for the consolidation of the Merchants' Power Company and the Consolidated Gas & Electric Company are about completed, in accordance with terms made with the city last winter.

BIRMINGHAM, ALA.—The Tennessee Coal, Iron & Railroad Company is contemplating the installation of new electrical machinery to operate its proposed blooming and finishing mills to be erected in the Fairfield district.

DOTHAN, ALA.—The City Council has closed a contract (over the Mayor's veto) with the South Alabama Power Company to furnish electricity to the city for a period of ten years. This action by the Council means the construction of a hydroelectric development on the Omussee Creek, 18 miles east of Dothan, by the power company, to cost about \$200,000, on which work will begin at once.

JASPER, ALA.—Petitions have been filed with the Public Service Commission seeking the transfer of the Jasper (Ala.) Light & Water Company and the Attalla (Ala.) Waterworks Company to the Alabama Power Company of Birmingham.

JASPER, ALA.—The City Council has granted the Alabama Power Company a 30-year franchise to operate in this city. The company has purchased the local electric plant and is erecting a transmission line from its emergency plant near Parrish into Jasper. The company, it is expected, will extend its line from Cordova to furnish service here.

GURDON, ARK.—The Gurdon Electric Company has recently completed the installation of an ornamental street-lighting system and is considering the installation of a larger generator in a mill close by for emergency use. T. H. Akers is manager.

LITTLE ROCK, ARK.—The Quartermaster's Department has awarded the Little Rock Railway & Electric Company a

contract to furnish electricity to the Twelfth Division cantonment near Little Rock.

LITTLE ROCK, ARK.—Tentative plans of the Little Rock Railway & Electric Company to extend its lines to the cantonment of the Twelfth National Army north of Fort Logan H. Roots have been abandoned owing to the inability of the company to secure steel rails.

PINE BLUFF, ARK.—Within the next six weeks the Pine Bluff Company expects to purchase one 2500-kw. turbo-generator and two 600-hp. boilers.

ARDMORE, OKLA.—Plans are being considered by the Ardmore Railway Company for the construction of a system of electric interurban railways covering the entire Healdton, Fox and other oil fields.

BUTLER, OKLA.—An issue of \$6,000 in bonds for the construction of a municipal electric-light plant in Butler has been approved by Attorney General Freeling.

HEALDTON, OKLA.—Sites have been purchased in Healdton for an electric light plant, ice factory and a cotton gin plant and for three oil refineries.

KENEFC, OKLA.—At an election held recently the proposal to grant W. A. Baehr and associates a franchise to supply electricity in Keneff was carried.

SENTINEL, OKLA.—An election will soon be called to vote on the proposal to issue \$15,000 in bonds for improvements to the electric-lighting system and extension to sewers.

TULSA, OKLA.—Improvements are contemplated by the Public Service Company of Tulsa to its local power plant, to cost about \$15,000.

TULSA, OKLA.—Bonds to the amount of \$1,042,500 have been voted, of which \$35,000 will be used to enlarge fire-alarm system, installation of additional alarm boxes in the business and residential section and complete equipments in West Tulsa and Kendall.

ALVIN, TEX.—The Alvin Light & Ice Company, recently incorporated with a capital stock of \$15,000, is planning to build an electric-light plant and ice factory. C. A. Leavens is a stockholder.

BEAUMONT, TEX.—The Beaumont Shipbuilding & Dry Dock Company, recently organized, is planning to construct a shipbuilding plant on Island Park to build ships of 4000 tons capacity and under. The plans provide for a power-house, 40 ft. by 25 ft. C. O. Yoakum is vice-president and manager.

BEEVILLE, TEX.—The contract for the construction of the proposed municipal electric-light plant has been awarded to John S. Fenner of Beeville at \$15,500.

DALLAS, TEX.—C. H. Alexander, president of the National Hydro-Electric & Conservation Company, has submitted a proposal to the City Commission offering to furnish energy to the extent of 20,000 continuous horsepower at 1 cent per kw.-hour for a period of 30 years. The plant is now under construction at Marble Falls, on the Colorado River, 50 miles above Austin, and 150 miles from Dallas. In case the contract is awarded the city would have to erect a distribution system or make arrangements with some other company to distribute electricity to consumers. The hydroelectric plant can be completed in about 18 months. The City Commission has declined to consider the proposal at this time, as the plant is not finished and ready to carry out any contract that might be made.

Pacific and Mountain States

ARLINGTON, WASH.—The Washington Coast Utilities Company has been granted a franchise by the Snohomish County Commissioners to erect electric transmission lines through eight townships in the north end of the county, covering in all about 200 miles of lines. The company will also supply electricity and water in this city.

CENTRALIA, WASH.—Arrangements have been completed by the Thomas Pulp & Paper Company, recently organized with a capital stock of \$5,000,000, it is reported, for the erection of a 40,000-hp. power plant in Centralia. R. Thomas of Portland, Ore., is president and manager of the company.

NEWPORT, WASH.—The property of the Northern Idaho & Montana Power Company will be sold in Newport on Aug. 10 under a decree of foreclosure issued by the United States District Court. The sale includes property and contracts of the company at Eugene, Ore., central stations, transmission and service lines of the company running from Newport and serving Newport, Wash., Sandpoint, Priest River, Clarksfork, Hope and East Hope, Idaho.

NORTHPORT, WASH.—The Northport Light & Power Company, recently incorporated with a capital stock of \$200,000, is planning to develop electric and gas plants in the State of Washington. The company proposes to furnish power for the Northport smelter and for mines and mills in this vicinity.

SEATTLE, WASH.—The Puget Sound Traction, Light & Power Company has been awarded contract for all outside wiring for the permanent cantonment at American Lake, including furnishing electricity for lamps and motors.

TACOMA, WASH.—An ordinance providing for an extension of the municipal street railway system from the city limits to the Todd shipyards on the tide flats, and for an issue of \$180,000 in bonds, has been passed by the City Council.

TACOMA, WASH.—An ordinance has been introduced in the City Council for the purchase of a rotary converter, to cost \$22,000, for use in connection with the municipal street car line. At present the city purchases its direct-current service from the Tacoma Railway & Power Company.

TACOMA, WASH.—Proposal for the purchase by the city of Tacoma of the Kaynor-Wright water-power site on the White and Green Rivers in Pierce and King Counties for \$225,000 has been submitted to the City Council by W. P. Wood and George D. Livesley. The site, if developed, would have a capacity greater than the low-water capacity of the La Grande plant.

TACOMA, WASH.—A claim for 600 cu. ft. of water per second on the Nisqually River and on Mineral Creek, and a claim for the use of Mineral Lake for storage purposes has been filed by the city of Tacoma. The claim was filed with the ultimate idea of constructing an auxiliary electric power plant in duplicate of the present plant at La Grande, at a site on the upper Nisqually River about 5 miles above Elbe.

VANCOUVER, WASH.—Plans are being prepared by Julius Zittel of Spokane and D. Nichols of Vancouver, architects, for the erection of power plant, industrial workshop and schoolroom at the State School for the Blind in Vancouver, to cost about \$40,000.

AUBURN, CAL.—The Bear River Water & Light Company, recently incorporated with a capital stock of \$10,000, con-

plates the construction of a large hydroelectric power plant on the Bear River. The incorporators are: J. W. Morgan and Daniel Kirby of Auburn, and Dr. J. L. Rollins of Colfax.

AZUSA, CAL.—The Railroad Commission has authorized the Southern California Edison Company to transfer its electrical distribution in Azusa to the municipality. The city has operated its own distributing system in part of the town and now will take over the entire system. It will purchase power from the Edison company.

LEMOORE, CAL.—All bids submitted for the installation of an electrolier lighting system and for other improvements have been rejected by the Board of Trustees. The bids exceeded the estimated cost by \$10,000. Bids, it is understood, will be readvertised.

LOS ANGELES, CAL.—Bids will soon be asked for the construction of a new power house for the County Hospital. The building, 80 ft. by 90 ft., will be erected on Wood Avenue, directly back of the main hospital group, and will cost about \$118,000. Work has resumed on new service building for the hospital.

OROVILLE, CAL.—Work will soon begin by the Great Western Power Company on the erection of a hydroelectric plant at Oroville, to cost about \$6,000,000.

PALO ALTO, CAL.—An army cantonment will be built in Palo Alto by the United States government for which the following material will be required: About 2,000,000 ft. of insulated wire, 16,000 ft. of lamp cord, 8000 key sockets, 9000 shades, 10,000 cleat receptacles, 8500 snap switches and other electrical equipment.

SAN FRANCISCO, CAL.—Application has been filed by the California-Oregon Power Company with the California Railroad Commission for authority to sell its hydroelectric properties in Trinity County to the Estabrook Gold Dredging Company.

SONORA, CAL.—A special election will be held on July 31 to vote on the proposal to issue \$45,000 in bonds to install a municipal electric-light plant and street-lighting system. The plans provide for complete system with underground wires.

VENTURA, CAL.—The Ventura County Power Company of Oxnard is installing an electric distributing system at Somis, at a cost of about \$4,000.

GRACE, IDAHO.—The Utah Power Company contemplates the construction of a new 7-ft. penstock and 1000 ft. of 13½-ft. woodstave pipe line; also installing new units having a generating capacity of 11,000 kw., increasing the output of the plant to 44,000 kw.

THACHER, ARIZ.—At an election to be held July 30 the proposal to issue \$18,000 for the installation of an electric-light plant and ice factory will be submitted to the voters.

BEAR CREEK, MONT.—The power house of the International Coal Company, it is reported, was recently destroyed by fire.

GREAT FALLS, MONT.—Plans have been completed for the erection of the proposed rod and wire mill, 125 ft. by 400 ft., to be erected by the Anaconda Copper Mining Company at Great Falls, to cost about \$500,000.

TERRY, MONT.—The local electric-light plant has been purchased by A. A. Jenson of Winona, Minn., who, it is said, will change the system from direct to alternating current.

MEEKER, COL.—The property of the Meeker Electric Company (William Laidlaw, owner and manager), has been purchased by C. W. Grove, who will operate the plant under its present name.

LOVELOCKS, NEV.—The Nevada Valleys Power Company has applied to the Commissioners of Washoe County and to the City Council of Reno for a franchise to erect electric transmission lines in the county of Washoe and the city of Reno.

RENO, NEV.—The Truckee River General Electric Company is erecting a high-tension transmission line from Verdi to the Poeville mining district.

Canada

RENFREW, ONT.—The Town Council has decided to purchase the property of the Renfrew Power Company at \$100,000.

SHERBROOKE, QUE.—The ratepayers have authorized an appropriation of \$150,000 for the erection of an electric transmission line from Weedon to Sherbrooke and for the construction of a substation in Sherbrooke.

1,232,863. CONTROL SYSTEM; Karl A. Simon and Arthur J. Hall, Wilkensburg, Pa. App. filed June 9, 1914. Adapted to compensate automatically for the inherent phase distortion and reduction of voltage of the phase converter under conditions of load, irrespective of whether it be a motor load or a generator load.

1,232,879. THERMIONIC AMPLIFYING CIRCUIT; Peter I. Wold, East Orange, N. J. App. filed Sept. 2, 1916. To make it possible to detect or measure such voltages or currents as could not otherwise be detected or measured by the instruments at hand.

1,232,908. LIGHT-TREATMENT APPARATUS; Ernest C. Feyrer, Erie, Pa. App. filed Feb. 26, 1917. For utilizing electric light for the treatment and relief of painful or congested conditions of the human body.

1,232,915. REGULATING DEVICE; Arthur J. Hall, Wilkensburg, Pa. App. filed May 25, 1914. Particular reference to torque-operated devices for effecting the actuation of a drum controller or other device.

1,232,917. RADIATING CAR TRUCK; Arthur F. H. Head, Philadelphia, Pa. App. filed Feb. 15, 1917. Rigid methods of supporting the motors and brake mechanism in this character of trucks.

1,232,919. THERMIONIC VOLT-METER; Raymond A. Heising, East Orange, N. J. App. filed Sept. 7, 1915. Designed to measure the voltage between two points of an electrical network without taking power from that network and without introducing frequency errors.

1,232,925. CONTROL SYSTEM; Henry D. James, Wilkensburg, Pa. App. filed Sept. 8, 1914. With special reference to alternating-current systems which employ single-phase sources of energy and polyphase dynamo-electric machines that are adapted to operate either as motors or as generators.

1,233,031. CONNECTING PLUG; Frank B. Cook, Chicago, Ill. App. filed Jan. 15, 1915. Relates to electric switches employing complementary parts in the form of spring jacks and conducting plugs.

Record of Electrical Patents

Notes on United States Patents
issued on July 10, 1917

1,233,062. AUTOMATIC CUT-OUT FOR ELECTRIC LINES; Robert Johansson, Gothenburg, Sweden. App. filed Sept. 30, 1916. For use as a substitute for the fuse plug cut-outs commonly used in house installations.

1,233,097. QUICK-BREAK SWITCH; Ralph K. Mason, Litchfield, Conn. App. filed Sept. 1, 1916. Improvements.

1,233,133. PERMUTATION SWITCH; Charles A. Short and Harry C. Dunning, Los Angeles, Cal. App. filed June 2, 1913. Designed for use in connection with the sparking circuit of an automobile.

1,233,137. X-RAY SYSTEM; Homer C. Snook, Philadelphia, Pa. App. filed April 13, 1909. Relates to a system and apparatus for delivering high-potential unidirectional current to an X-ray tube or other translating device or to a consumption circuit.

1,233,183. ELECTRICAL HEATING UNIT AND METHOD OF MAKING THE SAME; Wilber A. Carter and Sabin Crocker, Detroit, Mich. App. filed June 5, 1916. Designed for the heating of ovens to relatively low temperature.

1,233,188. OUTLET-BOX FITTING; Allan Coggeshall, Pleasantville, and Henry C. Schnake, New York, N. Y. App. filed Feb. 2, 1916. Fitting adapted to receive an attachment plug.

1,233,191. RESISTANCE UNIT AND METHOD OF MAKING THE SAME; Edgar F. Collins, Schenectady, N. Y. App. filed Dec. 29, 1916. Provision of a heater for air or other gases which is provided with a large radiating free circulation of the air to be heated therethrough.

1,233,192. CUT-OUT FOR ELECTRICAL CIRCUITS; Nicholas J. Conrad, Chicago, Ill. App. filed Oct. 16, 1915. Improvement.

1,233,196. AUTOMATIC RINGING AND SECRET-SERVICE TELEPHONE SYSTEM; Hiram D. Currier, Chicago, Ill. App. filed April 10, 1913. Improvement.

1,233,197. ELECTRIC TERMINAL; John Cuthbert, Chicago, Ill. App. filed Aug. 5, 1916. Will coil and clamp the wire or cable holding the threaded clamping members to prevent loosening.

1,233,199. SIGNALING SYSTEM; Philippo L. E. del Fungo-Giera, New York, N. Y. App. filed June 16, 1916. Indicates with certainty and accuracy the position of a ship, so that the direction and speed of such ship may be readily determined.

1,233,204. ELECTRIC BATTERY; Jay E. Dunn, Brooklyn, N. Y. App. filed Nov. 29, 1916. Comprising several cells disposed in a suitable container and connected in the required manner.

1,233,211. DEVICE FOR TELEGRAPHING UNDER WATER; Frank P. Fisher and Hugh Dehart, Radford, Va. App. filed Jan. 17, 1916. Transmitted through a body of water as a carrying medium without the necessity of a wire or metallic connection between the sending and receiving stations.

1,233,220. ELECTROMAGNETIC ORGAN ACTION; John A. Goodycz, Philadelphia, Pa. App. filed Feb. 17, 1915. Insures the action of the pallets or valves that control the ports between the wind box and the air channels communicating with the pipes.

1,233,232. WIND-WHEEL ELECTRIC GENERATOR; Albert H. Heyroth, Geraldine, Mont. App. filed Feb. 9, 1916. For use in connection with windmills in which the wheel thereof forms the rotor of the generator.

Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN
Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, AUGUST 4, 1917

No. 5

Power Transmission for Small Plants

THE special problems of the plant supplying a small community often lead to interesting results, and an excellent example of this is shown in R. E. Carlson's description in the current issue of the way in which a little Illinois town of 2000 inhabitants was furnished twenty-four-hour service on an economical basis by the purchase of transmitted power from a central station about 12 miles (19.2 km.) away. The situation is one not uncommon in small places, and it has been the cause of many a successful extension of the transmission networks which have done such sterling service throughout the country. The economic side of the matter is clear enough; except under unusually favorable circumstances the small generating plant cannot furnish twenty-four-hour power without extensive generating costs. A fairly large plant with enough day load to warrant running can take over the additional service without any particular difficulty and in most instances can furnish twenty-four-hour power at a price lower than that at which it can be locally generated.

In the case here considered the source of energy was a two-phase plant and the initial step was to install a two-phase-three-phase raising transformer equipment to put 13,200-volt energy on the line. The most interesting feature of the line itself is that despite the small amount of power transmitted, the total capacity being only 600 kva., it was found wise to use steel poles for the main line. For this purpose slender latticed steel poles 45 ft. (13.7 m.) long, spaced 300 ft. (91.4 m.) apart, were employed, set in concrete foundations and carrying three No. 4 stranded conductors with a stranded steel cable for a ground wire above. Despite the fact that most of the work was carried on in mid-winter under unfavorable conditions, the cost of construction ran little over \$1,800 a mile (\$1,080 a kilometer), a figure almost the same as the cost of a thoroughly well-built wooden pole line, with the advantage of a considerably longer probable life. To keep the construction figure down, the work had to be carried out in an orderly and systematic manner with various little precautions in the way of assembling poles and stringing wire which Mr. Carlson fully describes. The result has been highly satisfactory, and the example is one which may be followed to advantage in many small plants. The particularly interesting thing about it is the economical use of steel, not in the form of steel towers, but of light latticed poles. Steel of course is now high in price, but so are wooden poles, and every projected transmission line has to be figured very carefully to be sure of striking the correct economic balance between these two structural materials. The re-

sults can often be determined by the relative cost of transportation for the two reckoned from their necessary shipping points.

Mounting Costs and Higher Rates

AMONG certain operating officials there is a strong feeling that the movement to increase electric rates should have been started last winter when coal went up so sharply. This criticism has a direct bearing upon the attitude of companies which still hesitate to advance schedules. It is also of interest to the regulating commissions. Moreover, it opens the whole question of traditional central-station policy, which for years has been to build up volume of production and thereby to reduce unit operating costs and permit steady decreases in rates. To check the regular growth of this policy, to substitute advancing rates for the declining rates of the old order, is a change of front which is not made easily.

Familiarity may breed contempt even for economic laws. When there was apparently a safe margin of income over outgo it was a simple arithmetical calculation to figure that if the number of kilowatt-hours sold was only increased and there was even a slender margin of return the earnings were bettered. We continued the race for volume of production and sales, and the possibility of a change in the bases of cost remained in the disregarded background, did not enter at all into the equation. Totals were mounting, the load curve was rising, greater and more economical generating units were ordered. The industrial power load and the power factor improved, the local railway load gravitated to the central station because of the generating economies which concentration assured. Moving along these lines steadily, the entire electrical industry looked forward happily to the day of greater concentration of generating units, of networks of transmission lines carrying energy at lowest cost to every user.

War changes the face of all things, perhaps not for all time, certainly for the period when its rough play is the main economic force. At present the tendency toward declining rates has been arrested sharply. Whatever isolated exceptions there may be to this rule, the facts of inflated cost are incontrovertible. The first answer which the central station made last winter was to struggle as best it might against the current. There were clear reasons why it did not resort to immediate higher rates to avoid depletion of the corporate pocketbook.

Foremost among these was the traditional policy which we have been discussing. Second was the thought that coal prices could not misbehave except tem-

porarily, that they were out of joint for only a brief while, that coal was too plentiful to be in absurd demand at fancy figures, that the railroads would get control of the situation, etc. Third was the lamentable fact that utility rates, unlike the prices of the green-grocer, are not subject to day-by-day fluctuation according to the measure of supply at the source and the quantity of demand from the consumer; some stability has been regarded as necessary.

The distant vision still shows outlines, though a trifle more hazy, of ever-increasing size of generating units, ever-decreasing generating costs, of transmission steadily extended to wider areas with increasing benefits to the consuming public and industries in low rates; it is a vision to which the electrical industry will cling as the ideal of attainment which it will reach if and when possible. But in the meanwhile there is a sterner reality to confront. Some companies will not be brought face to face with the necessity of advancing rates to prevent red-ink balances; by fortunate circumstance, by unusual foresight, by the trick of fate, they will avoid it. But for the great bulk of companies higher cost is the inescapable factor in their accounts of which they will have to take cognizance to avoid regret.

Telephonometry

IN THE testing of telephone circuits it has long been the practice to ascertain by successive trials the number of miles of standard artificial telephone cable which give the same volume of telephonic sound as the particular circuit under test, using standard transmitting and receiving apparatus over both circuits alternately. Again, when telephone transmitters are tested, it is customary to take a definite length of standard cable circuit and talk over it with a standard transmitter and with the tested transmitter alternately. The difference in volume, if any, can then be expressed in terms of the difference in length of the standard cable circuit found necessary to restore auditory compensation. A similar test can be made in the case of telephone receivers.

The above auditory-comparison tests, while definite and reliable, are recognized as being very crude and tedious. An ideal method should permit of an exact quantitative determination being made, conveniently and swiftly, of the impedance of a telephone circuit in the one case, or of the strength of a transmitter, or of the sensitiveness of a receiver.

If any single frequency existed in telephony which was an exclusively critical frequency, tests of and for transmitters, circuits and receivers at that critical frequency could be made without much difficulty. The fact is, however, that while there are prominent telephonic frequencies, there is no single criterion of frequency. Speech contains any and all frequencies between, say, 100 and 2000 cycles per second, if not in one and the same voice, at least in the voices of a group of persons. This vague extension of telephonic action over so wide a range of frequency renders the question complex and indefinite.

A recent contribution to the subject has been made by B. S. Cohen in a paper before the Institution of Post Office Electrical Engineers in London. First, the carbon transmitter is replaced for testing purposes by an electromagnetic transmitter; secondly, an experimental artificial voice is described, and, thirdly, an experimental artificial quantitative ear.

The artificial voice consists of a revolving make-and-break interrupter, driven periodically over such a range of speeds as will cause the impressed frequency to vary to and fro over the range 700 cycles to 1300 cycles in less than one second. This is certainly impartial behavior in regard to frequency, since this range becomes completely covered. A specially constructed telephone receiver in the circuit of this interrupter emits acoustic oscillations, in a definite wail, during each such rhythmic discharge, there being no resonant rise in amplitude of vibration throughout. It is intimated that this constant-amplitude frequency-ranging wail is at least just as good for testing purposes as the well-worn count "one, two, three, four, five," or the familiar assertion "Mary had a little lamb," both of which incantations are in vogue among testing telephonists. The standard wail is then delivered to the transmitter at the sending end of the artificial cable circuit. At the receiving end is installed a step-up transformer, an audion or tandem-audion amplifier, a carborundum-steel rectifier, and a sensitive galvanometer of the D'Arsonval type. The latter gives a scale deflection in response to the wail at the sending end, and, by proper calibration, this deflection can be evaluated in microamperes.

The complete set, or telephonometer, has the great advantage of being definite, swift and reproducible in its action, so that either a transmitter or a telephone circuit can be tested quantitatively in a very short time by a single observer. The apparatus constitutes a distinct advance in the acoustic testing of telephone circuits, but it is probably capable of being simplified without sacrifice in effectiveness.

Revamping the Central Station

THE change in generating practice brought about by the introduction of the steam turbine some fifteen years ago has been very startling in its results, and particularly so in the case of big city plants in which economy of space may become nearly or quite as important as economy of coal. A very excellent example of what has happened will be found in John Hunter's description of the remodeling of the St. Louis generating station, which in its first stage of existence fourteen years ago happened to be one of the last big plants with reciprocating engines. One need not lament this unhappy condition, because for several years it was a grave question whether it were better to be on the last lap of the engine's career or the first lap of the turbine's. The former had to face that extremely disagreeable thing known to accountants as depreciation due to changes in the art; the latter ran up against depreciation of quite another, but no more desirable, kind.

All that has passed into history now, and the impor-

tant matter for consideration is the way in which a single station obtained more than eightfold capacity by change of equipment. The great cross-compound reciprocating engines of the original plant had scarcely more than settled down to their bearings before it was necessary to increase the station capacity, and four 5000-kw. turbine-generators were added. The original boiler plant consisted of twenty-eight Scotch boilers. To take care of the new units forty water-tube boilers were added on an upper deck. Note the outrageous number of boiler units then needed for a mere 20,000-kw. generating capacity. Three years later more output was required, and the four turbines were replaced, after only three years' service, by 12,000-kw. turbines. Again more steam was needed, and twelve of the Scotch boilers were replaced by water-tube boilers. So far as the turbine plant was concerned, it now had fifty-two boiler units to provide steam for 48,000 kw. as against forty boilers for the 20,000 kw. The generating equipment remained in this stage of evolution for seven years, and then there was another forward movement. This time one of the original 3000-kw. reciprocating-engine sets was removed, and in its space was installed a 20,000-kw. horizontal turbine. For this unit the remaining sixteen Scotch boilers came out and ten water-tube boilers went in, with 2000 kw. capacity per boiler. With the greatly increased output two of the reciprocating sets were removed and their room was utilized for the extension of the switchboard space. Finally, plans are now under way for abolishing the remaining two old units and putting two 20,000-kw. turbines in their place. One rarely sees a more striking example of the very radical changes in practice wrought by a few years' development. It would not be unsafe to prophesy that when the two new units go into place they will not require ten boilers apiece.

The Conservation of Transportation

A VERY important edict under the "defence of the Realm" regulations has been put forth in England by the Controller of Coal Mines. At one stroke the reorganization of transportation has been put under way, and work has been done in a few weeks which probably would require in this country not less than six months of jaw-play by the irreconcilables in Congress and 10,000 columns of open letters in the newspapers. The sum and substance of the English regulations is this, that the transportation of fuel is to be

reduced to a minimum by the very simple process of limiting the territory within which one source of supply can distribute its coal. In other words, instead of following our wasteful American method of transporting nearly everything over the maximum distance, the regulations see to it that at least one necessary article shall be systematically shipped over the minimum distances practicable. Moreover, the uses for which fuel is designed are divided into three classes, steam and manufacturing, gas and coking, and the house supply; and coal from a given source has its own territory of distribution which may or may not be quite the same for each of these three uses. The effect is obviously to keep down unnecessarily long shipments and to put the necessary fuel into each district with as little use of rolling stock as is possible.

To carry out such a project successfully implies exactly what exists in England, an iron hand on the whole mechanism of the production and distribution of this particular necessity. How far a similar scheme could be carried out in this country, even if the authority could be obtained in the course of time, is not altogether clear; yet it is certain that very much could be done in the way of easing the severe burden of transportation. The fuel regions of this country are not distributed nearly so favorably as in England, and the normal distances of carriage have to be much greater. Yet a very considerable measure of relief would be obtainable by an organization of the distribution so that the average distance traveled by a ton of coal would be considerably reduced. Such regulation would undoubtedly work inconvenience in some places where industries have been wont to secure desirable coal from certain localities even with a very long haul against it. It would make it necessary for consumers in general to use such coal as they were able to get, but in not a few instances the reduction of transportation would mean actual economy. The broad principle is one which in these grave times should be followed as far as is possible with respect to all commodities over which the government has direct or indirect control, otherwise we shall suffer severely from that gross waste of transportation facilities which has been characteristic of our industrial development. Whether the British fuel plan should be tried here or not in anything like its original form, there is no doubt that the principle is sound and deserves to be forwarded. Any saving, however slight, if applied nationally means much to our already overburdened railroads.

PRESENT prices of material and labor make it so essential to consider every means of increasing plant economy and securing the maximum benefit out of the invested money that the advantages of the uniflow engines should not be overlooked. In the Aug. 11 issue of the ELECTRICAL WORLD there will be presented an article on the performance of a uniflow engine in a steel mill. This issue will also contain the first installment of an article on transmission-line charging currents, taking up a method of

The Coming Issues

using capacity and potential coefficients to determine charging currents in three-phase lines. Prof. C. E. Clewell's article in the same issue will discuss the operation and upkeep of factory lighting systems. There will also be another article dealing with the coal situation in Central Western States. The articles on this subject which have been appearing in the ELECTRICAL WORLD are the report of an investigation by an editorial representative, designed to impress upon readers the importance of forehanded preparation.



ELECTRIC UTILITIES ASK PROMPT MOVEMENT OF CARS

Looking Ahead on the Coal Supply

Companies in Central Western States, Driven by Experiences with Scant Supply and High Prices, Trying to Meet Their Problems—Policy of Buying Coal Mines to Safeguard the Future

FOR their coal supply most central stations operating steam plants are dependent upon mine operators with whom they have contracts, upon open market coal and upon the railroads which move the coal from mining to consuming centers. At this time few properties own their own mines, but for their future protection central station interests will give more attention to safeguarding their fuel supply; in many cases mines will be bought and operated.

At present and during the winter of 1917-18 the problem of the companies is not so much what their future policy shall be, it is the very concrete one of how they are to get their coal supply at reasonable prices. Subject to such moral or legal suasion as governmental authorities may exercise upon the coal producers and distributors and railroads, the central stations are virtually in the hands of those agencies.

OUTLOOK IN CENTRAL WEST

There is a disposition in the Central West to feel that the seriousness of the coal situation is not appreciated in the East and in the national Capitol. Particularly is this the case where companies were perilously close to the suspension of service because of coal shortage last winter. In these instances the tendency is natural to feel that great efforts will be required to prevent a repetition of these conditions in the coming season.

It is difficult to allocate responsibility in every instance for non-delivery of contract coal between mine operator and railroad. The coal producer on many occasions has undoubtedly been tempted to neglect deliveries under low-price contracts because of the orders that he received where price was little if any consideration to the buyer. Whether or not a failure to make deliveries under contracts subjects the operator to possible liability for damage is one of the points which is under consideration.

No one questions that coal production is greatly stimulated by present prices. It is held back, however, by the shortages of labor and materials which affect other industries. Coal operators assign as one reason for their failure to hold men the fact that the irregularity

in car supply makes it impossible to assure continuous employment. Men will not stay unless employment is continuous because they can get jobs elsewhere in places where this objection does not arise. So far as central stations are concerned the point is not so much that this problem arises as that the lack of solution of it is one of the perils affecting the question of coal supply next winter.

PLANNING TO OVERCOME RAILROAD CONGESTION

Close as some of the great Western utilities are to the coal fields, they were absolutely bound time and again last winter by the fact that railroad congestion could not be overcome. The great advance in market price of coal can be relied on to stimulate producers to increase production, but the weak link in the chain from pit mouth to stoker is the railroad.

In the effort to prevent breakdown of the railroad numerous local movements have been set afoot, supplementing and co-ordinating the policies of the authorities and railroad and utility leaders at Washington. As large users of coal, vitally dependent upon regularity of supply, furnishing light, heat and power to the community, the electrical utilities have every interest to serve in stimulating local plans to facilitate coal car movement.

RESPONSIBILITY IS INDIVIDUAL

Utilities of the Central West appreciate that strong representations have been made on their behalf for preferential treatment in coal car movement. They realize that their recognized standing as quasi-public institutions, as purveyors of service to plants engaged in government military and naval operations, gives them a right to ask preferential treatment in the distribution of coal.

They also understand, however, that the obstacles which will hamper railroad operation are more fettering than any hitherto experienced. It is for this reason that executives of utilities in Central Western States feel that the first responsibility in the question of coal supply rests directly upon them. If they cannot get relief for themselves, Washington may do it for them;

but their standing will be improved if they go to Washington showing that they have first employed every means in their power to solve their own problems. Washington will have other things to do than to protect a company which does not make the effort to protect itself.

MORE MOVEMENT, NOT MORE CARS

Among the definite suggestions made to a representative of the *ELECTRICAL WORLD* on the railroad part of the coal problem, as published in last week's issue, is that of Alex Dow, president and general manager Detroit Edison Company. Mr. Dow points out that it is not more cars but more prompt movement of the existing car supply that is needed. To further this desirable end there is no question that the railroads, through their organization in Washington, subsidiary to the Council of National Defense, are co-operating more effectively than ever before.

As Mr. Dow also pointed out, to quicken the move-



PURCHASE OF COAL MINES IS ONE SOLUTION

ment of cars it is necessary that there be more locomotives, more trackage, more men for locomotives and switches. The new plan of co-ordinating facilities of railroads where there is competitive trackage between terminals will be a factor in preventing congestion in car movement, if it can be kept effective through the fall crop traffic period and the snows of winter months.

Electrical utilities understand thoroughly the difficulties under which railroads are laboring in their effort to meet increased costs without adequately increased rates. They appreciate that the public and the authorities, while asking greater traffic movement from the railroads than ever before, are hampering them seriously by the refusal to allow the higher rates which would make it easier to raise fresh capital for improvements. While not withholding full credit to the railroads for the improvement which they have made recently in operating results, the electrical utilities feel that they have the right to ask that there be no relaxation but that there be renewed determination to solve the problem of coal supply during the approaching winter.

Another factor which is not overlooked by the utilities of the Central West in their apprehensive calculations for the ensuing months is that upon the exceedingly active industrial demand of last winter there will be superimposed in the coming winter the enormous requirements of military and naval forces enlarged to war

standard. These will be a further tax upon the already overwhelming demands for railroad transportation.

STATE AUTHORITIES WILL ACT

In the States of Indiana, Ohio and Illinois the coal situation is to so large an extent an intrastate one that utilities are justified in looking to their state authorities for rigorous action toward relief. Observation shows clearly that state officials in at least one of these states are aroused in the largest sense to the economic possibilities of abnormal coal conditions during the coming winter. In each of these states the authorities can be relied on to use broad powers, granted and implied by the statutes, to keep the coal situation within bounds; and action of an extremely drastic character is possible if reasonable methods and arguments are ignored.

It is difficult to say much that is specific about prices of coal as they are reported in Central Western States because conditions differ so greatly in various localities. Companies report experiences with prices which are entirely in disagreement with the general understanding held in the East. In some instances companies report that the efforts made to produce lower prices have had merely the effect of causing advances. Standardization of price has not been effected and a number of companies despair of keeping their per ton costs down.

Closely connected with the question of difficulty in getting adequate supply is that of the rates which should be charged to offset the larger costs involved in higher price and larger investment in reserve stocks in order to safeguard against shortage. Except in Indiana, the question in the states mentioned, as well as in Michigan, is receiving consideration by companies acting individually. In Indiana the companies have united. Their first action through the Indiana Electric Light Association has been changed to comply with the ruling of the Public Utilities Commission that individual action by companies was preferable to association action. Generally, however, costs are being affected so heavily by coal conditions that corresponding changes in rates are regarded as essential to the proper protection of the properties.

The unexpected experiences of last winter and the continued troubles this year, together with the uncertain outlook for next winter, combine to impress upon companies the wisdom of new steps to strengthen their position as to coal supply. These steps will be the purchase of coal mines or of interests therein, not only in properties now in operation and yielding fuel for immediate requirements but also in lands capable of development in the future.

Easily Regulated Lamp Dimmer

By means of a socket formed of high-resistance material or introducing a helix of high-resistance wire between the base and the lamp a practically unlimited degree of illumination is obtained as outlined in patent No. 1,228,835 by screwing in the lamp in different ways. The invention is that of Harry Alexander of New York. Any suitable material—for example, tin or German silver—may be used for the high-resistance material, while copper may be used for the low-resistance material when employed.

Giving Twenty-four-Hour Service in Town of 2000

Local Generating Plant Supplanted by a Transmission Line Service—
Engineering Features—Method of Erecting and
Cost of Construction

BY R. E. CARLSON

UNTIL recently Mount Carroll, Ill., a town of 2000 inhabitants, was supplied with energy from a local generating plant. Although twenty-four-hour service was desired, it was not practicable to provide it owing to load conditions. To meet this need a 13,200-volt, three-phase transmission line has been constructed connecting it with the People's Gas & Electric Company's central station at Savanna, Ill. Some of the construction features of this line and the method of erecting will be described in what follows.

Part of the way between Savanna and Mount Carroll (12 miles, or 19.3 km.) the line runs along private right-of-way, and the rest of the route is along public highways. Wooden poles are used inside city limits and steel poles elsewhere. Outdoor substations are installed at each end of the line, and midway between them is a sectionalizing tower.

To convert the two-phase energy which is generated at Savanna into suitable form for economical transmission, T-connected transformers are installed at the generating end of the line. Three 1100-2200/13,200-volt units rated at 200 kva. each and having 5 and 10 per cent taps are employed, one being provided for reserve. From the switchboard to the transformers the low-tension circuits consist of lead-covered cable laid in underground fiber conduit with the exception of that portion extending above the substation foundation, where galvanized-metal conduit is employed.

Air-break switches are mounted on top of the substations, which are of the steel-tower type, the three phases being operated simultaneously by means of a lever at the bottom of the tower. Electrolytic lightning arresters are employed at the substations.

At the Mount Carroll end of the line are three 37.5-kva. single-phase delta-connected transformers, which keep the pressure down to 2200 volts, at which energy is distributed throughout the circuit. On the 2200 transformers there have been connected a poly-phase watt-hour meter, employed in the primary circuit, and a three-coil air-break switch on the 2200-volt side. Air-break switches similar to those installed at the Savanna substation are employed so that transformers may be disconnected for repairs or for changing connection without interrupting service on the high-tension line. Electrolytic lightning arresters cannot be used at this end of the line, as it was impossible to make the necessary arrangements to insure their being charged every day; consequently multigap-type arresters are used. If the arresters mentioned, used with the ground wire stretched along the top of the pole line, are not sufficient to protect against damage from lightning, others of multigap type will be installed along the lines at points to be determined by actual operating conditions. Both substations were furnished by the General Electric Company.

The sectionalizing tower was built by providing special steel work on one of the ordinary steel poles used

on the line and by mounting three Delta-Star type TM disconnecting units. A view of this tower is given herewith.

Although the line will be operated at 13,200 volts for the present, it is constructed to operate 3000-volt service, and this voltage will be adopted as soon as conditions warrant. From the generating station to the city limits, 45-ft. (13.7-m.) Western red-cedar poles with 8-in. (20-cm.) tops are installed about 150 ft. (45.7 m.) apart, except on curves, where shorter spacing is used. Corners are turned by means of two poles, no buck-arm constructions being employed. The wooden poles are equipped with Hubbard bow-arrow steel cross-arms,



FIG. 1—TYPE OF EXPANDED STEEL-TRUSS POLES USED

ground-wire bayonets and double-arming sets, Keystone trusses, Belcher ground-wire clamps and Locke insulators.

The conductors, which consist of three No. 4 B. & S. gage hard-drawn stranded cable, are placed symmetrically 36 in. (91.4 cm.) apart, with a 5/16-in. (7.9-mm.) Siemens-Martin stranded steel cable above on bayonets. The ground wire is connected with the earth as a fifth pole. In calculating the size of poles which would be required, it was assumed that the maximum stress will be equivalent to a loading of 0.5 in. (12.7 cm.) of ice and 8 lb. wind pressure (3.6 kg.—390 kg. per square meter) upon the conductors, which have a sag of 3.5 ft. (1.06 m.) on 150-ft. (45.7-m.) spans.

In the country Bates expanded steel-truss poles 45 ft. (13.7 m.) in length are installed, steel cross-arms on bayonets being employed. They were set in 1-2½-5 concrete and were placed 300 ft. (91.4 m.) apart except on curves. Storm guys were attached to the poles every half mile (0.8 km.), one pole equipped in this manner being shown in one of the accompanying illustrations.

Long corners and long spans were extra heavily guyed. Conductors were pulled to have a sag of 8 ft. (2.4 m.) in 300-ft. (91.4-m.) spans. Conductors were placed 48 in. (1.2 m.) apart and transposed at three points along the line in order to minimize static disturbances. No. 6 B. & S. gage dead-soft bare copper wire was employed after tying the wires to the insulators. Four



FIG. 2—TYPES OF COUNTRY AND CITY POLE CONSTRUCTION

storm guys were employed in some places and two in others, the wires being anchored with Everstick anchors, using $\frac{3}{8}$ -in. (9.5-mm.) iron cable for the guy wires.

Poles were transported without the cross-arms and fixtures attached, and the cross-arms were sent in bundles, one bundle for each pole. Poles were distributed among the cars in which they were transported so that a large portion could be unloaded at the middle of the transmission line, with smaller portions near the two ends. By doing this the average haul per pole after leaving the freight cars was reduced to about 3 miles (4.8 km.). In distributing the poles along the private right-of-way it was found that the best results could be obtained by carrying three poles per wagon with the average team and wagon available and under ordinary soil conditions.

Before erecting the poles the cross-arms were attached by means of clamps, thus eliminating the necessity of drilling any holes. Where double cross-arms were required they were placed on opposite sides of the poles and clamped together by means of through-bolts. Across the top 10-ft. (3-m.) sections of the poles were fastened to the main parts before the cross-arms were attached, this being done by riveting the web connectors to each side of the pole top with twenty rivets. The joints may readily be seen in the accompanying illustration. The ground-wire supports, or the bayonets, run up to the top of the pole by means of 0.5-in. (1.27-cm.) bolts. The holes which are required for these bolts were the only ones which had to be drilled on the entire pole, but this was not an impediment to construction, as the holes were drilled before the poles were distributed along the line.

The steel poles were set with a tackle consisting of a pole rope, a jack to elevate the pole rope at the beginning of hoisting operation, double blocks attached to

the ends of the pole rope, and hand lines to guide the pole while it was being raised. This rigging was found to be more satisfactory in raising by means of a gin pole or gin wagon. The pole rope was attached near the top of the pole and passed over the jack, which was placed near the middle of the pole, this jack being high enough to cause an upward pull on the pole when the pole rope was hauled in by a team of horses. One end of the double block was fastened to the pole rope, the other being suitably anchored, and the team was driven in the direction in which the pole was elevated. Under good conditions it was found that poles could be raised in from fifteen to twenty minutes.

After the poles were erected they were held in position with four temporary guys of No. 12 iron wire, the pole meantime resting on the ground. The work of setting poles was completed by the concreting gang, which followed the pole-raising gang. Supplies for making the concrete bases were distributed in advance of this gang in order that operations might be carried on with the least delay. Just enough sand and gravel were left at each pole to make the particular foundation. A motor truck was used to distribute most of the gravel, and teams were used for the construction wagons, which carried the concrete-mixing box and water tanks. This was done because otherwise the horses would have had to stand idle for a considerable portion of the time. In making the concrete bases a form about 4 ft. (1.2 m.) high was used, first being placed in the bottom of the 6½-ft. to 7-ft. (1.97-m. to 2.1-m.) holes which were excavated for the poles. After the concrete was poured in to the top of the form earth was packed around it and the form pulled up so that the remainder of the base could be completed. Hooks were attached to the forms in raising them. It was impossible to use a single form which would extend the



FIG. 3—POLE EQUIPPED WITH STORM GUYS; SECTIONALIZING TOWER

entire depth of the pole, since it would have been very difficult to raise the form out of a 6-ft. (1.8-m.) hole on account of the frictional resistance. The tops of the concrete bases were tapered to provide a watershed. Approximately 1 yd. (0.76 cu. m.) of concrete was used at each pole. At the turns in the line, however, a heavier setting was used, 1.5 yd. (1.44 cu. m.) being

utilized. The temporary guys previously mentioned were fastened in the ground by sticks 4 ft. or 5 ft. (1.2 m. or 1.5 m.) long, which were left in place for about a week after the pole was placed in order to give the concrete an opportunity to set.

To facilitate climbing the steel poles when installing the insulators and attaching the conductors thereto the construction men were provided with the special climbers described on page 97 of the Jan. 8, 1916, issue of the ELECTRICAL WORLD. Operations were carried on in such a manner that the linemen had to climb each pole only once. First of all, the transmission-line conductors were strung along the ground beside each pole. After the lineman had climbed the pole he installed a pulley on the cross-arm and hauled up the insulators and line conductors, which were attached to the pulley tackle by a ground man. The conductors were not attached to the insulators as soon as they were raised into position, but were allowed to rest on the cross-arm until they could be pulled to the proper tension. After this had been done and the sags had been allowed to equalize themselves for several days, a lineman placed the lines on the insulators and fastened them thereto. The ground wires were installed last of all.

The type of construction employed was selected because the cost was practically the same as that for equally well-built wooden pole lines, and it was felt that the fixed charges would be lower and longer life would be obtained by the use of steel poles. Poles were set in concreted joints in favorable weather, but the remainder of the wire work was carried on during the middle of the winter and under very cold and unfavorable conditions. The cost data follow:

Pole structures complete.	\$476.00	Framing	\$7.50
No. 4 copper	756.00	Setting	27.00
5/16-in. ground wire	105.00	Concreting	81.00
Insulators	56.00	Stringing	4.00
Hardware	30.00	Guying	30.00
Line switches	17.00	Tools	40.00
Survey	14.00	Miscellaneous material ..	21.00
Clearing	15.00	General expense	95.00
Hauling	14.50		
Digging	24.00	Total	\$1,857.00

TELLING THE PUBLIC ABOUT RATE ADVANCES

Method Followed by the Penn Central Light & Power Company—Why Increased Costs Mean Increased Rates

In making increases in rates because of higher costs of labor and of coal and other materials central stations have followed various methods of announcing the change in schedules to their customers. Among the companies which followed the plan of giving extensive publicity to the abnormal conditions leading to rate advances is the Penn Central Light & Power Company, Altoona, Pa., of which J. H. Shearer is the general superintendent.

This company entered upon an extensive campaign of publicity to acquaint the public with the facts. In a large advertisement addressed to the public a month before the new schedule became effective it gave the reasons why advance was necessary.

In the initial notice the company expressed its regret at being obliged to announce an increase in rates. The extent of the advance to general public consumers was stated frankly: "To domestic and commercial consumers the additional cost will amount to approximately 12 per cent."

A number of statistics of higher cost were shown, as for instance the following:

AVERAGE COST OF COAL PER GROSS TON, ALL PLANTS		AVERAGE PRICE PAID FOR COPPER PER POUND	
	Per Cent Increase		Per Cent Increase
1914	\$1.90	1914	\$0.1499
1915	2.11	1915	0.2003
1916	3.20	1916	0.2927
1917*	5.39	1917	0.3849

*Three months.

There has also been an increase in the prices paid for insulators, poles, cross-arms, hardware, etc., from 30 per cent to 150 per cent. These figures show an increase of at least \$3 per ton in the price now being paid for coal, as compared with 1914, which at the present rate of consumption means an increase in expense of \$240,000 per annum.

That Our Patrons May Know

Electricity is an imperponderable and invisible agent producing light and heat.

Coal is an important element in the manufacture of electricity, which becomes a transformed energy, transmitted over wires into homes and offices, where it is ready for use without the inconvenience and waste of the original fuel from which it has been converted. It requires no statistics or argument on the part of this company to demonstrate to the satisfaction of its "public" and its patrons that the increased cost of coal has become a serious item in the manufacture of its product.

Every consumer in greater or lesser degree has been affected by the fundamental and world wide conditions that have brought the cost of fuel to an unprecedented height.

The following tabulation is interesting in that it gives the comparative cost of coal in 1914 and ensuing years, and it furnishes complete justification for the higher rate of service which this company has been compelled to establish. **IT MAY FAITHFULLY FULFILL ITS FUNCTION AS A PUBLIC UTILITY CORPORATION**

AVERAGE COST OF COAL PER GROSS TON	
1914	\$1.90
1915	2.11 (11% increase)
1916	3.20 (68% increase)
1917 (three months)	5.39 (183% increase)

Coal is but one important element in the manufacture of electricity that has increased tremendously in cost, but it constitutes a burden upon this company that makes it imperative that income shall be increased.

At present prices and consumption, coal imposes an additional expense cost upon this company of \$240,000 per annum.

This company respectfully submits this fact to the candid and fair consideration of its public and patrons, confident that it will secure their cheerful acquiescence in the new policy which imperative business necessity has forced it to adopt.

There is no immediate prospect of relief from any source. On the contrary, the outlook is today less favorable than during the past four years.

This company has been reluctant to increase the cost of its product, but it now has no other alternative. It is unable to escape conditions which fall upon every individual and every corporation.

The MAINTENANCE OF EFFICIENT AND SATISFACTORY SERVICE makes it absolutely essential that this company increase its service rates and we earnestly solicit an intelligent understanding of our difficulties and our necessity, that the public may know why service rates have been increased.

This company has and will continue to serve its patrons at the lowest possible cost consistent with wise and economical management.

It demands only that it be permitted to continue as a servant of the people.

Penn Central Light & Power Co.

J. H. SHEARER, General Superintendent

That Our Patrons May Know

This company IS or IS NOT justified in asking its patrons to pay a higher rate for service which it has rendered and which it will continue to conscientiously render.

If this company PROVES that its present rates will not permit its system to be wisely, efficiently and ECONOMICALLY managed, that it may render THE SERVICE THAT ITS PATRONS EXPECT AND HAVE A RIGHT TO DEMAND then, it is respectfully submitted, its patrons will cheerfully accept a higher tariff which is dictated by IMPERATIVE BUSINESS NECESSITY.

If this company PROVES that its income is not sufficient to pay the wages of its workers, to purchase coal and other supplies and materials that are essential to successful operation and wise maintenance then, it is respectfully submitted, there cannot be REASONABLE OBJECTION to its aspiration to live.

If this company does not prove that its present income is insufficient to meet the demands of labor and the cost of materials and supplies, then objections to its new rates are warranted and should have due consideration.

The State of Pennsylvania has created a Public Service Commission entrusted with the responsibility of determining the REASONABLENESS of rates exacted for public service and that commission, unless it is satisfied that rates are REASONABLE, could not be induced to sanction the increase sought.

This company has presented statistics which are ample corroboration of its claim that present revenue is no longer adequate to its FULFILLMENT needs. It has proven that coal, the largest factor in the manufacture of electricity, has increased unprecedentedly in cost, and is imposing an additional burden of a quarter of a million dollars yearly upon it.

It has PROVEN that fundamental and world-wide economic conditions have intervened to disrupt long-existing stability, and that an increase of rates is essential to its maintenance of its function of supplying its public and patrons with an indispensable commodity.

Unless it is not PROVEN that this company has misrepresented its facts or has overestimated its case; if it is not proven that this company can successfully continue at existing rates, then, we represent in all fairness, it is entitled to the cheerful acquiescence and cooperation of its patrons in a policy which was reluctantly adopted, but to longer delay which would have been fraught with the most serious consequences.

This company does not come to its patrons animated by a desire to add to its profits.

It is controlled by but one consideration, and that is to secure sufficient revenue to meet the demands of labor and provide necessary supplies and materials entering into the production of electricity.

Unless it is demonstrated that this company IS NOT ENTITLED TO INCREASED COMPENSATION—unless it is clearly established that changing business conditions have not made it necessary to revise its schedules of rates—then, it is insisted, there cannot be substantial objection to the tariffs which have been filed with the State Public Service Commission.

The company's duty to the public and its patrons, no less than to its stockholders, is to provide sufficient revenue to meet all unavoidable expenditures and provide a reasonable return for money that has been economically invested.

PENN CENTRAL LIGHT AND POWER COMPANY

J. H. SHEARER, General Superintendent

Local Lamp and Inspection Work Lighting

Typical Cases of Good and Bad Local Lighting—A Case Where Local Units Are Desirable in Place of Overhead System—Requirements of Inspection Work and Its Importance

BY C. E. CLEWELL

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SUMMARY.—This article points out some of the faults in the prevalent misuse of local lamps and discusses a case where the proper use of local units was desirable in spite of the many advantages of the overhead system for ordinary cases of factory work. Methods of mounting local lamps are illustrated and some precautions are given which should be observed if the advantages of local units are to offset the usual disadvantages of such schemes. Owing to the very general mistakes in the installation and operation of local lamps, these notes are of unusual importance, and much emphasis is placed by the author on careful attention to details, which becomes so necessary where the local unit is placed within reach of the employee, who, through ignorance, so often adjusts the location of his own individual lamp with no regard to the proper shielding of his eyes from the direct light of the unit. The question of suitable illumination for factory inspection work is treated as representative of unusual requirements sometimes encountered here and there in lighting a given factory. Actual cases are used to illustrate special methods for meeting such conditions.

THE bad effects, as far as the eye is concerned, in the misuse of local lamps are likely to be greatly exaggerated in contrast with the same misuse of lamps mounted overhead. This follows because of the close proximity of such local lamps to the eye, bringing them often immediately in the line of vision when an operative is looking at his work, whereas lamps overhead are obviously less often in the line of vision and consequently are less likely, even when improperly equipped with reflectors, to produce glare effects as continuously and of the same magnitude as local units.

The widespread neglect in the use of reflectors as well as the use of reflectors which do not entirely conceal the bright lamp filaments of local lamps, as evidenced by careful investigations into certain trades, makes it desirable to call attention at least to the most important abuses and to suggest ways and means of applying local lamps to given cases in such a way that

vision when the operative is looking at the cutting tool. When this angle is very small, as suggested in this diagram, the glare produced by the direct light from the lamp filament is a continual menace to eye comfort and safety.

The lamp is shown in such a position that the larger part of the light flux passes directly toward the opera-

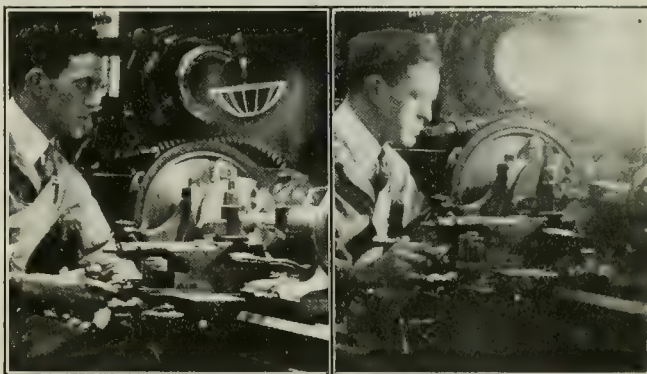


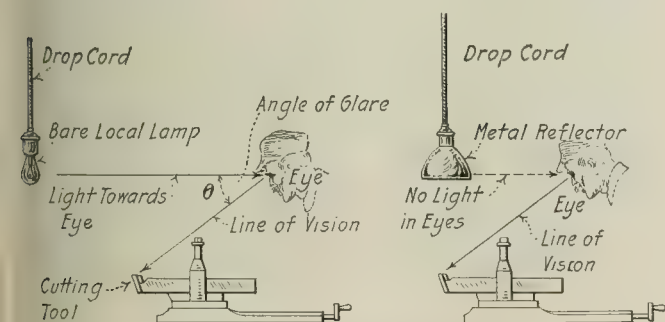
FIG. 3—GOOD AND BAD WAY OF ILLUMINATING A LATHE BY A LOCAL LAMP

tive's eyes, while a smaller portion passes away from the lamp toward the cutting tool which is supposedly the object for the illumination of which the lamp is installed. In Fig. 2 an improved arrangement is shown. Here the position of the lamp has been changed by bringing it more nearly over the cutting tool, and the metal reflector not only directs the luminous flux from the lamp effectively to the work but at the same time shields the bright lamp filament from the eyes of the workman.

Figs. 1 and 2 are made clearer by the photographic illustrations of Fig. 3.¹ The points just outlined are, of course, very simple and easily understood, but they constitute the keynote of the most widely ignored and most readily overlooked features in this problem of local lighting. The apparent remedies illustrated by Figs. 2 and 3 are probably the ones which are in need of the greatest attention by all those who are in a position to make suggestions to factory managements and operatives concerned with the use of a local lamp or lamps.

GENERAL VERSUS LOCAL LIGHTING

Almost every one has a natural tendency to desire a local lamp close to the objects under view. There seems to be a sense of satisfaction under such lighting conditions which is not so evident with an exactly similar quantity and quality of light from lamps overhead and at some distance from the work in hand. Factory workmen who have grown accustomed to strictly local lighting, if transferred to another section lighted solely



FIGS. 1 AND 2—GOOD AND BAD CASE OF LOCAL LIGHTING

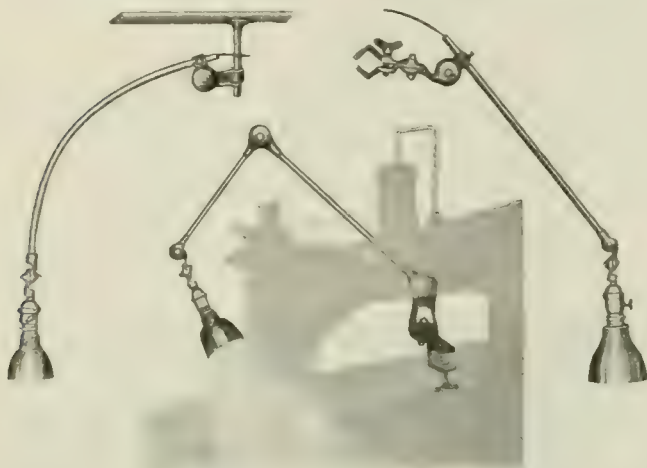
they may effectively illuminate the work and yet avoid the bad results alluded to above. Several typical cases, therefore, are appropriate to the subject at this point.

To illustrate some typical cases, Fig. 1 is drawn to show a common scheme for mounting a local unit close to a lathe or other machine tool and in bench work. The angle of glare as shown is based on the line of

¹Figs. 3 and 9 are due to the courtesy of the Edison Lamp Works of the General Electric Company, Figs. 4, 5 and 6 to the Franklin Specialty Manufacturing Company, Providence, R. I., and Figs. 10 and 11 to the Cooper Hewitt Electric Company.

from lamps at the ceiling, or if their own department is equipped with adequate general illumination and all drop lamps are removed, experience a feeling close to dissatisfaction even when the intensity is the same as before.

There is therefore a real difficulty in the way of convincing the average person that general illumination is



FIGS. 4, 5 AND 6—ADJUSTABLE LAMP HOLDERS, (1) FOR ATTACHMENT TO AN OVERHEAD RUNNING BOARD; (2) FOR CLAMPING TO A LINE OF PIPE OR CONDUIT; (3) FOR CLAMPING TO A SEWING-MACHINE TABLE

better than a system of local lamps. It is not merely a matter of stating that the general system is better; it is rather a feature which calls for continued work for some weeks under the general lighting condition before its advantages and satisfaction become realized. Thus large factory sections which formerly used local lamps almost or quite exclusively have been equipped with adequate general lighting, and the objections to the removal of the local lamps have been met successfully, not by their arbitrary removal, but under the agreement that they will be taken out and after a trial of the general scheme for several weeks will be reinstalled if actually found necessary.

The time element thus introduced gives the operatives an opportunity to become accustomed to the new scheme, and if the light from overhead is sufficient for the work, there is little likelihood that any considerable number of the local lamps will be asked for after the expiration of the time interval agreed upon. It is not necessary at this point to dwell on the advantages of the overhead system in contrast with the purely local lighting plan, but it may be observed that wherever possible local lighting should be discouraged in favor of the plan of general or localized general illumination. On the other hand, in those cases, some of which are found in nearly every industry, where a local lamp is a genuine necessity the same care should be bestowed upon the selection of its reflector and the method of its mounting as is given to the design of the general or the localized general schemes.

THE PROBLEM OF MOUNTING LOCAL LAMPS

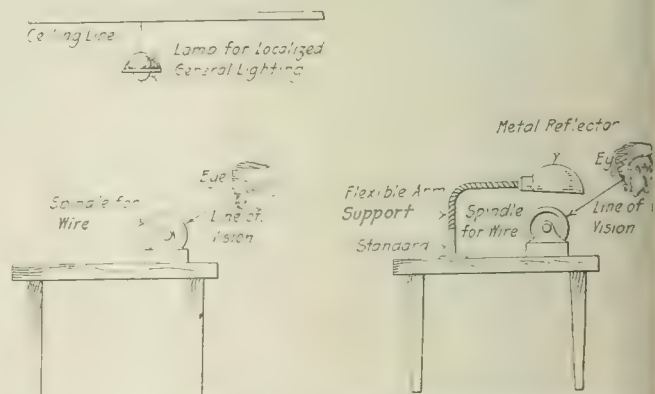
A common method of installing local lamps is by means of drop cords attached to the ceiling or other overhead supports. Such a plan is suggested by Figs. 1 and 2. Many cases arise, however, particularly with machine tools or in other processes, where it is desirable to be able to adjust the position of the lamp in various planes, and here some other form of mounting

than from drop cords becomes very important. This problem in itself is often one of the most difficult to handle in practical every-day factory lighting work.

Different "home-made" schemes have been developed to apply to given machine tools in various plants. These are likely to be limited in the flexibility of adjustment for the lamp and its reflector. An excellent device has been developed for increasing the freedom of motion, as illustrated by Figs. 4, 5 and 6. The universal friction joint used at different points in this adjustable lamp holder is the most interesting part of the device. High frictional resistance is secured in this joint by having the surface of contact at the outer edge of disks within the joint case. These disks are hollowed out so as to produce a resilient tension. The clamp screw passes through one disk and is screwed through the opposing disk so that the nut locks the adjustment permanently and the tension of the initial adjustment remains practically constant for long intervals without readjustment.

The advantage of such a fixture lies in the numerous directions of the motion with which the adjustment of the lamp and its reflector takes place and, in addition, in the various methods by which the fixture may be mounted. To illustrate the latter point, Fig. 4 is included to show a form of clamp by which the fixture may be attached to any convenient line of pipe or conduit at hand and slightly above the position to be taken by the lamp. In contrast, another method whereby the fixture may be attached to any convenient running board or to a low ceiling is shown in Fig. 5. In Fig. 6 one form of this holder is shown for attachment to the table of an ordinary sewing machine. Some idea of the freedom of motion of the lamp may be gained from this illustration.

Other schemes for mounting are also used; for example, a flexible arm as suggested by Fig. 8, and various combinations of pipe lengths and collars with thumb-nut locks. One firm has developed a magnetic holder by which the lamp may be placed against any convenient metal surface of a machine tool and will be held firmly by the magnetic attraction of the holder for the metal base on which it rests.



FIGS. 7 AND 8—INDIVIDUAL FLEXIBLE FIXTURES PROVE BETTER FOR THIS TYPE OF WORK

One of the departments on which the maintenance of a high standard of the manufactured product largely rests is that of inspection. Unusual requirements of the illumination are often made essential by the exacting nature of such work. The inspection table in Fig. 7 is used to support a number of spindles or reels on which or from which fine enameled wire is wound by

small motors. The wire comes to these inspection tables from the wire enameling department, and its inspection consists in the detection of bare or imperfect points on the enameled surface as the wire passes the inspector's line of vision.

Obviously, when this wire is manufactured on a large scale, the speed with which it may be reeled up on the

To make this clear, Fig. 10 is shown to give an idea of the details of inspection which may be conducted under a localized general distribution of the overhead lamps. In this case the work is carried on with an intensity of about 4.5 ft.-candles with the lamps mounted 9 ft. (2.7 m.) above the floor. Work allied with that of inspection, where general illumination is supplied by



FIGS. 9 AND 10—FINAL INSPECTION OF PLATE GLASS; INSPECTING AND SIZING ROLLER BEARINGS

spindles shown by Fig. 7 determines the amount of wire which may be handled by each inspector in the day's work. It was thought at first in this particular case that the unusual advantages of the overhead (and in this instance the localized general) method of lighting were such that a plan like that of Fig. 7 would prove satisfactory. The speed of the wire, however, and the consequent need for very clear vision in following its passage past a given point, placed materially different requirements on the illumination from those that apply to much ordinary manufacturing work.

After a fair trial, therefore, the plan of Fig. 7 was

mercury-vapor lamps mounted at the overhead iron work, is suggested by Fig. 11. Note particularly the clearness in the detail with which the various mechanical parts of the engines stand out under the artificial lighting in this view. Fig. 9 shows the inspection floor of a plate-glass manufacturing plant where a scheme approximating localized general illumination is used. This is a rather unusual example of inspection work and requires unusual accuracy of vision.

The foregoing notes point to the wisdom of exercising due care when a progressive campaign of general lighting is adopted in any plant to see to it that the merits of individual cases which seem to require local lamps are duly weighed. It sometimes happens that what is apparently a most excellent system of general lighting is not suited to every operation conducted in the shop section, in spite of its adequacy and satisfactory character for the greater part of the work. Such cases, by their very unusual nature, will now and then present the opportunity for a treatment somewhat different from that of the rest of the department concerned, and to refuse to recognize them, with the idea that what is good enough for the majority should be satisfactory for all, may actually work a hardship on certain operatives, which will of course in the end work to the disadvantage of the plant itself.



FIG. 11—CLEARNESS OF DETAIL POSSIBLE WITH MERCURY-VAPOR LAMPS FOR ENGINE ADJUSTING AND TESTING

changed to individual flexible fixtures for each spindle as shown by Fig. 8, this scheme fulfilling the needs of the case and proving that there are instances where the use of a local lamp becomes imperative to the success of the operation involved. There are, however, many cases of inspection where the localized general plan of illumination, and even the general plan, is satisfactory.

Foreign Service Committee

A committee has been sent to Europe to report from the front on scientific matters and to arrange for co-operation in the study of questions underlying military and industrial problems. This committee includes two physicists, two chemists, one metallurgist and two representatives of medicine and hygiene. Among committees of the Research Council not immediately engaged on national defense questions is that on the promotion of industrial research (Dr. J. J. Carty, chairman).

Light and Power Operations in May

Income from Energy Sold Totals Up to \$36,800,000 Against \$31,900,000 for May, 1916, While Output Amounts to 2,280,000,000 Kw.-Hr., as Against 1,820,000,000 in May, 1916

CENTRAL station electric light and power operations gave better results during the month of May in comparison with May, 1916, than any other month in the past year in comparison with the month a year previous, according to the returns received by the ELECTRICAL WORLD. For the month of May last these reports indicate earnings from light and power sales of \$36,800,000, in comparison with \$31,900,000 for

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percent- age of Industry Repre- sented	INCOME FROM THE SALE OF ENERGY			Kw.-Hr. OUTPUT		
		1916	1915	Per Cent In- crease	1916	1915	Per Cent In- crease
June...	64	20,254,000	17,551,000	15.4	1,170,679,000	968,724,000	21.0
July...	64	19,760,000	17,301,000	14.2	1,174,374,000	976,704,000	24.4
Aug...	64	20,502,000	17,861,000	15.0	1,262,575,000	1,015,805,000	22.4
Sept...	64	21,432,000	18,600,000	15.2	1,268,339,000	1,037,976,000	21.2
Oct...	64	22,882,000	20,164,000	13.5	1,347,502,000	1,125,132,000	19.9
Nov...	64	24,819,000	21,744,000	14.4	1,396,537,000	1,148,221,000	21.7
Dec...	62	25,306,000	22,029,000	15.0	1,345,883,000	1,112,280,000	21.0
1917		1917	1916		1917	1916	
Jan...	63	27,408,000	23,969,000	14.4	1,495,829,000	1,180,884,000	26.7
Feb...	63	25,204,000	22,295,000	13.1	1,240,995,000	1,036,014,000	20.0
March...	62	23,897,000	20,865,000	14.5	1,406,065,000	1,136,652,000	24.3
April...	62	22,850,000	20,097,000	13.9	1,324,730,000	1,082,666,000	22.6
May...	55	20,206,000	17,537,000	15.7	1,251,376,000	1,000,275,000	25.0

May, 1916, an increase of 15.7 per cent. The energy output sold during May last was 2,280,000,000 kw.-hr., in comparison with 1,820,000,000 kw.-hr. in May, 1916, or an increase of 25 per cent.

In the two eastern sections, the New England States and the Atlantic States, considerably greater increases

TABLE III—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED BY SIZE

	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May
INCOME:										
Group 1.....	13.9	15.0	11.6	13.0	15.0	12.0	12.5	13.0	12.0	14.0
Group 2.....	15.7	20.4	19.2	17.7	16.6	19.0	19.7	20.7	20.0	21.2
Group 3.....	20.9	18.4	18.5	18.2	15.2	15.2	12.5	15.1	15.0	16.0
Group 4.....	9.5	11.3	13.5	12.8	12.3	15.5	10.3	19.1	16.5	17.6
Group 5.....	14.9	13.3	16.0	12.8	9.5	20.2	57.5	16.1	19.7	17.4
OUTPUT:										
Group 1.....	21.4	18.5	16.6	18.2	18.7	22.5	19.0	20.0	18.7	22.6
Group 2.....	33.0	32.9	31.1	27.2	20.2	30.5	24.0	35.7	37.1	40.0
Group 3.....	31.1	19.3	24.0	32.0	28.8	34.4	14.8	25.1	24.5	23.4
Group 4.....	23.0	26.0	20.4	19.7	21.0	30.5	20.2	26.1	27.2	30.6
Group 5.....	16.8	15.3	18.3	33.0	25.4	21.3	21.7	44.0	22.0	27.0

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May
INCOME:										
Group 1.....	9.6	16.5	12.1	13.5	12.5	12.5	12.3	7.0	13.8	12.2
Group 2.....	15.1	25.5	21.3	20.0	30.2	16.1	18.4	18.2	17.9	21.0
Group 3.....	15.0	20.5	18.0	19.4	16.5	17.8	15.7	16.5	25.3	25.0
Group 4.....	11.1	10.5	15.4	16.0	16.0	22.0	12.8	25.8	23.0	31.3
Group 5.....	17.5	18.3	18.2	18.6	12.2	24.0	15.1	21.0	24.0	29.5
OUTPUT:										
Group 1.....	31.3	34.0	17.5	18.0	10.8	20.7	19.6	24.0	18.2	17.7
Group 2.....	32.0	37.7	35.0	24.7	18.2	24.8	18.5	21.1	21.3	30.3
Group 3.....	45.5	32.4	42.6	35.9	22.0	20.9	35.7	34.5	38.2	38.3
Group 4.....	39.4	32.9	48.9	40.0	55.2	73.8	38.1	32.7	49.3	66.8
Group 5.....	21.3	27.4	22.0	17.0	35.7	29.2	26.8	76.0	29.0	39.5

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

		Month	Percentage of Indus- try Represented	New England States			Percentage of Indus- try Represented	Atlantic States			Percentage of Indus- try Represented	Central States (Illinois Excluded)			Percentage of Indus- try Represented	Pacific and Mountain States		
				1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase
INCOME	June.....	65	2,208,000	1,906,000	16.0	67	8,045,000	6,905,000	16.5	56	6,007,000	5,143,000	16.9	88	4,017,000	3,539,000	13.5	
		65	2,130,000	1,875,000	13.7	67	7,832,000	6,621,000	16.4	56	5,926,000	5,095,000	16.3	88	3,755,000	3,493,000	7.6	
	August.....	65	2,203,000	1,935,000	13.7	66	8,000,000	6,875,000	16.4	56	6,195,000	5,266,000	17.7	88	3,883,000	3,582,000	8.4	
		65	2,315,000	1,982,000	16.8	66	8,631,000	7,445,000	16.0	56	6,505,000	5,537,000	17.8	88	3,979,000	3,644,000	9.2	
	October.....	65	2,684,000	2,331,000	15.2	65	8,887,000	7,930,000	12.1	56	6,968,000	5,895,000	18.2	87	4,213,000	3,889,000	8.3	
		65	2,912,000	2,516,000	15.7	65	10,061,000	8,859,000	13.5	56	7,410,000	6,313,000	17.4	87	4,246,000	3,947,000	7.6	
	December.....	65	3,203,000	2,814,000	14.0	66	11,059,000	9,348,000	19.6	56	7,898,000	6,997,000	13.0	75	2,987,000	2,735,000	9.2	
		1917		1917	1916			1917	1916			1917	1916			1917	1916	
	January....	64	3,181,000	2,762,000	15.1	66	11,400,000	9,874,000	15.6	56	8,081,000	7,013,000	15.2	86	4,602,000	4,020,000	9.5	
		64	3,039,000	2,686,000	13.1	65	10,249,000	9,021,000	13.6	55	7,471,000	6,530,000	14.4	86	4,284,000	3,926,000	9.1	
	February....	64	3,039,000	2,686,000	13.1	65	10,249,000	9,021,000	13.6	55	7,471,000	6,530,000	14.4	86	4,284,000	3,926,000	9.1	
		62	2,809,000	2,499,000	12.4	64	10,203,000	8,902,000	14.7	55	6,692,000	5,754,000	16.5	86	4,193,000	3,780,000	11.0	
	March.....	62	2,809,000	2,499,000	12.4	64	10,203,000	8,902,000	14.7	55	6,692,000	5,754,000	16.5	86	4,193,000	3,780,000	11.0	
62		2,706,000	2,312,000	17.1	61	8,586,000	7,752,000	10.7	54	7,132,000	6,094,000	7.0	87	4,170,000	3,811,000	12.1		
April.....	62	2,706,000	2,312,000	17.1	61	8,586,000	7,752,000	10.7	54	7,132,000	6,094,000	7.0	87	4,170,000	3,811,000	12.1		
	56	2,464,000	2,096,000	17.7	59	8,393,000	7,251,000	15.6	47	6,039,000	5,173,000	16.7	76	3,161,000	2,881,000	9.7		
May.....	56	2,464,000	2,096,000	17.7	59	8,393,000	7,251,000	15.6	47	6,039,000	5,173,000	16.7	76	3,161,000	2,881,000	9.7		
	1917		1917	1916			1917	1916			1917	1916			1917	1916		
KW.-HR. OUTPUT	June.....	65	87,829,000	69,506,000	27.6	67	396,630,000	327,541,000	21.2	56	350,015,000	288,982,000	21.2	88	328,996,000	277,915,000	18.6	
		65	85,317,000	71,166,000	19.8	67	401,179,000	333,771,000	20.3	56	350,708,000	287,407,000	22.2	88	325,647,000	279,285,000	17.4	
	August.....	65	97,197,000	72,900,000	33.4	66	433,129,000	344,730,000	25.7	56	374,327,000	295,866,000	26.5	88	333,468,000	279,976,000	19.1	
		65	98,350,000	73,343,000	34.2	66	446,534,000	369,815,000	20.8	56	387,626,000	307,485,000	26.2	88	335,817,000	288,332,000	16.4	
	October.....	65	107,756,000	83,705,000	28.8	65	426,151,000	373,705,000	14.2	56	408,364,000	324,509,000	25.9	87	355,014,000	306,828,000	15.8	
		65	111,873,000	89,015,000	25.7	65	533,252,000	424,746,000	25.6	56	415,491,000	334,044,000	24.4	87	346,847,000	293,518,000	18.2	
	December.....	65	117,763,000	97,387,000	21.0	66	535,410,000	444,923,000	20.4	56	425,510,000	354,258,000	20.0	75	256,006,000	206,838,000	23.8	
		1917		1917	1916			1917	1916			1917	1916			1917	1916	
	January....	64	120,211,000	93,163,000	29.1	66	564,699,000	429,432,000	31.5	56	437,923,000	351,335,000	24.5	86	363,094,000	298,990,000	21.4	
		64	110,114,000	88,324,000	24.7	65	418,407,000	341,877,000	22.5	55	373,988,000	323,158,000	15.8	86	326,891,000	274,079,000	19.3	
	February....	64	110,114,000	88,324,000	24.7	65	418,407,000	341,877,000	22.5	55	373,988,000	323,158,000	15.8	86	326,891,000	274,079,000	19.3	
		62	118,370,000	92,714,000	27.9	64	539,028,000	425,376,000	27.0	55	383,046,000	311,841,000	23.0	86	365,541,000	301,721,000	21.3	
	March.....	62	118,370,000	92,714,000	27.9	64	539,028,000	425,376,000	27.0	55	383,046,000	311,841,000	23.0	86	365,541,000	301,721,000	21.3	
62		106,182,000	84,788,000	25.5	61	449,030,000	362,429,000	24.0	54	390,103,000	317,505,000	22.9	87	368,396,000	309,360,000	19.1		
April.....	62	106,182,000	84,788,000	25.5	61	449,030,000	362,429,000	24.0	54	390,103,000	317,505,000	22.9	87	368,396,000	309,360,000	19.1		
	56	99,916,000	77,456,000	29.0	59	468,128,000	366,135,000	28.0	47	362,132,000	286,578,000	26.4	76	310,459,000	261,544,000	18.7		
May.....	56	99,916,000	77,456,000	29.0	59	468,128,000	366,135,000	28.0	47	362,132,000	286,578,000	26.4	76	310,459,000	261,544,000	18.7		
	1917		1917	1916			1917	1916			1917	1916			1917	1916		

were recorded for May than during the immediately preceding months. In the Central States the percentage of increase showed but little change, while there was a slightly lower rate of increase in the states in the Far West. However, on the basis of the first five months of the year, which show an increase in earnings of roughly \$25,000,000 and an increase in output of over 2,000,000 kw.-hr., it is estimated that at the same rate of increase the central station industry will have earned in the neighborhood of \$60,000,000 more in 1917 than in 1916 from the sale of energy for light and power only,

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED BY SIZE

	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May
INCOME:										
Group 1.....	16.1	16.2	10.7	13.7	18.8	15.0	13.0	14.3	8.9	15.2
Group 2.....	21.6	19.0	21.0	22.5	21.7	28.3	27.3	27.0	22.5	21.0
Group 3.....	15.0	14.0	14.6	13.0	13.4	12.5	10.4	15.1	13.9	16.9
Group 4.....	14.4	9.8	13.5	13.1	14.4	14.0	11.3	20.5	15.8	13.1
Group 5.....	19.4	8.9	14.3	16.0	14.3	11.1	11.8	12.5	6.3	12.5
OUTPUT:										
Group 1.....	28.5	23.6	19.2	20.8	21.5	32.5	22.0	21.3	21.6	29.7
Group 2.....	32.5	26.7	33.0	31.9	28.2	42.6	31.2	63.2	36.5	28.3
Group 3.....	16.0	24.7	4.5	19.0	15.9	27.2	21.2	21.6	25.5	24.8
Group 4.....	29.5	18.6	17.5	14.6	16.0	25.4	18.8	20.2	24.9	19.7
Group 5.....	20.4	1.3	1.5	5.8	6.9	9.4	17.0	3.2	10.0	7.2

while the output sold for these purposes will be in the neighborhood of 5,000,000,000 kw.-hr. greater in 1917 than in 1916.

The maintenance of these large percentages of in-

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED BY SIZE

	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May
INCOME:										
Group 1.....	16.5	16.6	18.0	16.5	13.0	15.5	14.5	16.0	16.6	16.2
Group 2.....	21.8	21.5	21.0	17.0	16.0	17.8	18.7	21.0	21.7	24.4
Group 3.....	18.4	13.4	10.9	13.0	1.8	6.0	0.5	4.4	6.5	7.6
Group 4.....	10.7	20.0	19.7	16.8	15	19.8	16.3	18.9	20.8	16.2
Group 5.....	11.8	11.8	18.4	14.3	†	19.3	16.7	11.0	27.0	3.3
OUTPUT:										
Group 1.....	24.3	22.3	24.9	24.8	22.3	25.4	19.2	22.0	19.5	22.0
Group 2.....	36.4	40.0	31.7	29.7	24.4	29.0	23.6	32.4	44.4	51.9
Group 3.....	25.7	20.7	17.3	19.7	1.2	5.8	30.0*	4.5	4.4	5.4
Group 4.....	23.0	33.8	26.1	21.2	21.4	24.5	13.0	25.7	21.4	18.6
Group 5.....	6.1	13.7	28.2	16.8	9.9	15.5	17.1	23.5	15.5	18.5

*Decrease.

†Results omitted owing to insufficient returns.

crease over the corresponding months of last year month by month indicates in what measure the central stations have been successful in connecting up large power loads. It must not be lost sight of that the

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May
INCOME:										
Group 1.....	5.5	6.2	4.2	4.5	4.0	5.4	7.2	8.5	11.2	6.7
Group 2.....	0.7	4.9	1.3	3.0	3.6	7.5	5.5	0.6	3.4	7.8
Group 3.....	32.5	28.5	32.4	31.0	30.0	27.6	23.5	22.8	19.7	17.9
Group 4.....	0.5	11.5	7.2	0.4	0.6*	8.6	2.0	13.2	10.0	13.0
Group 5.....	13.0	11.7	13.5	17.1	11.1	20.3	14.9	15.2	13.9	17.9
OUTPUT:										
Group 1.....	6.3	7.1	5.2	8.0	8.6	11.0	22.3	15.6	15.4	14.6
Group 2.....	6.5	7.8	9.7	11.4	8.7	11.8	16.2	8.9	16.1	13.0
Group 3.....	57.5	60.0	63.7	61.3	48.0	59.5	36.8	36.3	29.7	25.7
Group 4.....	7.5	12.0	*0.5	4.2	2.6	15.2	14.0	27.9	21.0	26.3
Group 5.....	16.5	7.0	14.7	42.3	5.4	19.1	9.4	21.6	20.6	20.0

*Decrease.

total volume of growth is considerably greater each month, although the percentages are about the same, because the totals dealt with are larger. In 1916 the load on the central station increased considerably be-

cause of the immediate demands for power, which, owing to prevailing conditions, it was possible to obtain only from the central stations. In the present year, however, other sources have developed which have considerably increased the load on central station lines. One of the most potent factors has been the coal situation. The small plant found itself in a very dangerous and unsatisfactory position, and in order to secure continuity of operation realized the necessity of using central station power.

A considerable part of this load manifested itself for

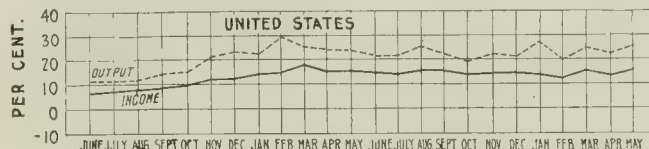
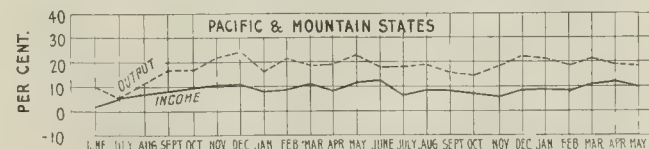
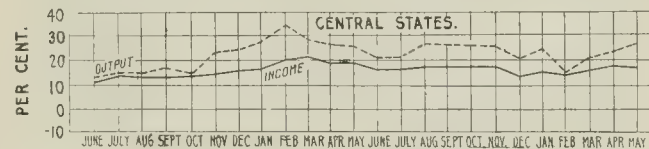
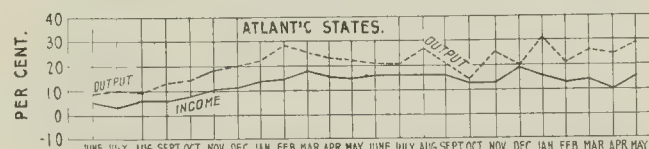
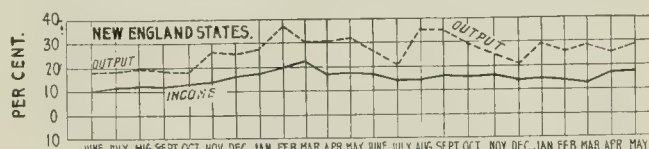


FIG. 1—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES

the first time during May last, and the slight jump in the percentage of increase is undoubtedly in large measure owing to this character of load. The May earnings also include some companies that had put coal clauses into effect, but to what extent this has increased the earnings of those companies is not known. In succeeding months, however, as more of the companies reporting have put coal clauses into effect the results of these temporary higher rates will undoubtedly be noticeable to some extent in the earning columns.

The accompanying curves show graphically the percentages of increase in both income and output as shown in Tables I and II. The remaining tables show the percentages of increase in both income and output for companies grouped according to the size of the



FIGS. 2 TO 5—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

territory in which they operate. Group 1 includes those companies operating in cities having a population of 100,000 or more; group 2 includes those operating in cities with a population of between 50,000 and 100,000; group 3 includes those between 25,000 and 50,000; group 4, between 10,000 and 25,000; group 5, between 5,000 and 10,000.

Modernizing Fifteen-Year-Old Steam Plant

Plant Designed for 12,000 Kw. Remodeled to Take Care of an Ultimate Capacity of 116,000 Kw.—Latest Unit, a 20,000-Kw. Generator, to Be Followed by Two More of Same Size—Unusual Difficulties

BY JOHN HUNTER

THAT central station equipment has developed rapidly during the last fifteen years is shown to a marked degree in the Ashley Street station of the Union Electric Light & Power Company of St. Louis, Mo. This station, originally designed and built in 1903 to deliver a maximum of 12,000 kw. of electrical energy, is to be re-equipped to an ultimate capacity of 116,000 kw. In the original plant there were installed five vertical cross-compound reciprocating engines driving 25-cycle generators. These units occupied practically the entire available space in the engine room and stood upon massive concrete foundations built upon bedrock lying beneath the plant. To furnish steam to these reciprocating units, the original installation included twenty-eight Scotch marine boilers equipped with Jones underfeed stokers. The auxiliary equipment was in every way typical of the most improved design in machinery known at that time. In 1905, after the station had been in operation only a little over a year, steam-turbine development had reached such a point that it was practicable to install four 5000-kw. generating units. To meet the steam demands of these units, it was necessary to rearrange the boiler room to receive forty water-tube boilers with chain-grate stokers, the new boilers being installed on a second deck above the original installation of Scotch marine boilers. The chain-grate type of stoker, burning low-grade Illinois coal, was at that time found to be much better adapted to central station work than the older type of internally fired boilers with underfeed stokers.

In 1908 it was found necessary to increase further the station capacity by replacing the 5000-kw. turbines with 12,000-kw. units. The change was somewhat unique in that the steam and electrical ends only were replaced, the condensers and auxiliaries of the smaller turbines being made to serve the machines of higher capacity. With this increase in generating capacity it was necessary to replace twelve of the old Scotch marine boilers with more modern and highly efficient units, twelve B. & W. boilers being chosen for this work. The latest addition brought up the capacity of the plant to 64,000 kw.

In the fall of 1915 it was found necessary again to increase the generating capacity. The first step was to replace one of the 3000-kw. reciprocating engines, installing in the space occupied by it a 20,000-kw. horizontal Curtis turbine. The generator is a 4500-volt, three-phase, 60-cycle unit with four poles and rated at 20,000 kw. at 80 per cent power factor. The speed is 1800 r.p.m. To supply steam to this new unit the remainder of the old Scotch marine boilers were removed and ten modern 558-hp. water-tube boilers were installed in their stead.

The depth of the foundation of the new turbine is much greater than that of the old engine foundation, requiring the excavation of approximately 2100 cu. yd. (1606 cu. m.) of rock in addition to the blasting away

of the engine foundation proper, occupying 900 cu. yd. (688 cu. m.).

To excavate in the heart of an engine room filled with large generating units and auxiliaries in operation was quite unusual in power plant reconstruction and was a task that required great care and attention with a view to preventing accidents or shutdowns. The work of blasting away the rock was done in close proximity both to adjacent turbine foundations and to the rock foundation of the building wall, all of which was accomplished without the necessity of resorting to underpinning. The nature of the rock was such that it was not

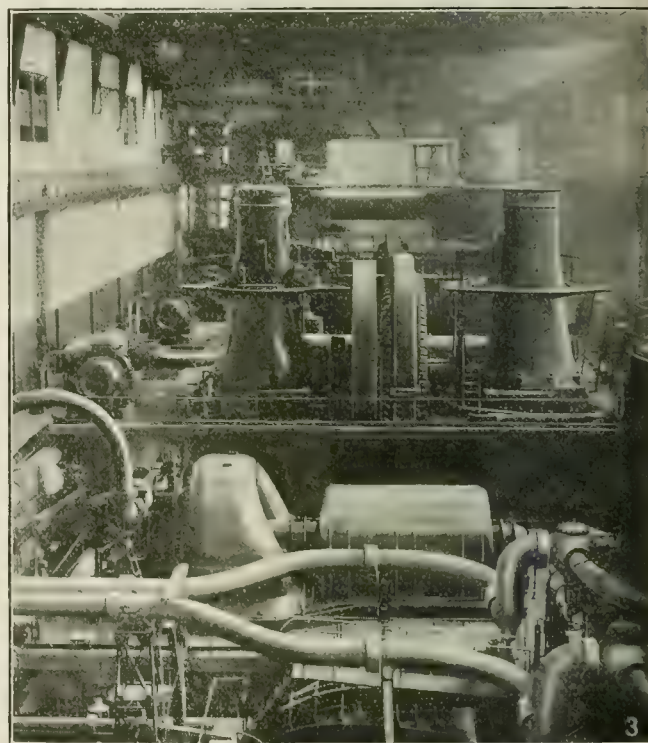


FIG. 1—GENERAL VIEW OF NEW TURBINE IN PLACE AND DISMANTLING OF RECIPROCATING ENGINES

always possible to use dynamite at all points in the blasting, and it was often necessary to resort to cutting away certain portions by "bull-pointing," the drills being driven for the most part by air machines.

The building of the foundation for the new 20,000-kw. turbine was started on May 15, 1916, and completed about six weeks later. The foundation was built up of heavy concrete columns and girders, supporting both the turbine proper and the 40,000-sq.-ft. (3716 sq. m.) condenser immediately below, a total weight of about 400 tons (362.8 t.). The reinforcing steel and the forms for the concrete were completely erected and in place before any pouring was done. The concrete was then poured continuously, requiring approximately three days' time.

The condenser, built by the C. H. Wheeler Company,

is of the two-pass type, circulating water being supplied by a Wheeler 50,000,000-gal. (189,266,600-l.) pump driven by a 300-hp. Kerr turbine. The vacuum pump is of the rotary "hurling water" type and successfully operates to within 1 in. (2.54 cm.) of the barometer while carrying full load. This equipment is supplemented by an air washer which passes 50,000 cu. ft. of

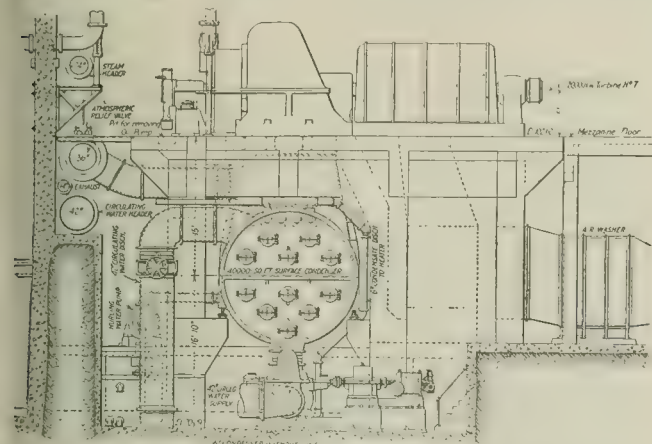


FIG. 2—CROSS-SECTION OF 20,000-KW. TURBINE INSTALLATION

air per minute (23,600 l. per second), humidifying, cleaning and cooling it before delivery to the ventilating duct of the generator. From the generator the air is discharged through an air duct 50 sq. ft. (4.6 sq. m.) in section to the boiler room, which is adjacent to the forced-draft fans.

Condensation from the turbine, amounting to roughly 240,000 lb. (108,862 km.) per hour, is diverted

ing engines has been utilized for the extension of the engine-house switch structure.

An interesting feature of the new installation is the turbine gage board. On the main panel are mounted the steam-pressure gages showing steam pressures on the main header and on the first stage of the turbine. At the left is the indicating vacuum gage with the recording instrument at the bottom center of the panel. Both these instruments show pressure on the condenser and are checked by means of a mercury column placed below the gage board. Vacuums are maintained on this condenser well within 1 in. (2.54 cm.) of the barometer. The frequency indicator with synchronizing lamps is shown at the center of the board. Beneath the slate panel is mounted a ship signal arrangement for communication between the operating floor and the switch-board. The alarm bell mounted beneath the ship signal calls the operator's attention to signals. Two sets of switches with button and pilot lights showing on each gage-board support are remote-control operating mechanisms for the circulating-water inlet and discharge valves.

The circulating-water system formerly supplying cooling water to the condensers has been replaced by large tunnels with both intake and discharge from the river. The capacity of the new system is over 240,000,000 gal. (908,480,000 l.) per day. Traveling screens installed in the new tunnels to remove rubbish usually found in the Mississippi River revolve on 53-ft. (16.2-m.) centers, this unusual length being necessary because of wide variations in the stages of the river.

Plans are now completed for the installation of two additional 20,000-kw. turbines in the space occupied by the remaining two reciprocating-engine units.

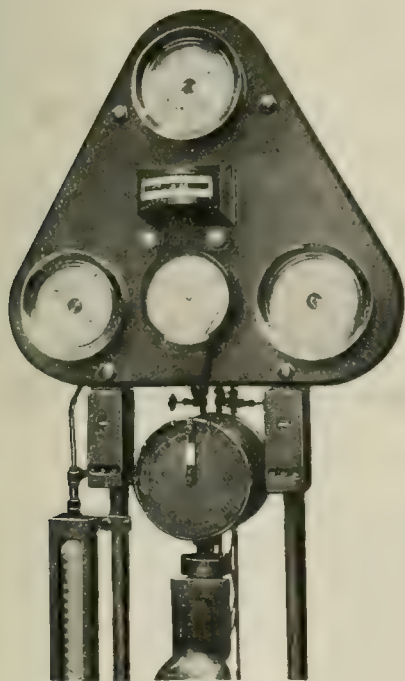


FIG. 3—GAGE BOARD FOR 20,000-KW. TURBINE

in part before it passes through the reheater on top of the condenser, and passed through the cooling coils and bearing jackets of the turbine proper. In this way a generous supply of pure circulating water is available for cooling and the heat absorbed is further utilized, inasmuch as it is returned direct to the feed-water heaters. The space occupied by two of the reciprocating

CONSUMERS OF GAS AS

CLASSIFIED IN CHICAGO

In New Contract Consumers Are to Be Treated as Domestic or Industrial and Charged Accordingly

A review of the new contract which has been made between the People's Gas Light & Coke Company of Chicago and the City Council of Chicago, written by C. T. Chenery of the staff of Sanderson & Porter, who represented the company in the negotiations with the city, shows that unusual features are included in the arrangement. Among them is a profit-sharing plan and the rate-making section.

In discussing the rates, Mr. Chenery says that it was suggested by the city representatives and agreed to by the company that for purposes of expediency, consumers with small meters—i.e., three, five and ten-light—should be regarded as domestic consumers, and customers with larger meters should be treated as industrial consumers, a simplification which an examination of the company's records appeared to justify. For the domestic consumer so described the rates are as follows:

	Cents Net
For the first 350 cu. ft. or less.....	30
From 350 cu. ft. to 10,000 cu. ft.....	70
From 10,000 cu. ft. to 50,000 cu. ft.....	65
All over 50,000 cu. ft.....	40

This charge of 30 cents for the first 350 cu. ft. or less acts both as a service charge and as a minimum bill.

Samuel Insull is chairman of the board of directors.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

TESTING INDUSTRIAL

ELECTRIC TRUCKS

How a Factory Man Secured Accurate Energy-Consumption Records on Industrial Truck Despite Lack of Interest of Operators

When the electrical department of the Willys-Overland Company, Toledo, Ohio, desired accurate information on the amount of energy used by one of the industrial electric trucks employed in hauling material about the factory, the problem of securing reliable information without putting a skilled investigator on the truck presented itself. To meet the situation special charging connections were attached to the truck and one of the charging outfits in the garage so that they only could be connected together. A watt-hour meter was then placed in the circuit between the rectifying equipment and the charging plug. This, of course, measured the direct input to the truck. Since the losses in the charging equipment were known, these were added to the readings of the watt-hour meter and this gave accurate data on energy consumption. Energy cost per ton-mile was then worked out from the mileage registered on a special speedometer and from truck loads taken from actual scale readings.

POLE-TOP EXTENSIONS

THAT EFFECT SAVING

Recent California Law Requires Vertical Separation of 2 Ft. More Between Primary and Secondary Cross-arms

A State law covering line construction in California requires a vertical separation of 4 ft. (1.2 m.) between primary and secondary cross-arms. Prior to the passage of this law this separation was ordinarily made 2 ft. (0.61 m.). The utility companies are therefore under the necessity of making extensive modifications in their construction.

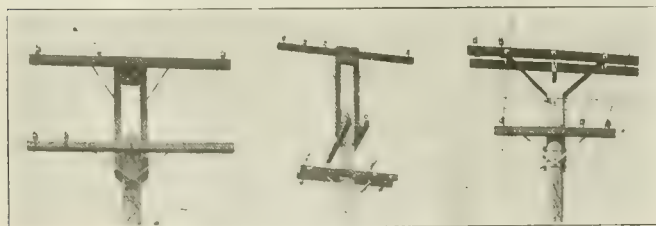


FIG. 1—THREE TYPES OF POLE EXTENSIONS

Owing to interfering cross leads of telephone and other supply lines or insufficient clearance above streets, it is often difficult to lower the secondary arms. To obviate the necessity of changing poles, one California company makes use of pole extensions which serve to increase the effective height of a pole by allowing the

placing of a top cross-arm exactly 4 ft. (1.2 m.) above the top gain of a pole. This construction often effects a considerable saving, as the cost of such extension is less than the expense involved in setting and transferring to higher poles, provided that the pole to be changed is still sound and otherwise adequate to the service required.

As will be seen from the accompanying illustrations, the extensions used are of two types, steel and wood.

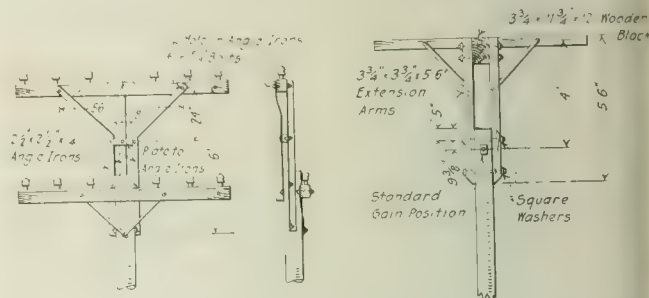


FIG. 2—STANDARD STEEL AND WOODEN POLE-TOP EXTENSIONS

The latter has the advantage of lower first cost and ease of installation. The steel extension is the stronger and is consequently used at corners and other points of strain, while the wood extension is used on all ordinary leads. It will be noted that the main braces on both types are slotted in order that the cross-arms may be leveled, even if the holes drilled through the pole are not exactly level.

A pole splice is a makeshift which when carelessly installed often leads to line failures and increased maintenance expenses. However, the use of these strong and standardized extensions has up to the present resulted in no failures, and it seems to be justified by the special requirements of the law.

GUARDS UNDER CRANE CIRCUITS

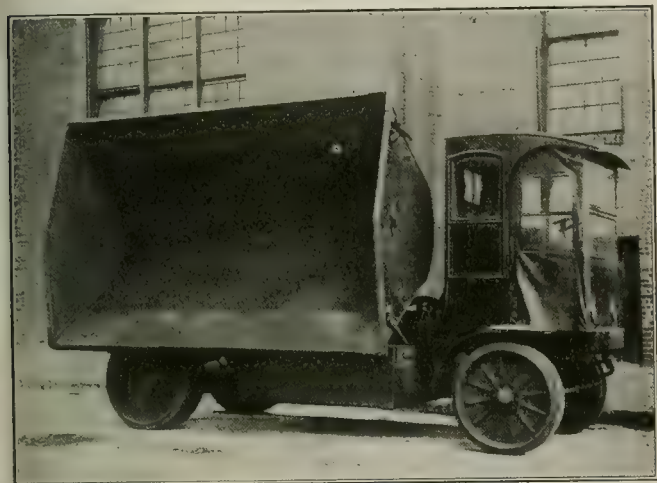
Basket Guards Used to Protect 2300-Volt Bus from Falling Crane Trolley

One of the places in power houses which are commonly unguarded has been given careful consideration in the station of the Galesburg (Ill.) Railway, Lighting & Power Company. The bare conductors which furnish energy at low potential for operating the overhead crane are carried along the wall over the switchboard. If one of the conductors were to fall it would probably strike across the buses which are installed between the switchboard panels and the wall. To obviate the possibility of such an accident a basket guard somewhat similar in construction to those used on pole lines in the earlier days of high-tension construction has been placed beneath the crane circuit. The slight expense incurred in constructing the basket is believed to be entirely justified, since it removes any chance of accident from this source.

HANDLING COAL WITH AN ELECTRIC TRUCK

Cost of Hauling Coal with Self-Dumping Truck— Description of Truck and Data on Its Operation

Since the first of this year the Canton (Ill.) Gas & Electric Company has been hauling coal to its electric and gas plants in an electric truck. While complete cost data on the operation of the truck have not yet been obtained, the results, according to E. H. Negley, secretary and manager of the company, indicate that the in-



**ELECTRIC TRUCK EQUIPPED WITH NEW TYPE OF BODY FOR
COAL HAULING**

vestment was a good one and that a considerable saving in coal-hauling costs is being made.

The haul from the railroad tracks to the company's electric plant is about three blocks long and to its gas plant about 1.5 miles (2.4 km.). Over this distance this truck makes a round trip to the electric plant in about seven minutes and can convey the contents of a 50-ton (45.5-t.) car of screenings to the station in about three

DATA ON OPERATION OF COAL-HAULING TRUCK FOR TWO WEEKS

Date	Time, Hours Out	Number of Stops	Miles	Road Con- ditions	AMPERE HOURS	
					Total Used	Per Mile
Jan. 22.....	9	36	15	Good	180	12.0
23.....	9	38	22	Good	228	10.4
24.....	9	38	21	Good	222	10.6
25.....	9	36	28	Good	276	9.8
26.....	10	42	30	Good	300	10.0
27.....	8	26	19	Good	168	9.0
		Total....	135		Average..	10.3
29.....	9	12	13	Mud	180	12.0
30.....	10	18	26	Mud	444	16.0
31.....	9	22	16	Mud	340	20.0
Feb. 1.....	9	19	23	Rough	220	9.0
2.....	10	18	22	Rough	312	14.0
3.....	9	22	16	Rough	204	12
4.....	5	10	6	Snow	96	16
		Total....	122		Average..	14

hours. The round-trip haul to the gas plant requires about thirty minutes.

The speed of the truck loaded is about 7 miles (11.3 km.) an hour, and in ordinary operation it will cover from 15 to 25 miles (24 km. to 40 km.) a day, depending on how many trips are made. The truck is a Walker Vehicle Company's design with forty-four cells of 31-

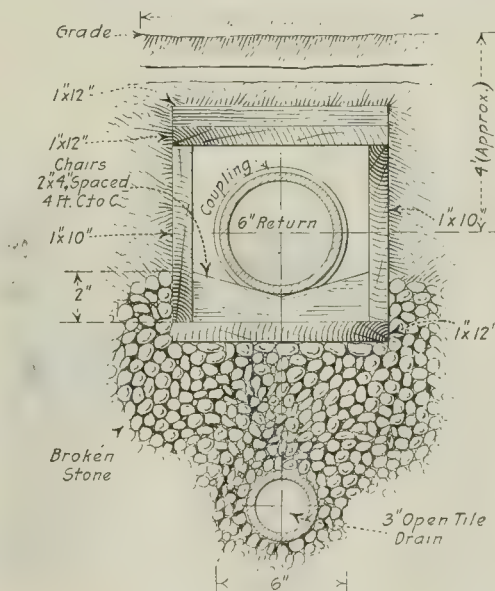
plate Philadelphia storage batteries. It is said to be the first electric truck to be equipped with a Lee Loader Company's dump body, the construction of which is shown in the illustration. The dumping feature of this body has demonstrated its value at Canton, since the driver alone through the use of it can unload 10,000 lb. (4536 kg.) of coal into the hopper in two minutes. The driver, who operates this truck exclusively, is responsible for its entire care, both as to charging and maintenance.

ANCHORAGES AND PROTECTION FOR UNDERGROUND MAINS

Wood-Box Protection, Provision for Drainage and Type of Concrete Anchorage Used in Recent Practice

BY T. W. REYNOLDS

Methods of protecting underground steam return mains, disposing of ground water and anchoring the mains are indicated by the accompanying illustration. A trench 18 in. (45.7 cm.) wide is dug and the pipe buried approximately 4 ft. (1.21 m.) below the surface. The pipe is supported on 2-in. by 4-in. (5.08-cm. by 10.16-cm.) cradles placed 4 ft. (1.21 m.) apart and inclosed by wood boxing, the sides of which are made of 1-in. by 10-in. (2.54-cm. by 25.4-cm.) boards and the top and bottom of 1-in. by 12-in. (2.54-cm. by 30.4-cm.) boards, two being used at the top. Sub-surface drainage is essential since water will collect and flow along the trenches even when they are back-filled. If it enters the boxing it will rot the wood, cause excessive condensation of the steam vapors in the return main and lower the temperature of the return water. Where steam-pipe covering is used it may be rapidly destroyed by water



**FIG. 1—METHOD OF INSTALLING GALVANIZED SHEET-IRON
WATER SHIELD**

flowing along the outside of the pipe and the insulation properties of the covering reduced by the latter sagging away from the pipe. When the fill is composed largely of cinders, ashes will wash along the bottom of the box and by collecting at the pipe supports will cause rapid deterioration at the point of contact.

As a partial preventive, a water shield of No. 22

U.S.G. galvanized sheet iron (commercial) may be bent over the pipe in the form of an inverted U with the edges resting on the bottom of the box next to the sides. As a further remedy broken stone may be laid across the trench from the bottom of the return main down to the base of the tile drain. The minimum distance between centers of return main and drain should be about 15

braced open to afford convenient access. Instead of hinge supports, at the top of the doors there are hangers or projections made of $\frac{1}{4}$ -in. (6.4-mm.) rods which engage with hooks embedded in the concrete. By lifting the door it may be entirely detached from the wall.

PRACTICAL FORMULA FOR SHUNT-FIELD COILS

Values That Will Be Found Sufficiently Exact When Only Approximate Calculations Are to Be Made

According to the London *Electrical Review*, the following formula reduced to simple expressions may be used for approximating readily the length of wire in or the ohmic resistance, current or ampere-turns of shunt-field coils:

$$\begin{aligned}\text{Length (ft.) of wire in coil} &= A \times T \times L_k, \\ \text{Resistance (ohms, cold)} &= A \times T \times R_k, \\ \text{Current (amp.)} &= V \times C_k / AT, \\ \text{Ampere-turns} &= V \times CT_k / T,\end{aligned}$$

when

A = area of winding space around magnet pole in square inches,

T = length of mean turn in inches,

V = volts across coil, and

L_k , R_k , C_k and CT_k are constants.

Constants may easily be worked out for any size of wire; values for Nos. 10 to 26 gage wires are given in the table below:

Wire Gage No.	Dia. D.C.C.	L_k	R_k	C_k	CT_k
10	0.14	4.25	0.00266	378	19,100
11	0.128	5.10	0.0039	260	15,650
12	0.116	6.2	0.0059	170	12,600
13	0.104	7.7	0.0093	108	9,850
14	0.090	10.3	0.0166	69.5	7,450
15	0.082	12.4	0.0247	40.7	6,040
16	0.074	15.2	0.0380	26.3	4,775
17	0.066	19.2	0.0630	15.9	3,650
18	0.058	24.70	0.110	9.1	2,680
19	0.050	33.30	0.212	4.72	1,860
20	0.042	47.2	0.375	2.675	1,510
21	0.038	57.5	0.58	1.72	1,190
22	0.034	72.0	0.945	1.06	913
23	0.030	92.5	1.65	0.605	670
24	0.028	106	2.26	0.442	563
25	0.026	123	3.175	0.315	465
26	0.024	144	4.6	0.217	376

The constants given were calculated on the slide rule and are not given as absolute values; they are, however, sufficiently close.

TONING LIGHT FROM ARC LAMPS OF HIGH INTENSITY

Shellac-Coated Globes Are Found to Be More Effective than Painted or Amber-Colored Globes for This Purpose

In attempting to produce a "Golden Way" by utilizing the regular street-lighting equipment the Union Electric Light & Power Company, St. Louis, Mo., encountered difficulty in coloring the globes of the high-intensity arc lamps used on the streets. Ordinary amber lamp coloring was too thin to have any effect. An attempt to use the amber coloring over a dense white failed because the white paint cracked and allowed the light to filter through the cracks. As a last resort the globes were coated with ordinary shellac, and this produced a very effective amber tone in the lighting.

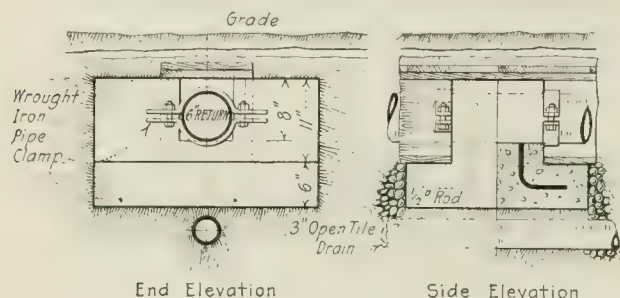


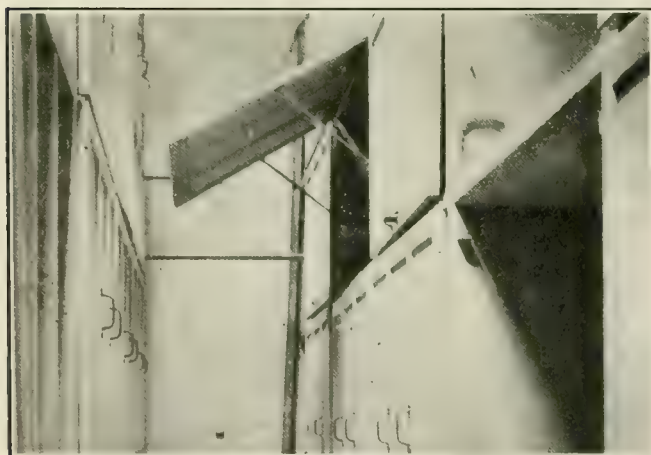
FIG. 2—DETAILS OF CONCRETE ANCHOR

in. (0.38 m.). Three-inch (7.62-cm.) tile drain can be used, being laid with open joints for the entrance of ground water which it conducts to the sewer. The concrete anchorages have 24-in. by 30-in. (0.6-m. by 0.75-m.) bases and are about 12 in. (0.3 m.) high. Through the top is a 7-in. by 8-in. (17.7-mm. by 20.3-mm.) opening for the passage of the pipe. Reinforcement with bent $4\frac{1}{2}$ -in. (11.3-cm.) square rods can be provided if desired. The boxing is omitted around the anchorages and wrought-iron pipe clamps are tightly bolted to the pipe, leaving a space between the upper and lower straps.

METHOD OF SUPPORTING SWITCH-CELL DOORS

Hangers Along Upper Edge of Door Engage with Hooks in Concrete—Braces for Holding Doors Open

For switch-cell construction on all voltages up to 11,000 the Pacific Gas & Electric Company has adopted



CELL DOOR BRACED OPEN

a door that embodies several features of convenience and economy. The panels consist of $\frac{1}{4}$ -in. (6.4-mm.) asbestos on a wood frame, the dimensions of the units ranging up to a maximum width of 4 ft. (1.2 m.) and a height of 5 ft. (1.5 m.).

The doors are swung from the top and the smaller sizes are provided with brackets so that they can be

CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

METHOD FOR HANDLING DELINQUENT ACCOUNTS

**Follow-up System Devised for Use by Properties
Operating in Communities of Small Size
in the East**

A follow-up system for handling delinquent accounts is now in use by the Coast Division of the Lakewood & Coast Electric Company, Point Pleasant, N. J., and

Form P2201-7-5-17-1M-L.

Lakewood and Coast Electric Company Coast Division

ARNOLD AVENUE, POINT PLEASANT, N. J.

We beg to advise you that up to this time we have not received remittance covering your previous account. The matter, no doubt, has escaped your attention, but as bills are due when rendered, we trust you will not take offense at our calling the matter to your attention.

Respectfully yours,
LAKEWOOD AND COAST ELECTRIC COMPANY
COAST DIVISION

Electric Service No.
Auditor's Dept. 1st.

DELINQUENT FORM NO. 1

by the Commonwealth Electric Company, Summit, N. J., an affiliated company, both of which operate in small New Jersey towns. The system has met with considerable success, and by means of it delinquencies are kept down to a minimum.

The system is made up of four forms, here reproduced. No. 1 is on a 6-in. by 3-in. (15.24-cm. by

Form P-2203-7-7-17 L-1000

Lakewood & Coast Electric Co. Coast Division

ARNOLD AVENUE, POINT PLEASANT, N. J.

Mr. _____

We regret to find that your outstanding account now covers a period of three months, and as we have twice called the matter to your attention, we feel that you cannot be unaware of this fact, and as stated in our previous notice, we do not feel justified in longer continuing the service without payment.

We are therefore obliged to notify you that unless payment is received on or before _____, we shall be obliged to discontinue the service.

Regretting that this action is necessary, we beg to remain,

Respectfully yours,
LAKEWOOD & COAST ELECTRIC CO.

Electric Service No. _____

Total amount due on _____, \$ _____

Collection Dept. Final.

DELINQUENT FORM NO. 3

7.62-cm.) white slip of paper and simply calls the customer's attention to the fact that he is one month in arrears. The following month form No. 2, which is on a 6-in. by 3 $\frac{3}{8}$ -in. (15.24-cm. by 8.25-cm.) yellow slip, is sent out, calling attention to the fact that the account is sixty days in arrears and that two bills are now due. If by the tenth of the month the account is

Form P2202-7-5-17 1M-L.

Lakewood and Coast Electric Company Coast Division

ARNOLD AVENUE, POINT PLEASANT, N. J.

We regret to note that your account is now sixty days in arrears as your two previous months' bills, as well as the enclosed bill, are now due. In justice to our selves and to our other customers, we must ask that you give this matter your early attention. Unless a satisfactory payment is made within the next five days we cannot feel justified in continuing the service. We have endeavored to furnish you a satisfactory service at a reasonable price. We believe we have done our part, won't you do yours?

Respectfully yours,
LAKEWOOD AND COAST ELECTRIC COMPANY
COAST DIVISION

Electric Service No.
Credit Dept. 2nd.

DELINQUENT FORM NO. 2

still unpaid, form No. 3, which is on a 6 $\frac{1}{4}$ -in. by 8-in. (15.88-cm. by 20.32-cm.) light pink sheet, is mailed, calling the customer's attention to the fact that he now owes for three months and that unless the account is paid by the fifteenth service will be discontinued. On the tenth, the account still being unpaid, form No. 4, which is on a 6 $\frac{1}{4}$ -in. by 7 $\frac{1}{2}$ -in. (15.88-cm. by 19.68-cm.) dark pink sheet, states that the disconnection

Form P-2204-10-16-16-100-L

Lakewood and Coast Electric Company Coast Division

ARNOLD AVENUE, POINT PLEASANT, N. J.

Mr. _____

We beg to advise you that in accordance with the notice sent you on the 5th inst., we have this day instructed our Disconnection Department to disconnect the service to _____ on or before 5 P. M. of the _____

We so advise you in order that you may not be inconvenienced more than necessary. We sincerely regret that this step has to be taken, but we believe it necessary for the proper conduct of our business.

Respectfully yours,
LAKEWOOD AND COAST ELECTRIC COMPANY
COAST DIVISION

Amount Due 1st inst., \$ _____

Electric Service No. _____

Office Check
No payment received up to

_____ { A. M.
_____ { P. M.

Date _____

Checked by _____

DELINQUENT FORM NO. 4

department has been notified to disconnect service on or before 5 p. m. of the fifteenth. This form is checked by the local superintendent. On the fifteenth an employee is sent out with instructions to collect or disconnect.

Very seldom, it is stated, does it become necessary to send out form No. 4 or even No. 3. It is generally understood that the companies mean what they say, and for that reason reminders such as No. 1 or No. 2 are generally sufficient.

HOW MUCH IS THE "ELECTRIC" WORTH TO A COMMUNITY?

What the Sale of Passenger Cars and Trucks Means in Dollars and Cents to Sales Agent, Central Station and Electrical Contractor

Peoria, Ill., is a hilly city with a population of 100,000. Topographically considered, it is not by any means an ideal place in which to promote electric vehicle sales. Nevertheless, some 300 electric passenger cars and a few commercial electric vehicles are driven daily on its streets. Figured on a per capita basis this showing compares quite favorably, not only with the country at large but with the figures for cities like Chicago.

A study of why the electric car is so popular at Peoria brought out several interesting facts, three of which seem more important than the others. First, the successful distributors have been electric car distributors; they have left the gasoline car strictly alone, not only commercially but actually. And while at the present time the chief agency firm in the city does a combination electric and gas car business, one member of the firm, who has been always an electric car man, devotes his entire time to the electric cars and never rides in a gas car. He believes in the electric absolutely, and he does not hesitate to say so. Counting sales of used cars as well as new cars, this man alone has sold 225 cars since he has been in the business at Peoria. He believes that it pays well to specialize on selling the electric.

The second great factor in electric vehicle success is the central station's attitude. The Central Illinois Light Company has tried to lend a hand in promoting vehicle business, but it has tried to do this without entirely subsidizing the sales agencies. Its vehicle promotion program has been about as follows: For private garages it established a 5-cent net rate; for commercial charging a power schedule sliding from 9 cents to 2 cents was used, and this gave a rate averaging less than 2.75 cents per kilowatt-hour. The company's co-operative sales effort consists in running a display advertisement on vehicles weekly in the Sunday papers and in using trucks for some company business.

The third important factor contributing to the success of the electric car at Peoria involves the general local situation. There are many people in the city who can and do afford two cars—an electric and a gasoline car. Moreover, Peoria is not in a location favorable to touring. When once a car leaves the paved streets it encounters roads so nearly impassable to any car that the joy of motoring turns into marked discomfort. This fact, of course, makes the electric almost as nearly 100 per cent usable as the gas car. It is an instance wherein bad roads help the sale of electric vehicles.

In addition to these three chief reasons, other causes, including a favorable garaging situation, undoubtedly have contributed to success. There are three large public electric garages, although about 60 per cent of the pleasure cars are kept and charged at home by owners. The fact that electric cars were made fashionable by sales to prominent families in the early days of the business may have helped popularize the electric.

While there is some difficulty in definitely determining the reason why electric cars should be popular in some cities and at the same time fail to gain in others, it is comparatively easy to show that as income producers electric cars are worth while popularizing. The local sources to which revenue flows from the sale and operation of these vehicles are the sales agencies, the central stations, the electrical contractors and the electric



THE PRIVATE ELECTRIC GARAGE IS GETTING TO BE A FACTOR IN HOME BUILDING AT PEORIA, ILL.

garages. The sales agencies at Peoria have disposed of 300 new cars in seven years of gradual growth. Many of these have been sold more than once as used cars, and hence have been more than once sources of revenue to the sales agencies. But, disregarding the revenue on used-car sales, it will be seen that 300 cars, at an average price of more than \$2,000, means gross sales of more than \$600,000 in seven years. The comfortable commissions on this amount must be regarded as income to the local section of the electrical industry. In addition to this, the car agencies have sold the majority of the charging sets for private garages. The retail price of this equipment in the aggregate would be about \$35,000. About sixty new cars have been sold in Peoria since Jan. 1, 1917.

The income to the central station can be determined even more definitely. There are in the city 179 private garages with charging apparatus. The average annual energy used per customer has been found to be 1250 kw.-hr.; 179 garages would therefore use approximately 223,740 kw.-hr. At the average rate of 5.03 cents per kilowatt-hour this would produce an income from privately garaged vehicles alone of \$11,212.56. Similarly, garages for commercial vehicles return to the company about \$1,800 a year. Public garages caring for both passenger cars and trucks pay annually, on a conservative estimate, more than \$3,000 a year for energy. It will be seen, therefore, that the company derives upward of \$16,000 annually from energy used for charging elec-

tric cars. The handling of this business requires the issuance of only between 1500 and 1800 monthly bills per year.

The electrical contractors find it difficult to say how much business the electric cars bring them. The more progressive business men among them admit that they bring some business in the shape of wiring jobs, but there is a general feeling among the contractors that they should sell the charging apparatus which is usually sold by the car agencies before others are aware that a prospective customer is in the market.

With the public garages business, of course, comes and goes; but on the average these concerns handle at all times at least 130 cars, which brings them a revenue of around \$45,000 a year, exclusive of their business in repair parts and tires, which is a considerable item.

CENTRAL STATION FOOD CONSERVATION SCHOOL

Merchants' Heat & Light Company of Indianapolis Teaches Methods of Saving Food and of Operating Electrical Appliances in an Eight Weeks' Course

At the suggestion of Mrs. R. A. MacGregor, the Merchants' Heat & Light Company of Indianapolis, Ind., is offering an eight weeks' home economics course. There are five classes with twenty women to each class. The meetings are held between the hours of 10 and 11 each morning except Saturday and Sunday.

These classes are in charge of Mrs. W. J. Marks, who has had several years of experience in teaching domestic science. There is no financial consideration in connection with the lectures and demonstrations, the movement being arranged as an aid to the food conservation movement advocated by Herbert C. Hoover. The program for the eight weeks is as follows:

Week of July 9, conservation and planning meals; week of July 16, buying, food values, receipts and demonstration; week of July 23, canning, drying, receipts and demonstration; week of July 30, care of foods, substitutes, receipts and demonstration; week of Aug. 6, starches, cereals, vegetables, receipts and demonstration; week of Aug. 13, milk, eggs, cheese, receipts and demonstration; week of Aug. 20, meat selection and substitutes, results and demonstration, and week of Aug. 27, fats, utilization and deep frying, and receipts and demonstration. In all demonstrations electrical appliances and electric ranges are utilized.

WATER-HEATER CAMPAIGN OF A WESTERN COMPANY

Southern California Edison Sales Exceeded 100 Heaters in First Half of Current Year, as Result of Vigorous Effort

Although there has been considerable activity in electric range sales, the electric water heater has generally been believed to require more development work before it can be marketed successfully on a large scale. In view, therefore, of the existing situation, it is interesting to note that the Southern California Edison Company, Los Angeles, at the beginning of the current year started a vigorous campaign on water heaters and is meeting with considerable success.

In commenting on this campaign before a recent meeting of the company's employees, S. M. Kennedy, general agent of the company, said:

Only eighteen months ago this company started selling electric ranges, after we had convinced ourselves that electric cooking was practical and that the electric range was an efficient appliance, and six months ago we commenced to sell electric water heaters in earnest.

There are three or four entirely satisfactory water heaters on the market, doing excellent work and giving good service. The establishment of the combination schedule takes care of the water heating in a very satisfactory way after the electric range has been installed. We have on the Edison company's system to-day, either installed or to be installed, a total of 1750 electric ranges. All of these are prospective water-heater customers. I believe our water-heater sales in the last six months have exceeded 100. The water-heater consumption is about as large as that of a range, so when we sell a water heater in connection with a range it doubles the income for the company.

ELECTRIC RANGE ENERGY CONSUMPTION DETAILS

Average Figures for Families of Different Size Showing Energy Use per Person per Month in Canadian Town

Details on energy consumption for electric cooking have been compiled by the Hydro-Electric Power Commission of Ontario for a number of the municipalities served. Averages from the municipality of London are shown in the accompanying table. Here the figures give the averages per family for families of the same size. It is interesting to note that for families of one the average energy consumption per person is 90 kw.-hr., while for families of ten the average is 29 kw.-hr.

DETAILS OF AVERAGE CONSUMPTION OF ELECTRIC RANGES

Average No. of Consumers	Average Size of Family	MONTHLY CONSUMPTION, Kw.-Hr.			Floor Area Sq. Ft.	MONTHLY BILL			Range Capacity, Kw.	Consumption per Kw. of Range, Kw.-hr.	Cost of Installation	Range Kw.-Hr. per Month per Person	Range Cost per Month per Person
		Without Range	With Range	Of Range		Without Range	With Range	For Range					
2	1	38	128	90	1050	\$0.91	\$1.72	\$0.81	4.2	21.4	7.65*	90	\$0.81
49	2	32	151	119	1270	0.88	2.03	1.15	5.13	23.2	17.04†	60	0.58
66	3	34	171	137	1620	0.99	2.33	1.34	5.35	25.6	17.71‡	46	0.45
53	4	39	212	173	1770	1.15	2.87	1.72	5.97	29.0	21.00¶	43	0.43
38	5	37	205	168	1780	1.13	2.82	1.69	5.5	37.3	16.82§	34	0.34
22	6	41	242	201	1830	1.20	3.16	1.96	6.15	33.7	19.10	34	0.33
11	7	68	274	206	2050	1.58	3.58	2.00	5.0	41.2	21.83**	29	0.29
6	8	53	275	222	2050	1.46	3.60	2.14	5.05	44.0	15.19††	28	0.27
5	9	36	292	256	1480	1.09	3.47	2.38	6.5	39.4	15.87	28	0.26
2	10	144	536	292	2650	2.72	6.26	3.54	6.5	60.7	23.20	29	0.35

RATES.—3 cents per month per 100 sq. ft. of floor area, plus 2 cents per kw.-hr. for the first 3 kw.-hr. per month, per 100 sq. ft. of floor area billed, plus 1 cent per kw.-hr. for all remaining consumption. Discount of 10 per cent for prompt payment.

*One consumer. †Average for 35 installations. ‡Average for 42 installations. ¶Average for 38 installations. §Average for 29 installations. **Average for 18 installations. ††Average for three installations.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

ERRORS OF REGISTRATION OF ELECTRICITY METERS

An Investigation of the Irregularities Caused in
Ampere-Hour Meters by Varying Loads—
Effect of Fluid Friction

THE errors of registration of electricity meters over periods during which there is a variation of the current passing are a matter of considerable interest, says G. W. Stubbings in the *London Electrical Review* for July 6, 1917. The article takes into consideration ampere-hour meters only, and variations of voltage have not therefore to be taken into account. The performance of a theoretically accurate meter with varying currents has been previously investigated, and it is now well known that such a meter with eddy-current braking, whether shunted or not, correctly records the total quantity of electricity, notwithstanding any variation of the current. The case of a meter of the commutator type may first be considered. With such a meter the error is due to an approximately constant frictional torque, and the percentage error curve is of the form $\eta = K - n/C$, η being the percentage error, n a constant depending on the frictional torque, K the percentage difference between the correct and ideal speeds of the meter, and C the current passing. Since the meter is inaccurate, the speed of the meter rotor will correspond to an inaccurate value of the current, which will be:

$$C_m = C(1 + K/100 - n/100C), \\ = C + KC/100 - n/100.$$

This expression refers to instantaneous values of the current, which may be any function of the time. The quantity recorded by the meter will therefore be obtained by integrating the expression between the limits 0 and t' , t' being the time during which current has been passing.

$$\int_0^{t'} C_m dt = Q + KQ/100 - nt'/100,$$

Q being the correct quantity. The percentage error will accordingly be $K - n/C_a$, C_a being the average current over the period t' . It therefore follows that in the case of a meter with an error curve of the form given, the error of registration over a period will be the error at the average current over the same period, whatever be the nature of the variation of the current. The case of a meter having fluid as well as solid friction is also considered. With such a meter the error curve will be of the form $\eta = K - n/C - mC$, m being a constant depending upon the magnitude of uncompensated fluid friction. We have therefore:

$$C_m = C + KC/100 - n/100 - mC^2/100,$$

$$\int_0^{t'} C_m dt = Q + KQ/100 - nt/100 - (m/100) \int_0^{t'} C^2 dt,$$

the percentage error being $K - n/C_a - (m/100) \int_0^{t'} C^2 dt$.

The portion of the error due to fluid friction is therefore proportional to the ratio of the mean square of the current to the average value of the same, and such value of the fluid friction error will thus always be higher than that at the average load. In the case of most house-service meters not only is the compensation for fluid friction fairly complete, but the effect of such friction is at the usual loads very small; the value of K is also, owing to the different shape of the error curve, higher than in the case of a meter with solid friction only. It is therefore legitimate to assume that the accuracy of a house-service mercury meter over extended periods will be equal to that of a commutator meter under similar conditions, the circumstance of variation of current only being taken into account. The effect of fluid friction with meters of higher capacities will become more important with varying loads, the magnitude depending upon the nature of the variation. With a load corresponding to $C = C_a(1 + a \sin pt)$, the ratio of the mean square to the mean current will be $C_a(1 + \frac{1}{2}a^2)$, and the effect of fluid friction is sensibly increased.

Generators, Motors and Transformers

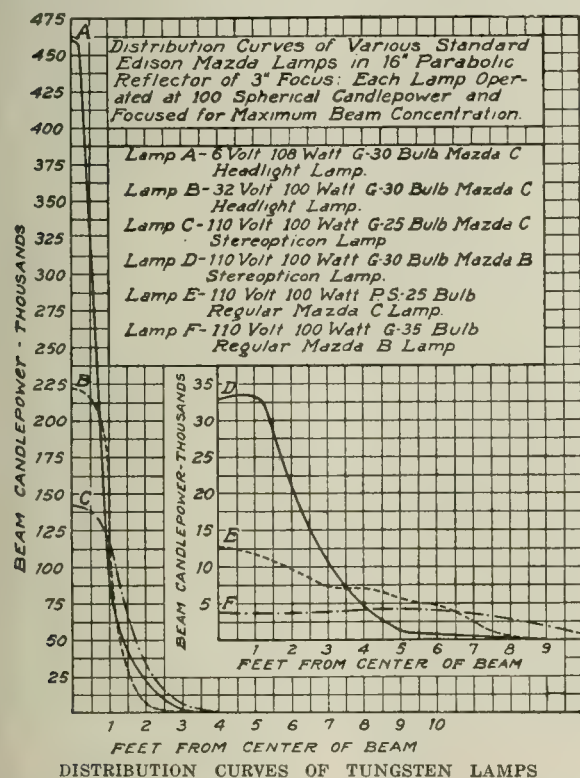
Bell Transformers.—E. WIRZ.—Transformers for operating bells and similar auxiliary services in houses are discussed in detail. Reference is made to design losses in operation, load and voltage drop, temperature rise, insulation, cost of operation and tariffs. In the cost of operation a comparison is made between transformers and batteries.—*London Electrician*, July 6 1917.

Lamps and Lighting

Luminous Radiation from a Black Body and the Mechanical Equivalent of Light.—W. W. COBLENTZ and W. B. EMERSON.—This paper gives some applications of the curve of visibility of radiation for the average eye (125 observers) to radiation problems. A mathematical equation is given of the average visibility curve. Using this visibility equation and Planck's equation of the black body, calculations are made of the luminous flux emitted by a black body at various temperatures, also the luminous efficiency, the Crova wave length, and the mechanical equivalent of light. The visibility curve of the average eye gives a value for the least mechanical equivalent of 1 lumen = 0.001627 watt of luminous flux of maximum luminous efficiency. The two determinations of the least mechanical equivalent of light made by Ives, Coblentz and Kingsbury are corrected. The value obtained by their two methods of measurement, using sixty-one observers, are in exact agreement, giving 1 lumen = 0.001606 watt. A further determination of the least mechanical equivalent of light was made by using a standardized vacuum tungsten lamp as a source of radiation. The measurements on this lamp gave:

value of 1 lumen = 0.00157 watt of radiant energy of maximum visibility. These computations are based upon the most probable values of the radiation constants: $C_2 = 14,350$ micron deg. and $\sigma = 5.7 \times 10^{-12}$ watt per cm^2 per deg.⁴ On this basis the most reliable data now available indicate that the value of the luminous equivalent of radiation of maximum luminous efficiency is of the order of: 1 watt = 617 lumens = 49.1 candles; 1 lumen = 0.00162 watt of luminous flux. Among other data this paper gives the determination of the radiant luminous efficiency of a vacuum tungsten lamp, the value being 1.42 per cent when operated at 1.23 watts per candle.—*Scientific Paper No. 305*, Bureau of Standards.

Floodlighting.—L. C. PORTER.—Some applications of floodlighting are enumerated and the principles of projection reviewed in this paper. Emphasis is placed on the importance of accurate focusing when using any form of projector. In one case to which the author



refers the beam candlepower was reduced from 220,000 cp. to 8000 cp. by moving the light source $\frac{1}{4}$ in. (64 mm.) back of the focus. Moving the filament an equal distance to one side of the focus threw the beam 4 ft. (1.2 m.) to one side at a distance of 100 ft. (30.5 m.) from the projector and reduced the beam candlepower from 220,000 cp. to 125,000 cp. The beam candlepower was also considerably affected by the magnitude of the light source, as shown by the accompanying curves. The intensity of illumination and voltage required depends on local conditions. If the surface to be lighted is very light in color and seen against a dark background, it may be practicable to use as low as $\frac{1}{4}$ watt per square foot (0.1 sq. m.) of surface lighted. Red brick requires at least 2 watts per square foot (0.1 sq. m.), while dark red, dark green and bronze surfaces may require as high as 5 watts per square foot (0.1 sq. m.). Ample allowance should be made for depreciation of the light equipment.—*Transactions of Ill. Eng. Soc.*, June 11, 1917.

Installations, Systems and Appliances

Fuel Economy.—J. A. ROBERTSON.—A paper read before the convention of the Incorporated Municipal Electrical Association. The author points out the necessity for fully utilizing the national resources to meet the economic conditions arising out of the war, which has made the question of fuel economy one of urgent and vital importance. The author presents diagrams and figures showing that the output of coal per annum per person employed in mining is diminishing in England and the cost is rising, whereas the converse is the case in the United States. The paper discusses the possibility of economizing fuel by centralizing the production of power and by combining the carbonization of coal and by-product recovery with the generation of electricity.—*London Electrician*, June 22, 1917.

Electrophysics and Magnetism

Electrical Resistivities of Iron Alloys.—T. S. FULLER.—Characteristics of iron alloys the resistivities of which are greater than those of the components. Data are given on iron-nickel, iron-chromium, iron-cobalt, iron-nickel-chromium, iron-nickel manganese and iron-nickel-chromium-manganese alloys.—*General Elec. Review*, July, 1917.

Permanent Magnets.—F. C. KELLEY.—Résumé of work done by the principal investigators along this line. The effect of chemical composition, shape and dimensions, heat treatment and usage on the strength and permanence of magnets is reviewed in detail.—*General Elec. Review*, July, 1917.

Electrochemistry and Batteries

New Steel Alloy, Cobaltchrom.—This alloy, discovered by Darwin and Milner of Sheffield, England, is the addition of cobalt to chromium-carbon steel, converting a steel which had no appreciable red cutting hardness into one which had the very valuable qualification. It is pointed out that the cutting efficiency of this new steel is quite equal, even in the form of castings, to that of tools made from the forged or rolled bar in which high-speed steel is supplied commercially.—*London Engineering*, July 6, 1917.

An Investigation of Radium Luminous Compound.—C. C. PATERSON, J. W. T. WALSH and W. F. HIGGINS.—The paper contains the results of measurements made on various samples of radium luminous compound during the last two years. Determinations of the brightness of the compound in powder form and when made up into paint, and also after the application of the paint to instrument dials, were carried out, and curves are given showing the rates of decay of luminosity. The radium contents of the compounds were determined by comparison of their X-ray activities with that of a preparation of pure radium bromide, which is periodically compared with the British radium standard. The various precautions which have to be observed and the corrections which have to be applied in making the various determinations are explained.—*London Engineering*, June 22, 1917.

Units, Measurements and Instruments

The Resistance of the Motion of a Lamina, Cylinder or Sphere in a Rarefied Gas.—F. J. W. WHIPPLE.—In this paper the investigation is carried out on the assumptions that the free paths of the particles of the gas are long compared with the dimensions of the mov-

ing body, and that the motion, relative to the body, of the particles which rebound from it depends only on its temperature. It is shown that if v , w be the components of velocity perpendicular to the surface of a lamina and parallel thereto, the corresponding components of the resistance are

$$(4 + \pi) \sqrt{\frac{3}{2\pi}} \frac{v}{V} p \text{ and } 2 \sqrt{\frac{3}{2\pi}} \frac{w}{V} p,$$

where V is the standard (root-mean-square) speed of the gas particles and p is the gas pressure. The resistance to the motion of a cylinder or a sphere is found to differ very slightly from the resistance to a lamina occupying the central section. The formula are applicable to the problem of the damping of the oscillations of a system suspended in a rarefied gas.—*London Engineering*, June 22, 1917.

Miscellaneous

Effect of War on the Development of Water Power.—Strange as the affirmation may seem, without the war and the needs that it has created, many waterfalls in the French Alps that have been put into service would probably have waited long for their complete utilization. The needs of national defense have put some of these into use for the first time and have caused a resumption of work on many others where it had been suspended at the time of mobilization. In spite of the great obstacles that had to be overcome, power houses are in course of construction that will have a total rating of 40,000 hp. and will afford to the industries of the region an additional 20,000 hp. in winter and 25,000 hp. in summer. Besides this, water from some of the highest falls is to be used directly by apparatus operating under static pressure at 50 or 60 atmospheres in a manner both ingenious and extremely important. Electrometallurgical and electrochemical processes have also been greatly stimulated by the hydroelectric developments of the war. If, with the return of peace, the possibilities of the French Alpine water powers are carried to their highest possible development, at least 15,000,000,000 kw.-hr. a year can be produced.—*Extracted from M. de la Brosse's "Compte Rendu du Service des Grandes Forces Hydrauliques," in L'Industrie Elec.*, June 10, 1917.

International Society of Electricians.—The annual convention of this society was held in Paris on April 5 concurrently with the regular monthly session. A congratulatory motion on the entrance of the United States in the war was cabled to the American Institute of Electrical Engineers. Among the papers contributed to the society in the year preceding the meeting, the report of the committee of administration made mention of one by M. Kioivici containing a theoretical and experimental study of transformers, one by D. Berthelot which provoked much discussion, on the reciprocal relations of electrical and magnetic phenomena, universal gravitation, the principle of relativity and the discontinued elementary factors of energy, and one by M. de la Gorce containing a description of the apparatus employed at the Central Electric Laboratory for the testing of transformers. Mention was also made of the report presented by R. V. Picou, chairman of a joint committee of the society and the Union of Electrical Syndicates, on the unification of line insulators, the report having been adopted by the two organizations.—*Bulletin de la Soc. Internat. des Elec.*, April, 1917.

Book Review

ELECTRIC TRACTION: A Treatise on the Application of Electric Power to Tramways and Railways. By A. T. Dover. New York: The Macmillan Company, 667 pages, 518 illustrations. Price, \$5.50.

The author of this book is a lecturer on electric traction at the Battersea Polytechnic, London, and the text is about what one would expect to find in a comprehensive course of lectures on electric traction. The style is appropriate to such a lecture course. In preparing the material for a wider audience Mr. Dover had in mind that the book would be useful to engineers as well as to advanced students. A considerable number of the illustrations of present practice are naturally drawn from that of Great Britain and the Continent, but American railways have by no means been neglected. The fundamental principles are, of course, applicable everywhere. The author has treated the main subject with the following topics as subdivisions: Mechanics of train movement; motors; control; auxiliary apparatus; rolling stock; detailed study of train movement; track and overhead construction, and distributing systems and substations. He has not tried to cover generating stations and transmission lines. If one keeps in mind that the text is addressed to a circle of readers familiar in a general way with the fundamentals of mechanics, electric circuits and engineering principles, who desire information on the peculiar problems of electric traction and the way in which these problems have been solved, he will have a pretty good notion of the kind of book which Mr. Dover has produced. In carrying out his aim, particularly with reference to students, he has naturally brought in a great many examples to show how the principles are applied, and along the same line has added a number of examination questions selected from those of four leading British institutions. The book is profusely illustrated with pictures and diagrams, covers direct-current and alternating-current railways, contains a great deal of comment as well as descriptive matter, and should prove a valuable reference work. The publication of this book suggests that the engineering world is indebted to the teaching profession for many treatises which are prepared as accompaniments to lecture or recitation courses. The preparation of such courses naturally leads to comprehensive study of the respective fields covered by them, and this in turn suggests publication, where the subjects are not yet adequately covered. In the present case one is inclined to wonder why another book in the field of electric traction was considered necessary at this time. It is true, however, that in many directions electric railway equipment is still developing rapidly and that a book in which existing practice is described soon becomes out of date.

Books Received

HOW TO STUDY. By George Fillmore Swain. New York: McGraw-Hill Book Company. 65 pages. 25 cents.

REPERTORIUM DER PHYSIK. By Rudolph H. Weber and Richard Gans. Leipzig and Berlin: B. G. Teubner. 614 pages, illustrated.

ELECTRICAL MEASUREMENTS IN PRACTICE. By F. Malcolm Farmer. New York: McGraw-Hill Book Company. 360 pages, 230 illustrations. Price, \$4.

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

PRESIDENT GETS COAL COSTS AND PRODUCTION ANALYSIS

**Indications Point to Fixing of a Single Price for
Government, Industries and Private
Consumers**

President Wilson has received from the Federal Trade Commission the analysis of costs of production and distribution of coal. This important information, for which the President has been waiting some time, will play a very material part in the policy which the government may pursue as to the relation between the government and private industry so far as the fixing of the price for coal and the price for other material in private industries is concerned. There have been rumors in Washington that certain important members of the Board of Coal Production and Distribution might resign from the positions they occupy in the Council of National Defense. Furthermore, it is reported that President Wilson might accept their resignations if offered.

Up to the time of going to press no information could be obtained at the White House as to what is to be done in regard to the price fixing of coal, but there is the clearest indication that if any one, no matter who he may be, attempts to get in the way of fixing the price of coal not only for the government but for private industry and the private consumer, President Wilson himself will make it clear that prices must be fixed with the assistance of the Attorney-General, to whom he has given instructions. There are certain indications at the White House, according to the report of the Washington correspondent of the ELECTRICAL WORLD, that the authorities intend to act favorably upon the recommendation of the Federal Trade Commission that one price shall be established not only for the government and for private industries but for the army of individual small private consumers of coal throughout the country as well.

COMMISSION ISSUES STATEMENT

A day or two prior to sending the report to the President the Federal Trade Commission authorized the following statement:

The report that will be sent to the President will be based on careful cost determination of wages, maintenance, overhead and material charges. Depreciation is carefully considered, as are investment and other factors.

The work entails careful study of many sets of books and inspection at the mines frequently of special factors bearing on costs. As the reports come to the commission the information is correlated and each report is carefully analyzed and checked up. All apparent exceptions are investigated. The result will be that when the report is sent to the President it will have been done with such complete thoroughness that a "fair and just" price can be determined on the basis of the cost determination. It is the cost determination only, not the price determination, that the commission is concerned with.

NO HEAVY TAXES ON ELECTRICAL INDUSTRY

**President Known to Be in Favor of Equitable Dis-
tribution of Taxes on Industries and May Yet
Take Personal Charge of This Work**

Senator Simmons, chairman of the finance committee of the Senate, assured the Washington correspondent of the ELECTRICAL WORLD Wednesday night that no heavy taxes would be imposed upon the electrical industry so far as he knows. This alludes to the situation of the war revenue tax bill in the Senate.

Senator Simmons, while believing that there will be no bond issue and that the desired revenue from the proposed taxes will be otherwise obtained, thinks that nevertheless Secretary McAdoo may recommend a bond issue in order to take up some of these taxes. Newspapers have reported what are apparently the conclusions of the Senate finance committee, but it is understood in Washington that all these apparent conclusions are still subject for negotiation. An effort has been made by some of the newspapers to show that there will be certain conditions to the war revenue tax bill, especially in regard to the amount of increased tax on excess profits.

Most of these proposals, according to the information obtained from Senator Simmons, are subject to the work of the House ways and means committee, and Senator Simmons himself is frankly worried and anxious as to what the House committee may do. Mr. Kitchin, chairman of the House committee, saw President Wilson for a few minutes at the White House during the week. There is a general impression among members of the House of Representatives that he wishes to have all of the industries in the eastern part of the United States taxed.

It is understood that he received no encouragement in this point of view during his call at the White House. It may be stated upon the highest authority that President Wilson will insist that the taxes shall be distributed in an equitable manner.

NATIONAL DEFENSE COUNCIL AND ITS SUBSIDIARIES

**Congressional Jealousy Over the Powers Assumed
by the Council May Lead to Difficulties—Pres-
ident Wilson to Support the Council**

A legislative fight of extreme bitterness is in progress in Washington, under the surface, apparently, in regard to the National Defense Council, its advisory commission and its committees.

The fight is on the question of whether the members of the Council, the commission and the committees shall be allowed to continue to specify which firms and

companies have materials which are needed by the government for the conduct of the war and what prices ought to be paid. The process has been that the committees and the commission and the Council have recommended that the government obtain its supplies from certain firms and the prices which should be paid. These recommendations have been followed by the executive branch of the government. Senators and representatives in Congress believe that this is an improper way of supplying the government, and many of them purpose to put a stop to it if they can.

President Wilson has taken a hand in the controversy. He has written a letter to Senator McKellar, a member of the Senate committee on agriculture, which has charge of the so-called food bill, urging him to induce the Senate to drop from that bill the provision which would prohibit members of the Council, its commission and its committees from serving on those bodies while firms and companies with which they are connected are supplying the government.

That President Wilson intends to support the Council, its commission and its committees was indicated in Washington in the past week when he attended a joint meeting of these bodies in the office of the Secretary of War, the president of the Council.

The President is understood to have discussed the possibility of his issuing an executive order recognizing the advisory commission as an independent body, without waiting for Congress to pass the food bill. Such a course, in the President's belief, it is said, would give effectiveness to the conclusions of the body and would carry out the President's views of its valuable objects and potentialities. Such a course was pursued in the establishment by the President of the food administration body, which is now at work, although Congress has not passed the food bill.

MISCELLANEOUS EQUIPMENT FOR THE EMERGENCY FLEET

Text of Specifications for Electric Wiring Materials for Ships Belonging to the National Merchant Fleet

Needs of the Emergency Fleet Corporation of the United States Shipping Board for certain miscellaneous electrical equipment are shown in detail in specification No. 127. The bids on this material will close about Aug. 5, 1917, the ELECTRICAL WORLD is advised. The text of the specification follows:

Each 3500-ton ship requires the following electric wiring materials, all of the commercial marine type, for a 120-volt, two-wire, direct-current installation:

Item 1.—108 deck fixtures, steam-tight or vapor-proof galvanized (or sherardized) iron or brass, with globe and switch, without guard, complete with all necessary fittings.

Item 2.—Thirty-seven bulkhead fixtures, steam-tight or vapor-proof, galvanized (or sherardized) iron or brass, with globe, switch and guard, complete with all necessary fittings.

Item 3.—One magazine fixture, same as Item 1, but with globe and guard and without switch.

Item 4.—Three 250-watt fixed units, non-water-tight, without switch, with porcelain-lined metal reflector and guard, complete with outlet box and all necessary fittings and accessories.

Item 5.—Ten 250-watt portable units, non-water-tight, with porcelain-lined metal reflector, guard and hooked handle, complete with socket and all necessary fittings and accessories, except that neither cord nor plug is required.

Item 6.—Five 500-watt portable units, otherwise same as Item 5.

Item 7.—Twelve desk lamps, non-water-tight, with switch and shade, without guard, complete with socket and all necessary fit-

tings and accessories, except that neither cord nor plug is required.

Item 8.—Twenty 60-watt portable units, otherwise same as Item 5.

Item 9.—Two battle lanterns, non-water-tight, without switch, with guard, hooked handle and opaque shutter for darkening light, complete with socket and all necessary fittings and accessories, including both cord and plug.

Item 10.—One blinker light, water-tight, brass base, rigid construction, complete with socket and all necessary fittings and accessories, including both cord or cable and plug.

Item 11.—Two sidelights (port and starboard), combination oil and electric, water-tight, brass base, rigid construction, regulation size, complete with socket and all necessary fittings and accessories, including both cord and plug.

Item 12.—Two anchor lights (fore and aft), combination oil and electric, regulation size, and otherwise as per Item 11.

Item 13.—One range light, combination oil and electric, regulation size, and otherwise as per Item 11.

Item 14.—One stern light, combination oil and electric, and otherwise as per Item 11.

Item 15.—One masthead light, combination oil and electric, regulation size, and otherwise as per Item 11.

Item 16.—One 50-amp. snap switch, double-pole, in steam-tight iron or brass box, complete with all fittings and accessories.

Item 17.—Ten 5-amp. snap switches, otherwise as per Item 16.

Item 18.—Thirteen 5-amp. snap switch and single-receptacle unit, double-pole, in steam-tight iron or brass box, complete with all fittings and accessories.

Item 19.—Thirty-two 5-amp. snap switches and double-receptacle unit, otherwise as per Item 18.

Item 20.—Twenty-five 5-amp. single receptacles, without switch, otherwise as per Item 18.

Item 21.—Thirty junction boxes, fused, steam-tight or vapor-proof, iron or brass box, complete with fuses and all necessary accessories, including 100 extra fuses per vessel.

Item 22.—Seventy-five branch boxes, unfused, steam-tight or vapor-proof, iron or brass box, complete with all necessary accessories.

Item 23.—Four distribution panels, six double-pole fused circuits, non-water-tight construction, in iron box with lock, runways for wires, without main switch or fuses, complete with all necessary fittings, lugs, terminals, cartridge fuses (and fifty extra cartridge fuses per panel), number plates, name plates and other appurtenances.

Item 24.—Three distribution panels, eight double-pole fused circuits, and otherwise as per Item 23.

Item 25.—One blinker controller, consisting of suitable key with $\frac{1}{8}$ -in. D. coin-silver contacts, and condenser, all contained in a weatherproof iron or brass box designed for mounting upon railing, including all fittings and accessories for operating the blinker lights (Item 10).

Item 26.—One telltale board for three circuits, with lamps and vibrator to indicate when signal lights are either burning or out, with necessary spare parts.

Item 27.—Seventy plugs for portables to fit receptacles of Items 18, 19 and 20 complete, without cord.

Item 28.—Thirty-six hooks, iron or brass, designed for mounting on bulkhead to support portables.

Item 29.—One connection box, iron or brass, with terminals for interconnecting feed wires, blinker controller, blinker snap switch and blinker light.

Item 30.—750 clips for $\frac{1}{2}$ -in. conduit, either strap iron or malleable casting.

Item 31.—125 clips for 1-in. conduit, either strap iron or malleable casting.

Item 32.—3000 ft. conduit, $\frac{1}{2}$ -in., galvanized or sherardized, N. E. C. S., with couplings.

Item 33.—550 ft. conduit, 1-in., galvanized or sherardized, N. E. C. S., with couplings.

Item 34.—3500 ft. wire, duplex, No. 14 B. & S. gage, double-braid, rubber-covered, N. E. C. S.

Item 35.—150 ft. wire, duplex, No. 12 B. & S. gage, double-braid, rubber-covered, N. E. C. S.

Item 36.—1000 ft. wire, single-conductor, No. 6 B. & S. gage, double-braid, rubber-covered, stranded, N. E. C. S.

Item 37.—250 ft. wire, single-conductor, No. 2 B. & S. gage, double-braid, rubber-covered, stranded, N. E. C. S.

Item 38.—1500 ft. cotton-braid, reinforced No. 14 B. & S. gage cord, for all portables, desk lamps, fans, etc., N. E. C. S.

Item 39.—One tool box, hardwood, with lock and two keys, containing the following: twelve sheets crocus cloth, twelve sheets emery cloth, twelve assorted files, 2 lb. fuse wire (3 amp.), one 16-oz. ball peen hammer, one pair 5-in. diagonal cutting nippers, two pairs 6-in. combination pliers, one pair 10-in. combination pliers, twenty-four sheets assorted sandpaper, 2 $\frac{1}{2}$ -in. Champion screwdriver, 8-in. Champion screwdriver, one 12-in. Champion screwdriver, one pointed soldering iron (1 lb), 2 lb. tubular solder, 2 lb. friction tape ($\frac{3}{4}$ -in.), 2 lb. rubber insulation tape ($\frac{3}{4}$ -in.), one Stillson wrench (6-in.), one monkey wrench

(6-in.), one gasoline blow torch (1 pint), one hacksaw (9-in.) with twelve blades, one wire peeler, one electrician scissors (5¼-in.), one combination tool set with nine attachments, and one wire gage.

Item 40 (a) to 40 (n).—Spare parts:

One set contact points for blinker controller (Item 25).

Twenty-four gaskets for deck and bulkhead fixtures (Items 1 and 2).

Six globes for deck and bulkhead fixtures (Items 1 and 2).

Six guards for portables (Item 8).

Two guards for portables (Item 5).

One guard for portable (Item 4).

Twelve sockets for deck and bulkhead fixtures (Items 1 and 2).

Two guards for bulkhead fixtures (Item 2).

Six globes for sidelights (Item 11), half red and half green.

Two globes for anchor lights (Item 12).

Two globes for range lights (Item 13).

Two globes for stern lights (Item 14).

Two globes for masthead light (Item 15).

Six handles for switches in distribution panels (Items 23 and 24).

All the aforesaid electrical material shall conform strictly to the requirements of the National Board of Fire Underwriters and shall comply with the rules and regulations of the American Bureau of Shipping and of the United States Steamboat Inspection Service, wherever such rules are applicable. Parts as far as practicable shall be interchangeable. Devices are to be the very best in material and workmanship. No lamps are to be furnished.

The manner in which the aforesaid electrical material is to be installed is shown in detail on an attached blueprint. All proposed devices and wiring material must be perfectly suited to the purposes of the contemplated installation, and particularly must outlet boxes, junction boxes and other fittings be provided with suitable connections for the particular point of installation.

The material is to be well packed to prevent breakage and is to be made up so that one or more units may be shipped to any point in the country.

Bidders must submit with their proposal either drawings showing the proposed equipment and material in detail or else a sample of the proposed devices, preferably the latter when not too bulky. Tenders are to be accompanied by complete specifications, characteristics and performances of the materials and devices proposed and of the construction employed in the manufacture thereof, so that the corporation may decide in regard to the suitability of the materials which it is purposed to furnish. Bidders are to state the place of manufacture and the point of delivery, and in event a bidder is not the manufacturer of the devices or material offered, the name of the manufacturer is to be stated in the proposal. Weights, both net and shipping, are to be stated.

UNUSUAL STRAIN UPON RAILROADS

War Board of the Carriers Asks Commissions and Public Authorities Not to Force Unnecessary Improvements

The Railroads' War Board has addressed a plea to public service commissions and all state, county and municipal authorities throughout the United States urging co-operation with the railroads in a suspension during the period of the war of "all efforts not designed to help directly in the winning of the war."

Specific suggestions which the Railroads' War Board makes are embodied in a letter forwarded by Chairman Fairfax Harrison. Mr. Harrison says in part:

The railroad committee earnestly recommends that during the war the railroads be required by the public authorities to make improvements and carry out projects involving the expenditure of money and labor only when they are absolutely essential for war purposes or public safety. The prevailing high interest rate on money, the difficulty of raising money in competition with the tax-free issues of the government, the excessive cost of supply and labor, the delay in obtaining material, the possible blockade of traffic and the diversion of labor all contribute to make non-essential construction undesirable during the war.

AMERICAN GAS & ELECTRIC SUBSIDIARIES RAISE RATES

Increase in Power Rates in Most of Communities Served Approximates 25 per Cent Except in Scranton Territory

Subsidiaries of the American Gas & Electric Company have made application, or have filed schedules, for an increase in power rates to offset the unusual cost of coal and materials in most of the communities served. Such increases are now effective in nearly all the communities served in Ohio and in all the communities served in Pennsylvania and in the territory served by the Muncie Electric Light Company in Indiana.

The increase in rates is approximately 25 per cent, except in the territory served by the Scranton Electric Company, where the increase is approximately 18 per cent. The smaller increase in the Scranton territory is due to the proximity of the coal mines and to the ownership by the Scranton Electric Company of large culm deposits.

No increase in lighting rates is contemplated at this time.

The recent decision of the Indiana Public Utilities Commission authorizing the Muncie Electric Light Company to add a surcharge of 0.5 cent per kilowatt-hour to bills of all power consumers, thus recognizing the necessity of relief to the utilities, is considered gratifying and fair.

CHANGE INDIANA PETITION FOR WAR RATE SURCHARGE

Public Service Commission Rules That Companies Must File Individual Applications Instead of Acting Through Association

The Indiana Public Service Commission, after hearing arguments against the form of the joint petition for a surcharge of 30 per cent on all bills by members of the Indiana Electric Light Association, ruled that it would be safer for the individual utility companies concerned to file individual petitions asking for relief. The consolidated hearing on these petitions will begin on Aug. 20, the commission announced. It is the plan to have a joint hearing, including a number of cases in one proceeding.

The hearing on Monday, July 23, was given to arguments on the form of the blanket petition for higher rates filed by the electric association. A group of authorities of cities in the State, headed by W. A. Bond, city attorney of Richmond, argued against the legality of consideration by the commission of the blanket application for a surcharge.

The request of the commission that the various companies file individual opinions will avoid any question in the future as to the form of petition.

William J. McInerney of South Bend, defending the form of the petition on behalf of the association, said that the companies were willing to amend their plea so as to permit separate decisions in regard to each company.

Late advices are that the two Indianapolis companies have filed a joint petition and that the commission has set Aug. 7 as the date for hearing the case as it applies to Indianapolis.

DISTRIBUTING AGREEMENT IS MADE BY LOS ANGELES

Agreement with Private Companies Extended to July 1, 1919, with Sanction of Railroad Commission—Suit Against City Is Affected

The city of Los Angeles has extended until July 1, 1919, the temporary operating agreement between the city and the two companies recently consolidated into the Southern California Edison Company. This agreement, described in the *ELECTRICAL WORLD* of May 19, was first entered into for a two-month period ended July 1, 1917. The two-year extension and the agreement have been approved by the California Railroad Commission.

The new agreement is practically the same as the one previously in effect. It states that Los Angeles has arranged to buy the electric distributing systems of the two companies within the city, that bonds must be voted and sold by the city to buy the properties, that the city is operating its own hydroelectric plant in San Francisquito Cañon with a capacity of 37,000 hp. and proposes to build other plants and possibly to buy a steam-electric generating plant of the Los Angeles Gas & Electric Corporation in Los Angeles, and that the city wants to sell consumers within the city its electrical energy and has arranged with the two corporations, pending payment of the purchase price of \$8,270,000, to operate their Los Angeles distributing systems for the benefit of the city.

The company shall retain from the revenue collected 8 per cent interest a year, payable monthly, on \$8,270,000, the assumed fair value on Jan. 1, 1917, of the distributing systems affected by the agreement, on such sum as shall be determined by the Railroad Commission as the value of distributing systems of the companies in the Westgate Annexation District, and also on the actual cost to the companies of extensions and betterments made since Jan. 1.

The companies agree to buy and distribute all the electricity generated by the city's plants and not distributed over the city's own electric system, and to supply the city with additional power necessary to serve the city's consumers, but the electricity to be bought from the companies monthly is not to be less than a maximum yearly peak demand of 25,000 hp. at an annual load factor of at least 36 per cent.

The companies are to maintain distributing systems in good operating condition and extend and improve them as necessary. Maintenance, extension and conduct of the business are to be overseen by two representatives designated by the public service commissioners, two by the companies and a fifth arbiter in case of dispute. The Railroad Commission is to be final umpire.

The companies are to collect all bills from consumers and pay to Los Angeles daily the amounts collected less 8 per cent interest and the actual cost incurred monthly for operation and maintenance, including taxes and licenses, but not including replacements, extensions or betterments.

A depreciation allowance at the rate of 3.36 per cent a year is to be retained monthly, to constitute a fund to be held in trust by the companies, with interest at 4 per cent, and out of the aggregate the cost of neces-

sary replacements is to be paid. If the property is purchased by the city, any unexpended balance in the depreciation fund is to belong to the city, but if otherwise the company is to keep the fund.

The city agrees not to parallel or duplicate distributing systems of the companies during the agreement, but this restriction is not to apply to city construction of lines for transmission or street-lighting. The agreement remains in force until July 1, 1919, with the right of the city at any time upon three months' notice to terminate the agreement, and subject also to determination by the voters.

The Los Angeles Gas & Electric Corporation has been seeking an injunction in the Los Angeles courts to prevent continuation of the agreement. After submission of all evidence the case was continued until after the commission's decision as to approval of the plan had been announced.

The corporation also appeared before the commission to protest against approval of the agreement, which, it was claimed, violated the State constitution and the Los Angeles city charter. It was also claimed that the estimate of the Edison and Pacific companies' properties used is too high, that the rate to be paid by the city for electric energy is excessive, and that the minimum amount of electricity which the city obligates itself to buy from the companies is greater than the amount that the city would use if it operated to capacity its San Francisquito plant.

The commission makes it clear that it is not passing upon the reasonableness of any rate now in effect or on discrimination in any rate, and also that it does not pass on any portion of a purchase agreement for these distributing lines which has been made but not yet put up to voters.

The city will buy from the companies electricity at from 1.22 cents per kilowatt-hour to 0.5 cent per kilowatt-hour, depending upon the varying annual load factor, these charges being based upon cost of supplying electrical energy at substations of the companies. The commission says that an analysis shows these rates to approximate actual cost to the company. The minimum annual payment to be made by the city to the companies for electricity is to be \$717,530. Between May 1 and June 13 the city realized \$85,740 from wholesale sale of power.

Failure of the two-million-dollar power bond issue on June 5 automatically prevents, under terms of the charter, consideration of the twelve-million-dollar bond issue for at least six months. Under these conditions it has been suggested that the differences between the city and the Los Angeles Gas & Electric Corporation might be arbitrated so that there would be complete municipal ownership and control of power. Effort is being made in this direction so as to avert, if possible, the long-drawn-out power war.

Explaining Electrical Activities

Under the title "Aims and Achievements," the Society for Electrical Development has issued a handsome booklet containing a brief summary of what the society is accomplishing for its members and for the entire electrical industry. The booklet contains thirty-six pages, including eleven full-page plates and a double-page chart.

**I. E. S. MAKES PLANS FOR ITS
CORRESPONDENCE CONVENTION**

**To Take the Place of Regular Meeting—First Papers
to Be Released During September, Others
to Follow in Succeeding Months**

The Illuminating Engineering Society's correspondence convention, which this year will replace the regular annual convention, will be inaugurated during September by the release of the following papers: Presidential address, by W. J. Serrill; report of committee on nomenclature and standards, Dr. A. E. Kennelly, chairman, and C. H. Sharp, secretary; "Illuminating Engineering Publicity," by G. H. Stickney; "Economics of Large Building Lighting," by C. L. Law and J. E. Buckley; "Illumination Intensities in Large New York Department Stores," by W. F. Little and J. F. Dick.

President Serrill's address, not being submitted for discussion, will appear in the *Transactions* of the society issued about the first of September. The three papers and the report will be distributed in pamphlet form to any one who applies for them to the society at its headquarters, 29 West Thirty-ninth Street, New York City. A general invitation is issued for written discussion of each of these papers to be printed with the names in the *Transactions* of the society. Any of these papers may be presented before meetings of sections of the society during the month of September. They will be released to the technical press for publication in full or in abstract at any time subsequent to Sept. 20.

Other papers of this correspondence convention will be released in October, November and December.

**PUSHING THE CAMPAIGN
TO KEEP BUSINESS GOING**

**Society for Electrical Development Says That Possi-
bilities Were Never so Great as at the
Present Time**

The Society for Electrical Development has sent to its entire mailing list of more than 20,000 a circular announcing its "Keep Business Going" campaign.

The circular contains a letter to the industry by Henry L. Doherty, president of the society. It suggests that in view of the greatly widened market for electric service, it is time to concentrate on building business.

The possibilities of electric power to replace steam power, of electric light to protect bridges, munition plants, waterways and work shops, of electrical appliances to lighten the labor of the home and on the farm, were, according to the circular, never so great as at this moment.

The society urges the sales side of the industry

*A Campaign
To Help
Make
Good Business
Better
For the Entire
Electrical
Industry*

to seek out new possibilities of serving the public. It suggests that many power-consuming devices which

formerly might have been thought to be luxuries are now certainly proved to be necessities.

The keynote of the new campaign is that business must be kept going if the banks, merchants, lighting companies and other commercial interests are to contribute their share to the national defense.

**GOVERNMENT SHIPMENTS
TO HAVE THE PRECEDENCE**

**Estimated that During the Next Few Months More
than 100,000 Cars Will Be Needed
for Government Uses**

Plans for the solution of one of the most important transportation problems thrust upon the railroads of this country by the war have been adopted by the Railroads' War Board after a series of conferences with authorized representatives of the army, the navy and the United States Shipping Board. The problem concerns the supply and prompt movement of the thousands of cars required by the government to transport lumber and other supplies.

Under the plans agreed upon by the Railroads' War Board and representatives of the government, the government will give advance notice to the War Board's commission on car service whenever orders are placed for more than ten carloads of materials or supplies.

The government will also issue where necessary, through its authorized representatives, orders to the railroads on which the supplies are to be shipped, instructing them to provide the number of cars ordered within the time specified and at the shipping points designated.

To prevent shippers from utilizing for their own selfish purposes cars needed for government service, the Railroads' War Board has issued strict orders to all the railroads absolutely to forbid shippers the use of any of the government-ordered cars for any purpose except the loading specified in the government order.

**INVESTIGATING UTILITIES
IN STATE OF NORTH DAKOTA**

**Hagenah & Erickson Making Inventories and Will
Also Examine Accounts of Properties
for State Officials**

A committee of officials of North Dakota, consisting of the Governor, Attorney General, the chairman of the State Tax Commission and chairman of the State Railroad Commission, has engaged Hagenah & Erickson of Chicago to investigate all public utilities in the State, the purpose of the investigation being to supply the state departments with accurate data regarding these properties. The investigation will embrace detailed inventory and appraisal of each property and an analysis of earnings and operating expenses for a number of years.

The appraisal work has been in progress for several weeks, and engineers from the firm are now making inventories in Bismarck, Fargo, Grand Forks, Minot, Jamestown, Mandan and many smaller cities. Certified public accountants in their employ will examine the books after completing the appraisals.

REDUCTION IN RATES ORDERED IN EUGENE, ORE.

Municipal Plant Directed by State Commission to
Lower Its Schedules for Electrical Energy—
Minimum Charge Reduced

Several months ago the municipal water board of Eugene, Ore., requested the Oregon Public Service Commission to make a survey of the Eugene water and light plants with an idea of ordering a more desirable set of rate schedules. The commission has ordered a substantial reduction in electric light and water rates. The city commission has accepted the report and has ordered the new rates into effect.

The outstanding feature of the new rates is the 75-cent minimum charge for electric light instead of \$1. A brief summary of the new residential rates follows:

Metered Service—To cover each service connection on all residences.

Primary Rate—Applies only to first 50 hours' use per month per kilowatt of consumers' active load: First 6 kw.-hr. or less, 75 cents; all over 6 kw.-hr. or less, 5 cents.

Secondary Rate—Applies only to consumption in excess of first 50 kw.-hr. used per month per kilowatt active load: First 50 kw.-hr., per month, 3 cents; all over 50 kw.-hr., per month, per kilowatt-hour, 2 cents.

Minimum Monthly Charge—75 cents plus 10 cents for each 100 watts or major fraction thereof of active load in excess of 500 watts.

Small heating, cooking and power devices, with an aggregate connection rating of not more than 2 kw., including small motors with a maximum individual rating of 1 hp. output (1 kw. input), if served under these rates and through the lighting meter, may be connected without being included in the active load on minimum charge.

Heating and cooking devices in excess of 2 kw. of aggregate connected rating will not be included in the active load, but will be assessed a minimum charge of 50 cents per kilowatt in addition to the regular lighting minimum.

The commercial lighting rates are as follows:

To cover each service connection on all commercial loads: First 50 kw.-hr. used per month per kilowatt of active load will be at the primary rate. All excess consumption over 50 kw.-hr. per month per kilowatt of active load will be at the secondary rate.

Primary Rate—First 6 kw.-hr. or less, 75 cents; excess over 6 kw.-hr., per kilowatt-hour, 5 cents.

Secondary Rate—First 100 kw.-hr., per kilowatt-hour, 4 cents; next 200 kw.-hr., per kilowatt-hour, 3 cents; over 300 kw.-hr., per kilowatt-hour, 2 cents.

Minimum Monthly Charge—75 cents plus 10 cents for each 100 watts or major fraction thereof of active load in excess of 500 watts.

No connected load will be considered less than 500 watts.

Small heating and power devices, with an aggregate connected rating of not more than 2 kw.-hr., including small motors with a maximum individual rating of 1 hp. output (1 kw. input), if served under these rates, and through the lighting meter, may be connected without being included in the active load or the minimum charge.

The Oregon commission has given considerable attention in the last year or two to the form and application of electric rates, and the ELECTRICAL WORLD for June 2 published the complete residential and commercial power rates for the city of Portland. A comparison of the two residential lighting rate schedules will be of considerable interest.

In comparing the schedules consideration should be

given to the fact that the population served by the Portland Railway, Light & Power Company is in the neighborhood of 300,000, while that served by the Eugene municipal lighting plant is approximately 10,000.

MR. HARRIMAN ON NEW ENGLAND HYDROELECTRIC DEVELOPMENT

Growth of New England Power Company and Its
Economic Influence on Energy Supply—
Problem of Coal Cost

Growth of the New England Power Company and its economic influence in the supply of electricity were discussed recently by President Henry I. Harriman at a hearing before the Massachusetts Gas and Electric Light Commission. The board was considering the issue of \$7,000,000 additional stock and bonds to meet the cost of a new hydroelectric development on the upper Deerfield River at Readsboro, Vt., and various transmission line and substation work, outlined in the ELECTRICAL WORLD of June 30, 1917.

Mr. Harriman stated that output of the system had increased from 34,000,000 kw.-hr. in 1910 to 245,000,000 kw.-hr. of the end of 1916. High coal cost and pressing demand for power greatly in excess of output of the present developments make necessary the immediate acquisition of new sources of power. It is estimated that the work will cost \$7,010,000, divided as follows:

Increasing capacity of certain existing lines by adapting them to 110,000-volt operation.....	\$600,000
Construction of Readsboro development (22,000 kw.), with dam, tunnel, etc.	5,614,000
Construction of new lines	360,000
Construction of new substations	155,000
Extensions to existing lines.....	30,000
Extensions to existing substations.....	190,000
Additions to Station No. 5, above Hoosac Tunnel.....	61,000

During the history of the company, which is a wholesaler, power has been sold at the switchboard at between 7 mills and 8 mills per kilowatt-hour, dividing the entire income by total output. Variations have depended upon the relative amounts of primary and secondary power sold. Thus, in 1914, a low-water year, with little secondary power output, the price averaged 8 mills at the switchboard; in 1916, a good water year with high prices of coal and other supplies, it averaged 7.6 mills. This last figure applied also to the first five months of 1917. Actual prices paid by customers were about 16 to 18 per cent above the foregoing, on account of electrical losses in transmission and conversion.

NEW ENGLAND POWER COMPANIES—PRODUCTION, SALES, ETC.

Since the beginning of operation in 1910 to June 1, 1917, total production of the system has been 910,528,499 kw.-hr. Primary sales at the switchboard totaled 603,961,029 kw.-hr., and the revenue per kilowatt-hour from primary sales was 1.027 cents. Secondary sales totaled 182,927,715 kw.-hr., yielding 0.485 cent each. Line and transformation losses totaled 123,639,755 kw.-hr., or an average of 13.58 per cent. In general, the consumer pays around 1 cent for primary power and about 6 mills for secondary power per kilowatt-hour. In general, also, purchased power taken from other plants or systems has cost about 1 cent per kilowatt-hour. As

a rule, the price to the consumer is the price at the street voltage, the consumer installing his own transformers, although this arrangement is not universal. The load has now reached a point where it is necessary to purchase steam power throughout nearly the year. Mr. Harriman said:

The amount of energy which we purchase is according to stream flow. We purchase from various electric companies. Their contract with us, as a rule, is on the basis that they will deliver electricity if they have capacity to spare. It is not in a sense primary power for which they have to reserve capacity. Electric light companies have their high load and must have their high load from 4 to 6 p. m. in October, November and December. An average company must have about 50 per cent greater demand at that time than in summer. Our low-water period practically comes always in the summer, therefore electric companies practically always have capacity available when we require it, and in that way we have been able to make arrangements which I think are jointly profitable, in that it doesn't require additional capacity and consequent interest charge to make up the deficiencies on the system; but we have now reached the point where it is necessary to carry some load on steam practically throughout the year.

The demand for power is more active to-day than it has ever been before. The system closed a contract a few weeks ago for 4000 kw. in Rhode Island with the largest cotton mill corporation in the State. We had an application—now a contract agreement—for between 4000 kw. and 5000 kw. for one customer in Massachusetts, and face the question whether we are practically to stop business until prices go down or will go ahead on the present basis of cost.

Secretary Lane recently made a rather interesting statement. He urged all hydroelectric companies to increase their capacity to the utmost, first, to offset the present high cost of coal; but he emphasized the fact that even though this development was not finished until after the war, destruction of life would so decrease labor supply throughout the world that he felt that common labor in particular would be high for many years, and that meant that coal prices would be up very materially above normal prices of the last ten or fifteen years. I don't mean to imply by that that I think, or that the Secretary implied, that coal would stay at its present exorbitant price, but our own best estimate is that coal will be from \$1 to \$2 per ton (\$1.10 to \$2.20 per t.) higher on the average for the next ten years than it has been throughout the last ten years, and that, of course, is due primarily to scarcity of common labor from which coal miners are recruited and to consequently higher wages.

I compiled a few figures to show from the standpoint of coal output what our hydroelectric output meant. For instance, the output of the system for the present year will be certainly in excess of 250,000,000 kw.-hr. of hydraulic energy. Now, if you assume a coal consumption of 3 lb. (1.36 kg.) per kilowatt-hour, which is a fair assumption for the average cotton, woolen or paper mill to which we would sell power, that means that hydroelectric power is equivalent to 375,000 tons (337,500 t.) of coal. The additional plant (and reservoir) which we purpose to develop is estimated to produce about 112,000,000 kw.-hr. yearly, equivalent to about 170,000 tons (153,000 t.) of coal. The saving is not only in coal, but in transportation and equipment. For instance, a railroad man informed me that the whole 375,000 tons (337,500 t.) of coal sent into New England would mean 12,500 carloads. That would mean the continuous use of practically 1000 cars throughout the year. Now, I don't need more than to state the fact of the value it means to release rolling stock and other railroad equipment at this time.

NOTABLE FEATURES OF READSBORO DEVELOPMENT

Mr. Harriman added that while the company would be glad to make a smaller development at Readsboro than the one indicated if it were feasible, the engineering problem practically dictates that one development shall be constructed on the site. In general, the plan is

to construct a dam nearly 200 ft. (60.9 m.) high on the Deerfield River above the town. The dam will probably be the largest earth dam in the world, with a concrete spillway on one side to take care of any surplus water. It will create a storage reservoir of about 3,600,000,000 cu. ft. (305,000,000 cu. m.) capacity. From the dam a tunnel 14,000 ft. (4267 m.) long will lead to a power plant with an installed capacity in waterwheels of about 36,000 hp., operating under a maximum head of 390 ft. (118.8 m.). Even if no hydroelectric station were built at this site, the creation of the reservoir and the conservation of water secured will add 44,000,000 kw.-hr. to the output of the present power houses on the river. In the new power house will be generated about 64,000,000 kw.-hr., so that the total added on the Deerfield River will be around 108,000,000 kw.-hr.

In addition, the creation of this new reservoir will allow the Vernon plant on the Connecticut River to run at a somewhat higher load factor and enable the Vernon station to turn out about 4,000,000 more kilowatt-hours than at present. High and low water do not occur absolutely simultaneously with the two rivers. The Somerset reservoir added 21,000,000 kw.-hr. to the low-water flow of the Deerfield. Storms do not always strike the two basins in their course, and through careful load dispatching the various stations are handled so as to utilize the stream flow at each plant to best advantage.

EXHIBITING MODEL OF A HYDROELECTRIC SYSTEM

Operating Department Employees of New England
Power Company Prepare Model for Displays
of Local Boards of Trade

Employees of the operating department of the New England Power Company, Millbury, Mass., have completed a model of the system, as illustrated herewith,



MODEL OF NEW ENGLAND HYDROELECTRIC SYSTEM

for exhibition in connection with a local board of trade display.

The model shows in paper-pulp the topography of the watersheds and the arrangement of plants, lines and substations at all important points. Miniature steel towers with fiber disk suspension and strain insulators are connected by bare copper wire and the overhead ground wire is shown as in service. Models of oil switches and transformers at open-air switching stations are shown, together with cardboard building mod-

els and appropriate depressions representing reservoirs. When surrounded by maps and photographs the model becomes the nucleus of an exhibit of no little technical as well as popular interest.

ELECTROCHEMICAL SOCIETY MEETING TO BE IN PITTSBURGH

Special Features of the Sessions from Oct. 3 to 6 Will Be Papers and Discussions on Electrochemical War Supplies

The thirty-second general meeting of the American Electrochemical Society will be held in Pittsburgh on Oct. 3 to 6. A special feature will be papers and discussions on electrochemical war supplies and the part the electrochemical industry will play in the struggle.

The committee in charge is outlining an elaborate plan of technical sessions, visits to industrial plants and entertainment features. It invites delegates to arrive on Oct. 2, so as to get together informally and enjoy some recreation.

On Oct. 3 a regular meeting will be held in the morning, with optional excursions to industrial plants in the afternoon. In the evening an illustrated lecture will be given.

On Oct. 4 a symposium on "Electrochemical War Supplies" will be held in the morning, followed by excursions to industrial plants in the afternoon. A subscription dinner will be held at the William Penn Hotel in the evening, with special entertainment features. The ladies are especially invited.

Saturday, Oct. 5, will be devoted to an all-day excursion on a special train, with complimentary luncheon, to several industrial plants.

ELECTRICAL MEN ARE NEEDED BY THE ARMY

Telegraph Operators Especially Are Required—
Movement Instituted at Chicago to Help
Recruiting for Signal Corps

At a meeting convened in Chicago at which the greater portion of the electrical industry in the city was represented by executive officers of various concerns, an advisory committee of the electrical industry of the State Council of Defense for Illinois was formed. With Samuel Insull, chairman of the State Council of Defense, presiding, the following committee organization was worked out: Consulting board, Louis A. Ferguson, vice-president Commonwealth Edison Company; H. M. Byllesby, president H. M. Byllesby & Company, and B. E. Sunny, president Chicago Telephone Company; committee chairman, A. H. Krom, general manager American Association of Engineers; vice-chairman, L. C. Spake, ELECTRICAL WORLD; secretary-treasurer, H. A. Mott, Chicago Telephone Company.

Colonel Wildman, U. S. A., summed up the recruiting for the Signal Corps as follows: "We should have had 2800 men by July 1, and practically promised the chief signal officer that this number would be recruited by that time; 1800 men have been actually recruited, and in addition to this there are a possible 200 or 300 that have not reported. The most needed are telegraph operators. There are two reasons why we cannot get them quickly: First, there are not enough operators of re-

cruitable age in the country to be diverted to the army without decreasing efficiency of commercial companies and thereby decreasing efficiency of the army which utilizes commercial companies. Commercial companies are releasing men as far as possible by employing girls, boys and old men to operate mechanical devices which supplant hand operators. Second, in addition to telegraph operators, the Signal Corps must be supplied with engineers and mechanics skilled in every branch of the electrical trade. It must be possible for the force to rehabilitate completely wrecked power stations and to do other work of that character."

Samuel Insull said: "We will have to organize our own industry just as other industries have organized. It has been found necessary to do so in Europe, and if the war lasts long enough we may get to a point where we shall have to pick out certain men just to operate certain necessary industries, and industries that are not necessary will have to go by the board.

"We hope, of course, that such a situation will not arise, but our government is going ahead on the basis that it is going to be a very long war. The best opinion is all to this effect. I think that the first thing we should do is to fill up the electrical branch of the army; that is what the Signal Corps really is."

CENTRAL STATION HELPS IN THE ENLISTMENT WORK

Worcester Electric Light Company Uses Its Windows for Displays to Attract Men to Military and Naval Service

Central station co-operation with the government to encourage army and navy enlistments is shown in the accompanying photograph of a window display established recently by the Worcester (Mass.) Electric Light Company at its main offices. One window was devoted



DISPLAY IN A CENTRAL STATION WINDOW TO AID RECRUITING

to army and the other to naval exhibits furnished by the authorities, the embroidered silk-crossed flags at the rear of the naval window having been brought from the Philippines by an officer. The display was illuminated in each window by nine 100-watt gas-filled lamps and attracted a great deal of favorable press and popular comment.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Contract with Municipality.—A corporation may receive a grant of franchise for a term of years extending beyond the life of the corporation, the Court of Appeals of Kentucky held (195 S.W. 1097). In view of a statute expressly giving the city councils of cities of the fifth class power to contract for supplying the city with light, under a valid electric lighting franchise granted by such a city running from Sept. 21, 1911, to Sept. 21, 1931, a contract made on Sept. 21, 1911, for furnishing the city electric light from Feb. 1, 1912, to Feb. 1, 1932, was not wholly invalid under the law forbidding municipalities to make such a contract for a term exceeding twenty years, but was enforceable during the existence of the franchise, and only invalid and unenforceable after the expiration of the period for which the franchise was granted.

Contributory Negligence in Case of Telephone Lineman Shocked by Contact with Power Company's Lines.—Where an electric power company constructed its line on a highway over and across a telephone company's service line, whether it was negligent in failing to protect such wires from contact with telephone wires, in consequence of which failure a telephone lineman was injured, was for the jury, although the accident occurred in a manner which the power company could not foresee in specific detail, the Supreme Court of Iowa held in *Toney versus Interstate Power Company* (163 N.W. 394). In such case a lineman injured while engaged in repairing the telephone service wire was neither a wrongdoer nor a mere naked licensee, so far as defendant power company was concerned. Where in the lower court the defendant succeeded in excluding evidence that its wires were in the highway as being immaterial to its liability, it could not on appeal urge that its line was outside the highway upon a private right-of-way. That other electric companies generally do not use nets and guards and insulating covers prescribed by law is no defense for a power company's failure to comply with these requirements. The statute applies to a case where an electric power company has constructed, although prior to the enactment of the statute, its line on a highway over and across a telephone company's service wire. An electric power company's duty to protect from injury from its wires applies to dangers not only from currents transmitted but also from static electricity accumulating on its wires. That the telephone lineman failed to observe that a telephone wire

which, in tightening, had escaped him had recoiled over a power company's wire which he knew was uninsulated did not show his contributory negligence as a matter of law. Damages of \$8,500 for injury by electric shock to telephone lineman, thirty-one years old, married and earning \$55 a month and expenses, the evidence as to the permanency of the injury being conflicting, was held not to be so large as to show passion or prejudice, but to be a reasonable compensation for injuries due to the negligence of the power company in constructing its line as described and omitting to take proper precautions against such injuries.

Contributory Negligence in Case of Absence of Guards.—In an action for death of an employee, a complaint charging that defendant did not furnish deceased with a safe place to work, in that its dangerous electrical appliances, including switches, were not safeguarded and protected, in consequence of which servants were exposed to such appliances and were liable to be killed or maimed by them, followed by particular allegations concerning the steps, platform, switch and fuse and the proximity of these, with the object of showing that one using what was provided for a passageway was liable to come into contact with the dangerous and deadly contrivances for handling electricity, sufficiently stated a cause of action based on negligence in not furnishing deceased with a safe place in which to work, it was held by the Kansas City Court of Appeals (195 S.W. 1055). The act of an employer maintaining in a power house in an unprotected state an apparently unmoving and silent deadly agency consisting of a switch on a slab carrying 500 volts of current in such proximity to a passageway which employees were authorized to use that a slight unbalance or misstep or accidental raising of the hand or extending of the arm would mean certain death was gross negligence. Where a power house employee was killed in a passageway by coming in contact with an exposed switchboard carrying a deadly current when he attempted to avoid another employee who was carrying tools on his shoulder, he was not guilty of contributory negligence as a matter of law, although he had been repeatedly warned of the passageway and that he should be careful to avoid injury. An instruction declaring as a matter of law that if deceased had been warned of the danger of the electric switches which killed him and knew where they were located, then in using the stairway which required him to pass by the switches he assumed the risk, was properly refused, since it ignored the duty of the employer to use ordinary care to furnish a reasonably safe place to work upon which plaintiff's action was founded. An instruction as to deceased having chosen the dangerous way was properly refused, since it was shown that the defendant authorized the use of such way, and the instruction was an attempt to relieve it of its negligence in maintaining that way.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Obligation to Serve the Public.—The California Railroad Commission has authorized the Great Western Power Company to construct, operate and maintain electrical transmission and distribution lines throughout Plumas County, except in territory reserved for the Grizzly Electric Company, Quincy Electric Light & Power Company and Plumas Light & Power Company. The commission permits the Great Western Power Company to continue to serve the Philadelphia Exploration Mine in the territory reserved to the Plumas Light & Power Company. The Great Western company is building a 50-mile 44,000-volt transmission line from its Las Plumas plant to Crescent mills. The cost is estimated at \$154,000. The company urges that the needs of certain power consumers in Plumas County demanded early and favorable action by the commission. In referring to this request the commission says: "The commission will not be induced to act prematurely upon any matter on the plea that an emergency exists, particularly when, as in this case, it is obvious that the application could have been presented at a much earlier date." The Great Western company contended that the Plumas Light & Power Company occupies the position of a competitor, and that it should not be required to sell electrical energy to the Plumas company in excess of the amount provided for in the present contract between the two companies. The commission rejects the contention of the Great Western and requires it to sell to the Plumas company such electrical energy at reasonable rates as the latter may require for distribution and resale in that portion of Plumas County reserved to it. Referring to the right of public utilities to select their patrons, the commission says: "It is clearly the duty of a public utility situated as is the petitioner to supply every reasonable demand for service at non-discriminatory rates and under just terms and conditions. Nor can this duty be avoided, modified or abridged in any manner whatsoever, either by contract between the utility and any private interest or by the maintenance of unsuitable facilities for general distribution. It should be made perfectly clear that the rights under a general franchise granted by competent public authority are not to be construed as simply permissive privileges to be exercised at the option of the utility solely for its private gain, but such a franchise contemplates service in the entire territory covered by the franchise in a manner which will best serve public interests."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Further Restriction of Lighting in Berlin.—An order has been issued restricting the lighting of stores, hotels, restaurants and cafés in Berlin to one-fifth of the degree of illumination permitted up to the middle of December, 1916, when the preliminary order affecting illumination went into effect.

Move to Reduce Number of Lamps in Clusters at Columbus.—Herman Gamper, consulting engineer at the municipal plant at Columbus, Ohio, is working out a plan to remove two of the lamps on all clusters in the business district, leaving three on each one. He claims that this will leave ample lighting capacity. Councilman Westlake will endeavor to have this plan incorporated in the street-lighting improvement plans, as he says that it will save the city \$100 per day or \$36,000 per year. He will also ask the Council to approve the use of red, white and blue globes on the lamps on High Street, as a recognition of the spirit of the times.

Hearing on Cincinnati Gas & Electric Company Application for Bond Issue.—Testimony was heard by the Ohio Public Utilities Commission on July 27 on the application of the Cincinnati Gas & Electric Company for permission to issue \$2,500,000 first and refunding mortgage 5 per cent forty-year sinking-fund bonds. Vice-president F. T. Wickham testified that the proceeds are to be used in completing the new central station and purchasing equipment, for which \$4,100,000 bonds were authorized in 1916. The outlay on the new station to May 31 is said to have been \$1,878,344, and it is hoped to complete the plant before the lease on the Miami & Erie Canal water expires in 1918. Water for the new plant will be taken from the Ohio River.

California Companies Seek Consolidation.—The Sierra & San Francisco Power Company and the Yosemite Power Company have filed with the California Railroad Commission an application for authority for the latter company to sell to the former all the property in its La Grange division for \$450,000, or such sum as the commission shall determine to be a fair price. The Sierra company operates an electric and water system in the counties lying between San Francisco and Tuolumne and also in Stanislaus County, and the La Grange division of the Yosemite company is in Stanislaus and Tuolumne Counties. The Sierra company has an authorized capital of \$20,000,000, all outstanding, and \$17,000,000 bonds. The company has paid no dividends. The Yosemite company has an authorized capital of \$10,000,-

000, of which \$2,050,000 is outstanding. It has bonds of \$1,708,000. It has not paid interest on its bonds during the last fiscal year, and owes notes besides. The company says that the original cost of the La Grange division property to it was \$473,700, and that its present reproduction value is \$559,000. The Sierra company states that it wants to buy the property because it can manage it advantageously in connection with its other plants in Stanislaus County and elsewhere, and that the Yosemite company wants to sell because the communities served by it are growing beyond its capacity and it has no other electric power plants to meet the increasing demands for power. It has, says the company, large and varied property capable of developing electric power, and by transferring the operating property of the La Grange division to the Sierra company, the latter can serve these communities, while the Yosemite company can devote its efforts to latent properties.

Hearing in Cleveland Rate Case.—The hearing on the valuation of the property of the Cleveland Electric Illuminating Company before the Ohio Public Utilities Commission was completed on July 26. The hearing follows an appeal from an ordinance which sought to establish a rate of 3 cents for energy for domestic purposes in Cleveland. Company engineers placed the value of the property at \$22,478,342, while engineers of the commission fixed a tentative valuation of \$20,820,061. The chief witness for the city at the adjourned hearing, which consumed two days, was F. W. Ballard, former Light and Heat Commissioner of Cleveland. He declared the value of the property to be \$11,913,061. According to his testimony, he took the company figures and rejected such items as he thought should not be included. Interest during construction, Mr. Ballard claimed, had been paid from earnings and should not be included in the capital account. Money supplied from the earnings to the upkeep fund and used for extensions was counted both in the upkeep fund and the extensions, he claimed. Many of the items included in the \$6,000,000 of intangible values were thrown out by Mr. Ballard, because he thought that they should not be there. The company will make its contest against his testimony on the ground that he did not have sufficient time to make a proper investigation. Roy Husselman, employed as consulting engineer by the city, was cross-examined on his claim of \$14,000,000 as a proper value for the property. The city presented testimony showing that the company since its organization in 1899 had paid \$8,832,046 dividends. The best year was 1914, when dividends to common stockholders were \$1,163,110. For the last two years the dividends have been \$781,080 per year. The idea of the city in producing this testimony was to show that the company is paying too much in dividends and that some of this should go toward reduction of rates.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 239 of this number.

Dayton Company Gives Dinner to Enlisted Employees.—The officers of the Dayton Power & Light Company Section of the National Electric Light Association gave a dinner on July 12 to the employees of the company who are leaving it at the present time to go into active military service. Charles F. Bell, Charles E. Collins, Frank Kendig and Howard Tanzey have joined Battery D of the First Field Artillery, Ohio National Guard, and John Carrothers has joined Company C of the Third Indiana Infantry. M. H. Wagner, president of the section, was chairman at the meeting.

St. Louis Jovians Have Excursion and Elect Officers.—Nearly 2000 persons, including Jovians, their families and friends, attended the river excursion held aboard the steamer Alton at St. Louis on Friday evening, July 20. The event marked the retirement of E. H. Waddington as chairman of the entertainment committee after a very successful term of three years. The election of officers of the league for the coming term, held aboard the boat, resulted as follows: President, W. N. Matthews, president W. N. Matthews & Bro.; vice-president, E. H. Waddington, sales manager Western Electric Company; secretary-treasurer, George McD. Johns, superintendent fire-alarm system of St. Louis; executive committee, Bruce Cameron of the United Railways, C. E. Ruffner of the Electric Company, S. M. Boyer of the General Electric Company, and Horace Beck of the Light & Development Company.

Annual Meeting of Society for the Promotion of Engineering Education.—The twenty-fifth annual meeting of the Society for the Promotion of Engineering Education was held in Washington, D. C., July 6-7. As President Chatburn stated in his annual address, the meeting was transferred from Northwestern University, Evanston, Ill., to Washington, D. C., "because the exigencies of the times demanded that the meeting be held in proximity to those who were working out the measures for the successful prosecution of the war. We could not expect them to leave their work for two or three days, whereas if we came to Washington we might hope for an hour or two of the time of several persons in authority covering many branches of governmental service." The program was devoted to the general topic of "The Relation of Engineering Schools to the Government During War." Among the speakers were Secretary of War Baker and other prominent government officials.



BRIG. GEN. G. O. SQUIER

Brig. Gen. George O. Squier, U. S. A., chief signal officer of the army, has recently been made a fellow of the Royal Society of England in recognition of his invention of a new system of ocean cabling which, it is believed, will be of the greatest service in the war. A patent was obtained on the invention by General Squier on Wednesday of last week. He was graduated from Johns Hopkins University in 1893 and worked as a research student under the late Professor Rowland. He devoted especial attention to radio-telegraphy in military operations. In 1911 he presented a paper before the American Institute of Electrical Engineers on multiplex telephony and telegraphy by means of waves guided by wire, and in the following year he was awarded the Elliott Cresson gold medal for his researches in multiplex telephony. In 1912 he was appointed military attaché to the United States Embassy at London, and it was while in London that he applied for the patent which has just been granted to him.

W. O. Haymond has been appointed superintendent of power and will have charge of the plant of the Muncie (Ind.) Electric Light Company.

I. B. Shepherd has been appointed general manager of the Etowah (Tenn.) Water & Light Company, succeeding W. H. Price, who resigned.

Homer Mock, commercial manager of the Lancaster (Ohio) division of the Ohio Light & Power Company, has joined the Logan (Ohio) company of the Seventh Infantry.

W. L. Barker, electrical engineer of the Southern Utilities Company, consisting of electric, gas and ice properties in Florida, has resigned to accept the position of electrical engineer of the Manila (P. I.) Electric Railroad & Light Company. Both of these companies are under the management of the J. G. White Management Corporation of New York City. Before joining the organization of the Southern Utilities Company Mr. Barker was connected with the staff of the General Electric Company. He is a graduate of the Alabama Polytechnic Institute.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

F. A. Noyes has been appointed division superintendent of the eastern division of the Consumers' Power Company, with headquarters at Saginaw, Mich. Mr. Noyes succeeds D. R. McDuffee.

E. L. Whitehead, who for a number of years has been chief engineer of the Kalamazoo steam plant of the Consumers' Power Company, has been appointed to the position of chief engineer of the company's plant at Battle Creek, Mich., succeeding T. M. Hooper.

A. Larkin, who for many years assisted E. L. Whitehead in the operation of the Kalamazoo steam plant of the Consumers' Power Company, has been appointed chief engineer of the plant, succeeding Mr. Whitehead, who has gone to the Battle Creek plant of the company.

John F. Card, for the last eighteen years superintendent and designing engineer of direct-current machinery for Fairbanks, Morse & Company at Three Rivers, Mich., has resigned to go into the manufacturing business on his own account. Mr. Card has been in the electrical machinery and manufacturing business for twenty-five years. He was at one time connected with the Triumph Electric Company of Cincinnati, Ohio, later going to Mansfield, Ohio, to organize the Card Electric Company, now known as the Phoenix Electric Company. After remaining with this company about five years, Mr. Card took up his residence at Three Rivers, Mich., during the spring of 1899, and organized the Three Rivers Electric Company, then owned by the Sheffield Car Company, but later purchased by Fairbanks, Morse & Company of Chicago. He was born in Illinois, received his education at Covington, Ky., and began his business career with the Card Electric Motor & Dynamo Company of Cincinnati, now the Allis Chalmers Company. Later he took charge of a large electrical repair shop after having been in the employ of the Cincinnati office of the General Electric Company for about one year retesting and rebuilding arc lamps and arc machines.

Edward N. Hurley, former chairman of the Federal Trade Commission, was appointed last week by President Wilson to head the Shipping Board. Mr. Hurley is well known as an electrical manufacturer, having been president of the Hurley Machine Company, manufacturer of electric washing machines, prior to his appointment on the trade commission. He resumed the presidency of this company early in 1917



E. N. HURLEY

on his resignation from the commission. Mr. Hurley was born in 1864 and entered railroad work in early life, serving as engineer for the Chicago, Burlington & Quincy Railroad until 1888, when he joined the United States Metallic Packing Company as a salesman, later becoming manager. In 1896 he resigned to organize the Standard Pneumatic Tool Company, his interests in which he sold in 1902, when he engaged in farming and stockraising. In 1913 he was appointed United States trade commissioner to the Latin-American republics. He was made president of the Illinois Manufacturers' Association in 1914, and in the following spring was appointed a member of the Federal Trade Commission.

Obituary

B. H. Durbin, one of the best known younger electrical men in the Middle West, was killed in an automobile accident near Pittsburgh, Pa., on July 21, when a faulty steering gear threw the automobile over an embankment. For the last five years Mr. Durbin had been connected with the Bryan-Marsh division of the National Lamp Works of the General Electric Company, traveling out of its Kansas City office. He was an active Jovian, holding the office of statesman from Iowa.

Albert Frederick Ganz, professor of electrical engineering at the Stevens Institute of Technology, Hoboken, N. J., died suddenly on July 28. He was born April 25, 1872, at Elberfeld, Germany, and came to this country in 1881. He was graduated from Stevens in 1895 and entered the department of physics and applied engineering at the institute as an instructor, becoming assistant professor two years later and professor and head of the department of electrical engineering in 1902. Professor Ganz contributed largely to the development of engineering and of the technical press. He was known for his research work on electrolysis from stray electric currents. He was a member of a large number of national engineering societies and was a fellow of the American Institute of Electrical Engineers.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

LARGE OUTPUT OF PORCELAIN ELECTRICAL SUPPLIES IN 1916

Domestic Market Buys \$7,034,420 Worth, Which Is an Increase of \$2,363,218 Over the Previous Twelve Months

The value of porcelain electrical supplies marketed in the United States in 1916 was \$7,034,420, an increase of \$2,363,218 over 1915, according to the United States Geological Survey, Department of the Interior. These wares were reported from ten states, of which Ohio was the leader, reporting wares to the value of \$2,181,026. New Jersey was second, with \$1,674,093, and New York third, with \$1,623,433. These three states reported 78 per cent of the value of the entire output.

WAR CREATES CHANGES IN DISTRIBUTION POLICIES

Rule Not to Quote to Government but Only to Sell Through Regular Channels Temporarily Abandoned

It has been a policy with some manufacturers never to sell except through recognized local channels of distribution, such as agents or jobbers. A sales policy of quoting prices on and selling no complete apparatus to the user has been established, and manufacturers have declined to quote on or furnish apparatus direct to the federal government or to state or city governments purchasing apparatus for use by themselves.

War conditions have brought many readjustments and changes to every one. With a view to facilitating the conduct of the government during time of war and actuated by a patriotic desire to effect for the country at large any possible saving of time or money in the procuring of apparatus or material, one of the largest manufacturers of fan motors announces that it will until further notice quote on and furnish any apparatus or material its factory can supply direct to the federal government or any department thereof. Such orders and requests for prices will no longer be referred to dealers and wholesalers, but will be handled with all the dispatch which can be concentrated upon emergency purchases.

GROWTH OF PLAN TO TIE UP WITH NATIONAL PUBLICITY

Hotpoint Electric Heating Company Sends to Trade Comprehensive Plan for Its Advertising for Remainder of Current Year

With all the national advertising that is now being run in high-priced weekly and monthly magazines, tending to interest the ultimate consumer, it is doubtful if there is very much simultaneous advertising done by the trade. To a certain extent, of course, this has been due to misplaced confidence. It has not been unusual for manufacturers and large distributors, after going to the trade promising large advertisements in national magazines having immense circulation and urging the dealer to stock up in anticipation of the demand which this publicity would create, to back down on the publicity when the time came. A good many dealers, therefore, have taken the stand that they believe only what they see.

To come out, however, with a comprehensive campaign

for national publicity in black and white covering a very definite period, showing the trade how it can tie up with it and furnishing for the trade all kinds of selling help such as window displays, newspaper advertisements, slides and information on merchandising, is a new step.

Two weeks ago the Western Electric Company brought out a book showing in detail all its dealer help and how they could be tied up with the national publicity campaign that it is continually running. This week the Hotpoint Electric Heating Company has brought out a book giving in detail the national publicity campaign of the company for the remainder of the current year, together with a complete catalog of all of its appliances with prices, sales help for the dealer for tying up with this publicity, sales plans for summer, fall and holiday campaigns in detail, and seasonable window displays with information on how to set them up.

These two books, while entirely different, aim to accomplish practically the same results. The dealer knows the plans of the distributor, knows how he can tie up with him, what help he can expect from him, and how to sell those goods in advance. The coming out of these two books at this time and so close together is significant, and there seems no doubt that a new era in electrical merchandising has been begun.

THE WEEK IN TRADE

MARKET conditions generally showed little change during the week. Some jobbers altered their discounts in wiring material, probably in an effort to stimulate contractor buying, which has fallen away to almost a minimum. In each case, however, the condition was probably entirely local. Wire showed a little softening, particularly in small lots. The price of copper, however, is strengthening, and it is doubtful if some of the low prices quoted on wire this week can be maintained.

Seasonable supplies show better sales as a result of the hot wave that is engulfing the Middle West and East.

NEW YORK

There has been practically little or no change in the New York market during the past week. Prices, with the exception of standard porcelain and a few odds and ends, were steady. There has been, of course, the usual summer slump from the regular channels of trade, but this has been made up by demands from other sources. Contractors are doing practically no buying, as building operations are at a low point. On the other hand, the industrial requirements are still large and show no abatement.

Local stocks on standard material, with the exception of fans, which moved rapidly under the spell of extreme hot weather, and perhaps a few other items, are in excellent shape under the better deliveries.

It is not improbable that buying by jobbers may fall off considerably within the next few months. A good many orders were placed earlier as protection against poor deliveries, but now that the railroads are making better time local stocks are fast filling up to the limit. Should local building continue to show a falling off, these stocks will serve for an indefinite period, and therefore higher prices seem further away.

There appears to be a tightening up on credit terms,

with greater insistence on prompt payment, especially from contractors and fixture dealers. Collections have picked up after the slump of a week or ten days ago.

LABOR.—The report on the labor market in New York State for June has just been made by the State Department of Labor, and shows a slight decrease in the number of employees. The water, light and power utilities increased both their number of employees and wage payment of 5 per cent in June as compared with May, thereby establishing new high records in both respects. As compared with June of last year, there were 7 per cent more workers and 13 per cent more wages.

BELLS.—One of the manufacturers of bells and gongs and similar house goods advanced the price on his lines during the week.

FANS.—The more seasonable weather of last week was reflected in local fan sales. Retailers did a very good business. Wholesale stocks are now gone with the exception of a few odds and ends. Weather reports indicate a continuation of hot weather for an indefinite period, so that it is reasonable to believe that retailers will carry little or no fan stock over the winter. There has been great difficulty in obtaining standard types of fans, while orders for special-finish fans that are coming in every day are being turned down.

HEATING APPLIANCES.—One large distributor received orders for nine electric mangles last week for use in large homes in the near vicinity of New York City. Ordinarily the sale of two mangles a month is considered good business. The acuteness of the servant problem in this territory is undoubtedly the controlling factor in these sales. There is a good demand for heating appliances from the government. Central stations are not buying any flatirons, but are placing some orders for toasters.

WASHING MACHINES.—The announcement of an advance in prices which is daily expected had not been made up to the time this was written.

STANDARD PORCELAIN.—A considerable advance, in the neighborhood of 15 per cent, has just been made. The advance is not uniform and depends largely upon the grade and kind of porcelain. Deliveries are becoming much better.

WIRE.—The market is rather uncertain. Some manufacturers are quoting lower prices, while others are holding firm. There are reports of some unloading of copper by those with large stocks, but on the whole it is just as difficult to obtain stocks as it ever was.

CONDUIT.—The demand from contractors owing to the falling off in building operations is not keeping up, and for this reason it seems doubtful if there will be any immediate increase in spite of certain rumors of coming advances. Local stocks are in good shape. Owing to freight embargoes on conduit on certain roads to Eastern points it is difficult to obtain supplies at present.

ARMORED CONDUCTOR.—There is no particular call for flexible-steel armored conductor. Large stocks were laid in some time ago, and there has been no appreciable depletion of them.

SOCKETS AND FITTINGS.—Local stocks are excellent and deliveries are good. There are no indications of a change in price. There have been rumors of anticipated prices, but it is doubtful if these rumors have been other than efforts to boom the market.

AUTOMOBILE EQUIPMENT.—The demand for electric starting and lighting equipments for medium and low-priced cars for the last thirty days has been increasing and it is believed will continue to increase, although for some time there has been a very marked slump in this market.

CREDITS AND COLLECTIONS.—There was a marked falling off in collections a week to ten days ago, but they are now much better and indications are that the collections for the month of July will be very heavy. Credits are getting tighter and tighter with certain classes of the trade. Less time is being given to contractors and fixture houses owing to the conditions with which these two elements of the trade have to contend. Fixture houses have experienced a very considerable falling off in business, while the contractors are faced with the slump in building opera-

tions in all but industrial lines. Contractors have also laid in large stocks of material at high prices. For these reasons these classes of the trade are not considered so good a risk as in normal times.

CHICAGO

The question "How is business?" asked in the Chicago territory this week usually brought the answer "Slowed up a little." An investigation showed, however, that the general impression that business is slowing up is obtained through a view of comparative values. Inquiries into the business of jobbers for June showed that the sales for that month had been from 25 to 40 per cent ahead of the same month last year, the average figures for the jobbers interviewed being between 30 and 35 per cent. It is expected that July will not be so far ahead of July last year on account of the fact that last year's sales were boosted by the heavy movement of fans, while this year fan sales have been light. Furthermore, the business in the city of Chicago has been affected by labor conditions. While the opinion is not unanimous, some jobbers believe that the government's policy in connection with copper and steel purchases has caused uncertainty which made itself felt in their business. They state that the effect has been somewhat the same as would be expected during peace negotiations. At the same time, however, these jobbers are not at all in a mood to sacrifice the stock they are carrying, since they realize that the deliveries they will be able to make from stock later on in the year will permit them to render valuable service. Credits and collections remain about the same.

INSULATED WIRE.—Wire salesmen are having a difficult time explaining the present situation to customers. The advance in cotton yarn has more than offset the recent decrease in the price of copper, so that the price of insulated wire has increased. To illustrate how important this phase of the wire situation is, it may be pointed out that in 1000 ft. of No. 18 fixture wire the difference in cost of manufacture now, as against three months ago, is 44 cents. This is entirely due to the difference in the cost of yarn. Of course, in larger conductors the increase in proportion to total cost is not so noticeable.

FANS.—Fans are moving rapidly. The majority of purchases are being made by isolated plants and offices. The jobbers have noticed this tendency, and it is further borne out by the fact that department store sales have been almost nil.

TRANSFORMERS.—Many central stations in the Middle West have already sent lists of transformers to government authorities at Washington covering the units which they are prepared to furnish for cantonment purposes. It is understood that the government was unable to secure new transformers and has taken this means of getting the equipment promptly.

AUTOMOBILE SUPPLIES.—While the season as a whole has been somewhat backward, the demand for this class of goods is generally fair.

INCANDESCENT LAMPS.—William P. Clark, international president of the Flint Glass Workers' Union, announced at Toledo, Ohio, on July 26, that 1200 electric-bulb makers in Ohio had been granted an increase of 35 per cent in wages.

BOSTON

No marked change in the volume of business appears among jobbers compared with a week ago, although a slight improvement in credit conditions is reported in eastern Massachusetts. Trade is rather spotty at this time, some dealers noting an increase and others slight reduction in business. A prominent Boston jobber reports that the demand for large electrical equipment holds up well and that appliances are moving more freely. The outlook for housewiring this fall appears to be very poor, with the exception of alteration jobs. Architects specializing in residential work are quiet, the high cost of labor and materials proving a discouraging factor to owners of both

cheap and expensive establishments. Shore resorts in this territory report excellent business, which is reflected in good central station earnings. More attention than ever is being given to the efficient merchandising of appliances at seaside places, especially those occupied by the well-to-do.

No specific price increases were noted this week, and in some instances prices on large jobbing orders have been shaded a trifle in order to secure the business. Labor conditions remain about as a week ago, and deliveries are practically unchanged.

A very heavy volume of business is being handled in the textile power field, motors being in great demand for both war order and private mill service. The central station is coming into its own here, unit cost of power being less of a factor than the increased value of capital for use in manufactures as compared with money invested in private plant equipment.

LAMPS.—Prospective central station demands are fully up to normal. The volume of business holds well and manufacturers are increasing their stocks daily. The amount of business which will be carried this fall cannot readily be forecast at this time, pending settlement of the agency-consignment question between central stations and lamp producers. Deliveries are improving and prices remain the same, in general.

TEXTILE POWER EQUIPMENT.—Motors are in great demand and price is a secondary consideration in this field at present. Central stations in New Bedford and Fall River, Mass., and elsewhere are coming into their own in regard to textile service. The June output of the former company exceeded that of June, 1916, by 203 per cent, and a 207 per cent increase was noted in May. The growth of power business in New Bedford, a city of about 110,000 inhabitants, has necessitated the building of a 52,000-kw. turbine plant rapidly approaching completion. In the Connecticut Valley important power developments are under way associated with textile and other service. It would be unsafe, according to good authority, to count upon unchanged textile motor prices, since these reflect manufacturing costs subject to increase.

INDUSTRIAL ELECTRIC TRUCKS.—Inquiries are increasing, and price changes are not in immediate prospect. Diversified sales are a feature of this business, and competition is unusually keen. Deliveries remain satisfactory, on the whole.

FANS.—Recent warm weather lowered stocks materially, and some jobbers are nearly cleaned out. Central stations report a brisk demand.

IRON CONDUIT.—The demand is strong for industrial wiring installations, and jobbers with stocks filled in advance of present requirements are still able to supply local needs to advantage. On the manufacturing side, however, the shortage of labor, raw material and transportation tells heavily against satisfactory delivery and price conditions.

LABOR.—Conditions are on the whole fairly good. A serious strike in the shoe industry at Lynn, Mass., is being protracted to a troublesome point, with adverse influence upon local electrical demands. A prominent jobber reports improved labor conditions. Contractors are finding conditions easier as regards labor supply.

FIXTURES.—Business is increasing somewhat, though little fall trade can be identified as yet. Prices remain about the same as last week.

APPLIANCES.—Trade continues excellent. One suburban central station outside of Boston notes a growing demand for electric ranges, even of the higher-priced types. Purchasers are emphasizing the economy of these equipments as a striking advantage under present fuel-cost conditions. Washing machines are moving well.

TELEPHONE EQUIPMENT, ETC.—The manufacture of telephone equipment and industrial signaling apparatus is at present stimulated by government orders. It cannot be said that prices have reached the top in view of labor and material conditions. Plants are very active.

ELECTRIC HEATING APPARATUS.—A heavy demand for domestic and industrial apparatus is noted. Much electric heating equipment is on order for the army and navy. In-

dustrial products are moving freely and stocks are light. Although no price advances are scheduled, good authority looks for further increases before many months if present tendencies continue.

ATLANTA

Building permits are far in excess of the same period a year ago, with an equivalent increase in the amounts expended. June was considerably above last year's record, and up to the present time July is doing almost as well.

The good showing in construction is exclusive of that being done at cantonments and in the fire district. Practically no building has been started in the section of Atlanta wiped out by the big fire. This is due to the fact that all labor is employed on other work. Building material prices are very high and hard to obtain. It is not probable that any extensive rehabilitation will take place until the necessary factors in construction ease up. Other construction, however, is keeping all lines busy. The jobbers are securing some good orders from quartermasters at cantonments covering material for temporary work until such time as regular shipments commence on material already on order from the large distributors.

FIXTURES.—There has always been a strong demand for the standard types of fixtures in this section, but the business for this year to date is away above normal. In fact, one jobber reports his sales as being 50 per cent greater than last year. The many new apartments and small residences under construction, combined with building renovations, accounts, no doubt, for the increased activity in this line. The candelabra and semi-indirect types seem to be the most popular.

HOUSEHOLD APPLIANCES.—The market for specialties has not been so good lately, and this is probably due to a momentary move of economy. However, the dealers have had a good week on the sale of vibrators and electric churns. Heating appliances, sewing-machine motors and vacuum cleaners are moving slowly, which is to be expected at this season of the year.

FANS.—The vicinity of Atlanta is experiencing cooler weather than normal, and the trade has only had about three weeks of real fan business up to date. Although the season is advancing rapidly, there is no apparent sign of discouragement as the more southerly districts and so-called "hot belt" sections are drawing on stocks steadily, which will offset deficiencies for the northern portion. It is expected, therefore, that the business as a whole will be equal to last year.

INSULATORS.—The construction of new and re-insulating of existing transmission lines by the power companies of the Southeast has created a heavy demand on the insulator manufacturers during the period in which they have had labor difficulties. Prices have advanced 100 per cent over last year, and deliveries for this vicinity show no improvement.

ST. LOUIS

There has been very little change in the electrical commercial situation in this territory during the last week. Collections are possibly a little better and orders continue to hold up. On the whole, the outlook for good crops in this vicinity is splendid, which augurs well for prosperity in the agricultural districts in the fall.

Although a large amount of material is being purchased for the United States army cantonments and encampments now building at Little Rock, Ark., Belleville, Ill., and Fort Sill and Fort Worth, Tex., not a great deal of this material is being taken from St. Louis stocks. As has been before noted in these columns, the orders have to a large extent been placed direct with the manufacturers, who have for the most part been shipping direct to the point of installation. However, some material bought from some of the big concerns in New York is being sent to the encampments from the manufacturers' St. Louis stocks or from those of local jobbers.

The local manufacturers still complain of the tremendous difficulty in obtaining raw materials, principally those

of iron, such as castings and sheets. Prices for iron materials are excessive. In fact, in some instances plans for future manufacture have been held in abeyance on account of the high nominal prices which are now being quoted for these metals. Certain executives are holding off buying at the present prices.

In Wichita conditions are about the same. Some other lines are suffering a decrease, but the electrical line continues to hold up. At Dallas, Tex., and Memphis, Tenn., business in general is above normal with no indications of an immediate let-up. One jobbing house in St. Joseph, Mo., reports that its business is the best it has had in years.

WIRING SUPPLIES.—Conditions are practically the same as outlined in last week's report. Conduit and conduit fittings are still giving considerable worry because of inability to obtain them. One instance has been reported where some iron conduit fittings ordered last April have not yet been delivered.

FANS.—Fans are still moving but very slowly. However, the temperatures have during the past week been much higher on the average in this territory, which will doubtless accelerate sales.

POLES.—Poles are scarce and promise to be scarcer. Prices are up and doubtless will go higher.

CROSS-ARMS.—An advance has been scheduled for Aug. 1. No definite information can be had as to the amount of the promised advance. Some local jobbers will not now quote on orders other than those which they can fill from their existing stocks. The coming advance is apparently due to labor difficulties and to the great demand for timber for government and other purposes.

INCANDESCENT LAMPS.—The situation remains about the same as last week. There is a tendency in some quarters to discount the prediction that was made last week that there might be a scarcity of lamps in the fall.

ELECTRIC MINING EQUIPMENT.—An order for electric locomotives and motors totaling in the neighborhood of \$50,000 was placed in this territory recently.

FARM-LIGHTING OUTFITS.—The demand is not great during the summer months, but the jobbers and manufacturers are preparing for a big business later in the season. It is believed that, owing to the advertising effects of the exhibits which will be used at the county fairs this fall and to the general prosperity of the farmers, the aggregate sales will be very satisfactory.

SAN FRANCISCO

Conditions have changed only slightly since last week. However, in spite of the fact that there has been little building activity, contractors and dealers are still meeting obligations promptly. Industrial business remains good. Several large government orders for cantonment supplies have been booked this week and shipbuilding continues to be an important factor in the trade of the month. July and August are the slack months in California on account of weather and vacations, particularly in the city of San Francisco, and it is not predicted that there will be much change in the general conditions for some weeks.

FANS.—There is still a great demand for fans, and the continued hot weather in the central valleys indicates that this will continue much later than usual. Deliveries are still very poor.

WIRE.—Rubber-covered wire is active and stocks are good. Price is steady.

POLE HARDWARE.—Condition of stock in pole hardware is improving on account of better deliveries, and the demand in this line is very brisk.

LAMPS.—The lamp situation remains serious, with no prospect of change.

SWITCHES.—Safety switches are in great demand, probably because of inspection by the Industrial Accident Commission, which is enforcing its safety rules; but this business is hard to handle on account of slow deliveries. Knife switches in all sizes are in great demand, but deliveries are so poor that the business cannot be well handled.

SEATTLE

Business along all lines in the Northwest is chaotic on account of prevailing strikes and threatening walk-outs. No particular change is noticed in electrical stock conditions over last week, while buying continues to be conservative. Appliance business is holding up well owing to constant activities of large central stations, although there was a slight decrease during the week in comparison with the week previous. Large building is at a minimum and small building is very slack. This applies to every city in the Northwest with the exception of Spokane, which shows a slight increase in the volume of business of larger dealers. July business was about the same as for the same period last year, with the number of customers cut almost in half. The shipyard business is the mainstay of Northwest dealers. Owing to decreased movements of lumber to Eastern markets, the railways serving the Northwest are enjoying a period of car surplus and arrangements are under way by which idle equipment may be stored on sidetracks of subsidiary lines. Traffic men believe that within a few weeks, when farm crops move to market, surplus cars will be in demand. Slowing up in lumber shipping is attributed to decreased production caused by strikes in a majority of the mills and logging camps. Credits and collections are fair. Dealers report considerable falling off of demand for motors, lighting equipment and electrical equipment in sawmills.

CONDUIT.—Conduit prices are unchanged, but indications are that there will be further advances in the near future.

LINE MATERIAL.—The demand is falling off slightly. Increase in price is noted.

APPLIANCES.—The demand for electric ranges shows steady improvement. Irons show satisfactory volume of sales.

FIXTURES.—Fixtures are rather quiet. The fall trade has not begun to materialize.

MOTORS.—Demand for motors for industrial shops and shipyards far outstrips supply. Shipments on these are extremely hard to obtain.

LAMPS.—There is a satisfactory summer business. Prices remain about the same.

WIRING DEVICES.—Movement on wiring devices remains firm and jobbers are fulfilling orders.

METALS MARKETS CONDITIONS

Copper Quotations Show Marked Strengthening on Shortage Rumors

Copper quotations became much stronger during last week on rumors of a threatened shortage due to the strikes at the mines. Wire base, however, showed a further softening. Aluminum dropped off considerably last week.

Nominal quotations on electrolytic copper on Monday were as follows: August, 28.25 cents; September, 27.75 cents; October, 27.25 cents; fourth quarter, 26.75 cents.

NEW YORK METAL MARKET PRICES

	July 23			July 30		
	£	s	d	£	s	d
Copper:						
London, standard spot	130	0	0	125	0	0
Prime Lake	28.00	to	29.00*	29.50	to	30.00*
Electrolytic	26.25	to	26.75*	28.00	to	28.50*
Casting	25.00	to	25.50*	26.50	to	27.00*
Wire base	35.00	to	36.00*	33.00	to	33.50*
Lead, trust price	11.00			11.00		
Nickel, ingot	50.00			50.00		
Sheet zinc, f.o.b. smelter	19.00			19.00		
Spelter, spot	8.55	to	8.67½	8.55	to	8.67½
Tin, Straits	62.50			63.60		
Aluminum, 98 to 99 per cent.	51.00	to	53.00*	46.00	to	48.00*

OLD METALS

Heavy copper and wire	25.50 to 26.00	24.00 to 24.50
Brass, heavy	15.00 to 15.50	15.00 to 15.50
Brass, light	12.50 to 13.00	12.50 to 13.00
Lead, heavy	8.75 to 9.25	8.75 to 9.00
Zinc, old scrap	6.00 to 6.25	6.25 to 6.50

*Nominal.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor		List, per 1000 Ft.
B. & S. Size		
No. 14 solid.....		\$61.00
No. 12 solid.....		71.00
No. 10 solid.....		90.00
No. 8 solid.....		106.00
No. 6 solid.....		145.00
No. 10 stranded.....		95.00
No. 8 stranded.....		115.00
No. 6 stranded.....		160.00
No. 4 stranded.....		205.00
No. 2 stranded.....		266.00
No. 1 stranded.....		315.00

Twin-Conductor		
No. 14 solid.....		104.00
No. 12 solid.....		135.00
No. 10 solid.....		185.00
No. 8 stranded.....		235.00
No. 6 stranded.....		370.00
No. 4 stranded.....		575.00

NET PRICE PER 1000 FT.—NEW YORK

Single-Conductor		
No. 14 solid.....		
Less than coil.....	\$54.90 to \$67.10	
Coil to 1000 ft.....	48.80 to 59.17	
No. 12 solid.....		
Less than coil.....	63.90 to 78.10	
Coil to 1000 ft.....	56.80 to 68.87	

Twin-Conductor		
No. 14 solid.....		
Less than coil.....	\$78.00 to \$114.40	
Coil to 1000 ft.....	75.00 to 93.60	
No. 12 solid.....		
Less than coil.....	121.50 to 148.50	
Coil to 1000 ft.....	108.00 to 130.95	

DISCOUNT—CHICAGO

Single-Conductor		
Less than coil.....	+10%	
Coil to 1000 ft.....	10%	

Twin-Conductor		
Less than coil.....	+10%	
Coil to 1000 ft.....	10%	

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	12% to +20%
1/5 to std. pkg.....	20% to Net
Std. pkg.....	30% to 44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	12% to -20%
1/5 to std. pkg.....	20% to Net
Std. pkg.....	30% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 30.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28	.29

BATTERIES, DRY—Continued CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 30.....	.35	.35
50 to barrel.....	.31 to .31 3/4	.32 to .32 3/4
Barrel lots.....	.28 3/4	.29 3/4

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less than Coil	Coil to 1000 Ft.
3/8-in. single strip.....	\$67.50 to \$75.00 \$60.00 to \$69.75
3/8-in. double strip.....	73.75 to 75.00 66.25 to 72.00
1/2-in. single strip.....	90.00 to 100.00 80.00 to 93.00
1/2-in. double strip.....	95.00 to 100.00 85.00 to 96.00

NET PER 1000 FT.—CHICAGO

Less than Coil	Coil to 1000 Ft.
3/8-in. single strip.....	\$71.25 to \$75.00 \$60.00 to \$63.75
3/8-in. double strip.....	75.00 to 78.75 67.50 to 71.25
1/2-in. single strip.....	95.00 to 100.00 80.00 to 85.00
1/2-in. double strip.....	100.00 to 105.00 90.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List, per Foot	Size, In.	List, per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
3/4.....	.15	2.....	.55
1.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$55.00 \$24.50-\$25.50	\$21.50-\$24.75
1/4-in.—	\$40.00-\$60.00	\$27.00-\$30.00 \$23.50-\$27.00

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$55.00	\$27.50 \$23.10-\$24.75
1/4-in.—	\$60.00	\$30.00 \$25.20-\$27.00

CONDUIT, COUPLINGS AND ELBOWS RIGID IRON

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Size, In.	Couplings, List	Elbows, List
1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.60
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

Less than 2500 lb.....	5.8% to 8% 7.8% to 10%
2500 to 5000 lb.....	8.8% to 11% 10.8% to 13%
(For galvanized deduct six points from above discounts.)	

DISCOUNT—CHICAGO

Less than 2500 lb.....	5.8% to 8% 7.8% to 10%
2500 to 5000 lb.....	8.8% to 11% 10.8% to 13%
(For galvanized deduct six points from above discounts.)	

FLATIRONS NEW YORK

Net.....	\$3.15 to \$4.
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CHICAGO

Net.....	\$3.15 to \$3.
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FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.
35-amp. to 60-amp.....	100	
65-amp. to 100-amp.....	50	
110-amp. to 200-amp.....	25	2.
225-amp. to 400-amp.....	25	3.
450-amp. to 600-amp.....	10	5.
600-Volt		
3-amp. to 30-amp.....	100	\$0.
35-amp. to 60-amp.....	100	
65-amp. to 100-amp.....	50	1.
110-amp. to 200-amp.....	25	2.
225-amp. to 400-amp.....	25	5.
450-amp. to 600-amp.....	10	8.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28
1/5 to std. pkg.....	38

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28
1/5 to std. pkg.....	38 to 39

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.....	\$5.75 to \$6.30
1/5 to std. pkg.....	4.50 to 5.25
Standard package, 500. List, each, \$0.07.	

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.....	\$6.25
1/5 to std. pkg.....	5.25
Standard package, 500. List, each, \$0.07.	

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B.....	100	\$0.27
60-watt—B.....	100	.36
100-watt—B.....	24	.65
75-watt—C.....	50	.65
100-watt—C.....	24	1.00
200-watt—C.....	24	2.00
300-watt—C.....	24	3.00
Round bulb, 3 1/4 in., frosted:		
15-watt—G.....	50	.50
25-watt—G.....	50	.50
40-watt—G.....	50	.50
Round bulbs, 3 3/4 in., frosted:		
60-watt—G.....	24	.72
Round bulbs, 4 1/4 in., frosted:		
100-watt—G.....	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.....	Net
Std. pkg.	20%

DISCOUNT—CHICAGO

Less than std. pg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.).....	\$30.00 to \$37.84
Coil to 1000 ft.....	21.00 to 28.38

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.).....	\$37.20 to \$38.16
Coil to 1000 ft.....	27.90 to 28.62

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100.....	\$18.00 to \$30.00
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CHICAGO

Net per 100	\$13.33 to \$30.00
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OUTLET BOXES

Nos.	List, per 100
101—A, A1 1/2, 4 S.C., 6200, 320.....	\$30.00
102—B.A., 6200 S.E., 300, A.X. 1 1/2, 4 S.....	30.00
103—C.A., 9, 4 R, B 1 1/2.....	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.....	20.00

DISCOUNT—NEW YORK

Black Galvanized

Less than \$10.00 lost	List to 40%	42% to 50%
\$10.00 to \$50.00 list	List to 35%	37% to 45%

DISCOUNT—CHICAGO

Black Galvanized

Less than \$10.00 list	40%	35%
\$10.00 to \$50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. wire.....	\$14.00 to \$18.00
1/5 to std. pkg.....	13.00
Standard package, 2200. List per 1000, \$20.	

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.....	\$14.00 to \$18.20
1/5 to std. pkg.....	13.00 to 16.90
Standard package, 2200. List per 1000, \$20.	

PORCELAIN KNOBS

NEW YORK

	5 1/2 N.C.—Solid Nail-it—N.C.	Std. Pkg. 3500	Std. Pkg. 4000
Per 1000 Net			
Less than 1/5 std. pkg.	\$18.50 to \$24.30	\$20.75 to \$28.00	
1/5 to std. pkg.	9.00 to 12.15	16.30 to 21.50	

CHICAGO

	5 1/2 N.C.—Solid Nail-it—N.C.	Std. Pkg. 3500	Std. Pkg. 4000
Per 1000 Net			
Less than 1/5 std. pkg.	\$10.20 to \$10.50	\$28.00	
1/5 to std. pkg.	9.60 to 9.75	21.50	

SOCKETS AND RECEPTACLES

	Std. Pk.	List
1/4-in. cap key and push sockets	500	\$0.33
1/4-in. cap keyless socket.....	500	.30
1/4-in. cap pull socket.....	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	Net
1/5 to std. pkg.....	15%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	Net
1/5 to std. pkg.....	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	List
30-amp. S. P. S. T.....	\$0.80
60-amp. S. P. S. T.....	1.20
100-amp. S. P. S. T.....	2.25
200-amp. S. P. S. T.....	3.48
300-amp. S. P. S. T.....	5.34
30-amp. D. P. S. T.....	1.20
60-amp. D. P. S. T.....	1.78
100-amp. D. P. S. T.....	3.38
200-amp. D. P. S. T.....	5.20
300-amp. D. P. S. T.....	8.00
30-amp. 3 P. S. T.....	1.80
60-amp. 3 P. S. T.....	2.68
100-amp. 3 P. S. T.....	5.08
200-amp. 3 P. S. T.....	7.80
300-amp. 3 P. S. T.....	12.00
Low Grade:	
30-amp. S. P. S. T.....	0.42
60-amp. S. P. S. T.....	0.74
100-amp. S. P. S. T.....	1.50
200-amp. S. P. S. T.....	2.70
30-amp. D. P. S. T.....	0.68
60-amp. D. P. S. T.....	1.22
100-amp. D. P. S. T.....	2.50
200-amp. D. P. S. T.....	4.50
30-amp. 3 P. S. T.....	1.02
60-amp. 3 P. S. T.....	1.84
100-amp. 3 P. S. T.....	3.76
200-amp. 3 P. S. T.....	6.76

DISCOUNT—NEW YORK

High Grade:	
Less than \$10 list.....	+5% to list
\$10 to \$25 list.....	11%
\$25 to \$50 list.....	14%

Low Grade:	
Less than \$10.00 list.....	5%
\$10.00 to \$25.00 list.....	16%
\$25.00 to \$50.00 list.....	24%

DISCOUNT—CHICAGO

High Grade:	
Less than \$10 list.....	+5%
\$10 to \$25 list.....	11%
\$25 to \$50 list.....	14%

Low Grade:	
Less than \$10.00 list.....	5%
\$10.00 to \$25.00 list.....	16%
\$25.00 to \$50.00 list.....	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole.....	250	\$0.28
5-amp. single-pole ind.....	250	.32
10-amp. single-pole.....	100	.48
10-amp. single-pole, ind.....	100	.54
5-amp. three-point.....	100	.56
10-amp. three-point.....	50	.76
10-amp., 250-volt, D. P.....	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole.....	100	\$0.45
10-amp. three-way.....	50	.70
10-amp. double-pole.....	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	Net to —20%
1/5 to std. pkg.	15% to Net
Std. pkg.	28% to 30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	Net to —20%
1/5 to std. pkg.	15% to Net
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

	List, Each
Union and Similar	
No. 155	\$0.34
No. 160 .....	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list	List to 25%	15% to 18%
\$2.00 to \$10.00 list	23% to 25%	15% to 18%
\$10.00 to \$50.00 list	23% to 35%	18% to 25%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list	40% to 50%	30% to 40%
\$2.00 to \$10.00 list	50%	40%
\$10.00 to \$50.00 list	64%	52%

TOASTERS, UPRIGHT

NEW YORK

Net price	\$3.15 to \$3.50
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CHICAGO

Net price	\$2.80 to \$3.50
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WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

No. 18, less than full spools.....	\$0.52 to \$0.65
No. 18, full spools	0.48 to 0.55

CHICAGO

	Per Lb. Net
No. 18, less than full spools	\$0.65 to \$0.6885
No. 18, full spools	0.5285 to 0.56

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

NEW YORK			
No.	Price per 1000 Ft. Net		
	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14 ...	\$15.00-18.00	\$12.00-16.00	\$11.50-14.00
12 ...	19.89-21.06	18.96-25.62	18.01-21.35
10 ...	29.60-41.51	26.64-35.58	25.31-29.65
8 ...	42.40-60.13	38.16-51.50	36.25-42.95
6 ...	72.19-89.57	64.98-76.80	60.50-61.73

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14 ...	\$18.00	\$16.00	\$14.00
12 ...	25.99-29.89	21.96-25.62	20.13-23.48
10 ...	36.49-42.28	30.84-36.24	28.27-33.22
8 ...	51.54-51.83	43.80-47.25	40.15-47.25
6 ...	74.80-81.93	68.00-69.40	56.54-61.20

WIRE, WEATHER-PROOF

Solid-Conductor, Triple-Braid, Sizes 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$40.25 to \$45.00
25 to 50 lb.	39.25 to 44.00
50 to 100 lb.	38.00 to 43.00

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	\$38.35 to \$45.35
25 to 50 lb.	37.35 to 44.35
50 to 100 lb.	36.35 to 43.35

NEW APPARATUS AND APPLIANCES

*A Record of Latest Developments and Improvements in Manufacturers' Products
Used in the Electrical Field*

Porcelain Pendent Switch

The General Electric Company of Schenectady, N. Y., has designed a new all-porcelain pendent switch for use in installations where the switch is exposed to dampness and other cor-

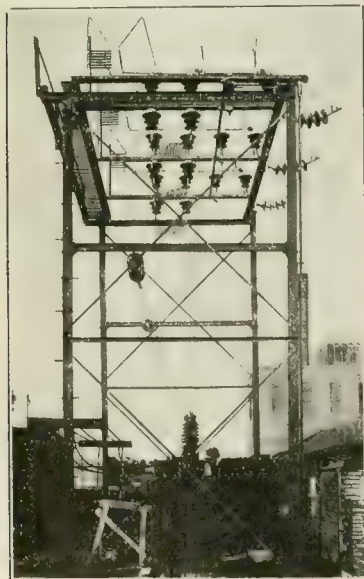


PENDENT SWITCH FOR DAMP PLACES

roding influences. The pendent switch is small and compact, yet very strong and rugged. The operating mechanism is quick make and break and is rated at 3 amp., 250 volts, and 6 amp., 125 volts. The porcelain shell is in two parts.

Cotton Mill Outdoor Substation

Under present fuel conditions cotton mill managers are beginning to realize that it is to their advantage to purchase central station power. The large volume of business being handled is taxing isolated plants. Fortunately many cotton mill districts are quite



OUTDOOR SUBSTATION FOR INDUSTRIAL LOADS

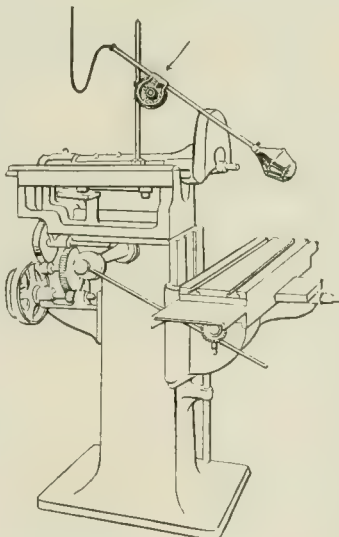
accessible to transmission lines, and a good example of central station supply through a standard outdoor substation is shown. In this particular installation the transformer capacity is 450 kva., primary voltage 44,000, second-

ary 600. High-cost switching and protective equipment is absent, the entire high-tension control being of the modern type, employing air-brake switches, high-speed sphere gap, graded-resistance type lightning arresters, carbon-tetrachloride fuses, and long-term cylinder-form choke coils.

Central stations by means of the outdoor substation will now secure many industrial loads which could not be taken on with the conventional type of high-cost indoor substation. This station is made by the Delta-Star Electric Company of Chicago

Adjustable Lamp Holders

W. N. Matthews & Brother, St. Louis, Mo., have placed on the market a fitting which consists simply of a universal joint that permits a lamp



ADJUSTABLE DEVICE APPLIED TO FIXTURE ON A MILLING MACHINE

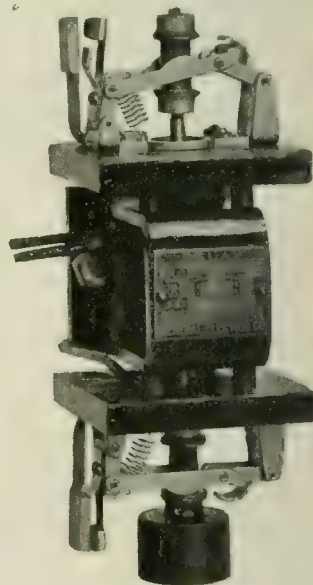
fixture clamped to it to be held in any position in which it is moved. The Matthews company is marketing only that part which contains the adjustable feature and is not selling lighting fixtures with it. The device is made of 20-gage pressed steel. The friction plates are held together by a brass rivet, and it is said the tension of the plates will take care of practically all conditions where any adjustable fixture will be needed. It is made to fit standard $\frac{3}{8}$ -in. (9.5-mm.) conduit, galvduct and sheraduct and the standard $\frac{3}{8}$ -in. (9.5-mm.) black iron pipe and $\frac{1}{2}$ -in. (15.9-mm.) rod, which are usually in stock. With the adjustable device and the equipment an industrial plant already has it is possible to make all individual lamps adjustable.

Relay for Electrically Operated Breakers

The General Electric Company, Schenectady, N. Y., has developed a "trip-free relay" to prevent electrically (solenoid or motor) operated breakers from being held closed on overload. It accomplishes the same purpose as a trip-free mechanism on hand-operated breakers; that is, it prevents the breaker from being held in on overload or short circuit. This is accomplished by the addition of the trip-free relay to the usual control apparatus.

If the breakers are solenoid-operated, the lower coil of the trip-free relay is connected in parallel with the trip coil of the breaker, but with motor-operated breakers the lower coil is connected in series with the trip-coil circuit.

If the breaker is closed when there is an overload on the line, the overload relay energizes the lower coil of the trip-free relay and the plunger which operates both sets of contacts is raised. The opening of the upper contacts disconnects the closing coil of the solenoid or motor-operated breaker. At the same time the breaker opens and remains open until the pull-button control switch is opened, since after the lower contacts of the trip-free relay are closed they are sealed closed by



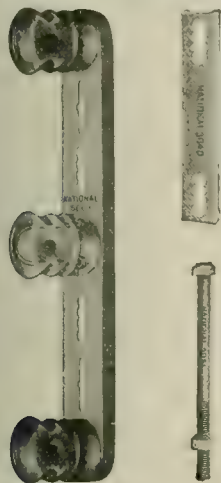
TRIP-FREE RELAY

the upper coil of the relay until the control switch has been opened.

When the trip-free coils are not energized the contacts fall by gravity into the normal operating position. These relays are mounted usually near the breaker or behind the switchboard.

Three-Point Brackets for Service Connections

Slight changes in the design of the three-point bracket made by the National Metal Molding Company of Pittsburgh, Pa., have recently been made. The bracket in question is known as No. 5003. Through the provision of

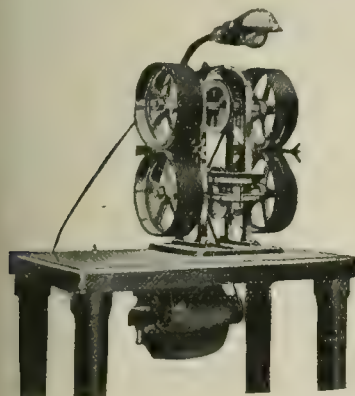


THREE-POINT BRACKET AND PARTS

slots, as shown in the accompanying illustration, and similar slots in straps No. 5040, in conjunction with bolts No. 5051, this bracket may be used as either a two-point or three-point break arm. The slots allow for the varying sizes of cross-arms or for the application of the brackets in either vertical or horizontal position. With a stock of one, two or three point brackets, corner chairs, break-arm straps and bolts, it is claimed that practically any service connection can be made.

Electrically Operated Razor-Blade Sharpener

The razor-blade sharpener made by the A. E. Hill Manufacturing Company, Atlanta, Ga., sharpens the blade on the same principle that has always been used in sharpening the old-style razor



SMALL MOTOR RUNS THIS SHARPENER

by hand. The only difference is that with this machine the hone and strops are rotated instead of moving the razor over them. The hone is in the form of a flat disk, which rotates in a horizontal plane, and the strops are mounted on

wheels, which run in vertical planes. A special holder fits every style of blade.

A lamp bracket is mounted on the head of the machine so as to throw a good light directly upon the work. The stropping wheels and hone are belt-driven from a 1/10-hp. Robbins & Myers motor.

Spot-Lighting the Automobile Flag

An electric lamp for illuminating a radiator flag, and which may also be used as a portable inspection lamp, is being marketed by the Flaglite Sales Corporation, 1790 Broadway, New York City. The outfit includes a silk flag, a silver-plated parabolic reflector and a rubber-finished rolled-steel bracket. By means of the clamp the miniature floodlamp can be attached to the filler stem of the automobile radiator in a few seconds.

Electric Tea Cart

D. C. Lamb & Company of Ottawa, Ill., has placed several styles of electrical tea wagons on the market. A feature of this line of electrical furniture is the adjustable table reel under the tray rack which takes care of the



ELECTRICAL TEA WAGON WITH TWO OUTLETS

attachment cord. This reel operates like a window shade and permits any convenient length of cord up to 16 ft. (4.9 m.) to be unrolled or rolled up at will. There are two 660-volt. outlets at the sides of the table for attaching the appliance plugs. The wagons are being supplied in mahogany, oak and walnut. Practically all styles measure 17 in. (43.2 cm.) wide by 27 in. (68.6 cm.) long by 29 in. (73.7 cm.) high. The receptacles and attachment plug were supplied by Harvey Hubbell, Inc.

Industrial Truck

The Enterprise Machine Works, 115 West Redondo Street, Los Angeles, Cal., have developed an electric tractor which is equipped with a high-speed four-pole motor running on Hess-Bright ball bearings. The motor is mounted on the yoke over the tractor wheels and is geared thereto. Three speeds are obtained by cutting out the field coils, using a speed controller consisting of a single-switch blade conveyed into three switch jaws. The con-

trol of the motor can also be secured automatically by the foot brake. As standard equipment a fourteen-cell, fifteen-plate battery is used, either Gould, Exide or Philadelphia make. The battery is supported low under the truck and suspended on coil springs that absorb any bumps the truck may be subjected to. The brakes are foot-operated, with electric current cut-off, affecting 2-in. (5.08-cm.) contracting



TRUCK HAS TURNING RADIUS WITHIN ITS TOTAL LENGTH

brake bands on each rear wheel. The wheelbase of a standard floor truck is 66 in. (167.6 cm.), and that of the tractor 40 in. (101.6 cm.). The tread is 37 in. (94 cm.). Steering is accomplished by mounting directly to the steering head a large-sized automobile steering wheel. The steering head revolves in a Timken roller bearing and has two projecting arms terminating with small ball-bearing wheels running on a circular track to withstand rough roadbed operating. The weight of the truck is 1500 lb. (680 kg.). The turning radius, it is said, is absolutely within the total length of the truck.

Two-Circuit Service Electrolier Pull Switches

Switches for two-circuit service-making electrolier connections have been added to the "new-wrinkle line" of the Bryant Electric Company of Bridgeport, Conn. These switches have been furnished heretofore, however, only in the single-pole construction. Successive pulls of the operating chain will light respectively the lamps on circuits "1," "2," "1 and 2" and "off." This switch can be used with any of the forty-one caps and bases of the standard "new-wrinkle line," being interchangeable with any of the other "new-wrinkle" bodies. A knurled lock



INTERCHANGEABLE-SERVICE PULL SWITCH

nut turned up on the shoulder fastens the switch securely in position. These switches are all National Electrical Code standard and have an approved rating of 3 amp., 125 volts, or 1 amp., 250 volts.

Trade Notes

W. N. MATTHEWS & BRO., INC., has moved its Chicago office from 507 South Clinton Street, where it has been for the past sixteen years, to Room 400, Lees Building, 19 South Fifth Avenue.

F. H. JAMESON, for a number of years a member of the selling force of the Ohio Brass Company and more recently associated with the Electric Service Supplies Company, died at his home in Chicago on July 10.

EDGAR N. DOLLIN, organizer and president of the Acme Die-Casting Corporation, has sold his holdings in that company and is retiring from active management. Mr. Dollin was formerly secretary of the Doehler Die-Casting Co.

THE CALEBAUGH SELF-LUBRICATING CARBON CO., Philadelphia, announces that, owing to an enormous increase in business, its plant will hereafter be at 1508-1518 Columbia Avenue. The offices will still remain at 1503 Columbia Avenue.

THE PHILLIPS WIRE COMPANY, Pawtucket, R. I., announces that the business operated as the Phillips Insulated Wire Company will hereafter be conducted under the name Phillips Wire Company. This is a change in corporate name only. The location of the business, policy and management will be the same as heretofore.

THE ACME DIE-CASTING CORPORATION of Brooklyn, N. Y., has issued a statement saying that the suit recently brought against it by the Doehler Die-Casting Company for infringement of patent No. 1,156,093 does not in any way affect the product or present business of the Acme Die-Casting Corporation, as it covers a process not now in use.

STEPHEN GARDNER, for thirteen years connected with the sales office of the Westinghouse Electric & Manufacturing Company, has resigned to accept a position with the Greenlee interests of Chicago. Mr. Gardner entered the electrical business in 1896 in the employ of the Commonwealth Edison Company. In recent years he has been handling the business of the Insull properties for the Westinghouse company. In his new position he will be secretary of the Northwestern Stove Repair Company, treasurer of the Northwestern Foundry Company and treasurer of the Greenlee Foundry Company.

New Incorporations

THE ASHTABULA (Ohio) Electric COMPANY has been incorporated with a capital stock of \$15,000 by R. A. Wentz, W. H. Murbach, E. H. Wentz and others.

THE RELIANCE ELECTRIC COMPANY of Norfolk, Va., has been incorporated with a capital stock of \$50,000. The officers are: F. W. Sharp, president and W. J. Cannon, secretary.

THE PORTAGE LIGHT, HEAT & POWER COMPANY of Cleveland, Ohio, has been chartered with a capital stock of \$50,000 by R. H. Jamison, H. A. Hauxhurst, R. Hall, W. R. Daley and J. H. Kellogg.

THE GIBSONBURG (Ohio) ELECTRIC LIGHT COMPANY has been chartered with a capital stock of \$40,000 by A. H. Miller, N. B. Ervin, C. B. Snyder, W. J. Mead, F. W. Zorn, G. W. Hornung and F. C. Hornung.

THE LA FRENCH POWER SPARK PLUG COMPANY of Dayton, Ohio, has been chartered with a capital stock of \$100,000 by F. A. Eastman, Harry N. Eastman, Arthur A. Nixon, Harvey C. Garber and I. A. Lytle.

THE HEREZ LIGHT SUPPLY COMPANY of Philadelphia, Pa., has been incorporated with a capital stock of \$25,000 to manufacture gas and electric fixtures. Samuel Strausmann, 1523 Poplar Street, is the principal incorporator.

THE O. K. STORAGE BATTERY COMPANY of Oklahoma City, Okla., has been chartered with a capital stock of \$100,000 by A. F. Fricks, Earl Rueb and C. F. Wilson. The company proposes to manufacture storage batteries.

THE MILNOR ELECTRIC COMPANY of Cincinnati, Ohio, has been incorporated with a capital stock of \$40,000 to manufacture machinery. The incorporators are: L. T. Milnor, J. P. Milnor, H. T. Ritchie, H. B. Machoy and M. Jaquish.

THE W. B. PERRY ELECTRIC COMPANY of Brooklyn, N. Y., has been incorporated by William B. Perry, Victor V. Shorey and G. Burchard Smith. The company is capitalized at \$75,000 and proposes to do a general electrical engineering business.

THE MARITIME ELECTRIC COMPANY of Fredericton, N. B., has been incorporated with a capital stock of \$1,000,000 to construct and operate electric-light and power plants. The incorporators are: John J. F. Winslow, John J. McCaffrey, Ernest A. McKay and others.

THE HOBBS STORAGE BATTERY COMPANY of Los Angeles, Cal., has been incorporated by A. A. Hobbs, A. W. Bumiller, S. M. Haskins and H. V. Andrews. The company is capitalized at \$100,000 and proposes to manufacture storage batteries and other electrical equipment.

THE MIDLAND ELECTRIC STEEL COMPANY of Chicago, Ill., has been chartered with a capital stock of \$10,000 by Joseph S. Samuels, Stanley Filip and R. I. Davis. Equipment, it is reported, will be supplied by the Booth-Hall Company of Chicago, Ill., recently organized.

COLE & MORGAN of Caldwell, N. J., have filed articles of incorporation with a capital stock of \$5,000 for the purpose of doing a mechanical and electrical engineering business. The incorporators are: A. B. Cole of Caldwell, N. J.; A. P. Morgan and A. G. Morgan of Montclair, N. J.

THE LONG ISLAND WRECKING & REPAIR CORPORATION of Elmhurst, N. Y., has been chartered with a capital stock of \$5,000 by W. S. and F. M. Basore and A. C. Douglas of Elmhurst. The company proposes to do a general mechanical and electrical engineering business.

THE POWER DEVELOPMENT COMPANY of Montreal, Que., Canada, has been incorporated by Gerald A. Coughlin, Francis G. Bush, George R. Drennan and others. The company is capitalized at \$500,000 and proposes to generate and distribute electricity for lamps, heaters and motors.

THE CLINCHFIELD (Tenn.) HYDRO-ELECTRIC POWER COMPANY has been incorporated with a capital stock of \$50,000 by John A. Thompson, E. K. Baldwin, M. P. Beasley, L. D. Carmack and C. D. Jarvis. The company proposes to develop water power and establish a hydroelectric plant.

THE GLOBE ENGINEERING COMPANY of Hamilton, Ont., Canada, has been incorporated with a capital stock of \$100,000 to take over the plants and holdings of the Globe Electric Machine Company. The incorporators are: Ivor Lewis, William F. Coote, Russell W. Treleaven and others.

THE CLEMENS ELECTRICAL CORPORATION OF CANADA of Hamilton, Ont., Canada, has been chartered with a capital stock of \$50,000 to manufacture electrical appliances, machinery, etc. The incorporators are: Henry N. Kittson, Alexander Metherell, William D. Dailey and others.

SCHROCK & SQUIRES of New York, N. Y., have filed articles of incorporation with the Secretary of State for the purpose of doing a general electrical engineering business, manufacturing iron, steel and copper products. The incorporators are: J. J. O'Connor, F. W. Bain and W. B. Nealis, 291 Pearl Street, New York, N. Y.

THE H. A. BAUER COMPANY of Lansdowne, Pa., has been chartered by H. A. Bauer, 22 Lansdowne Avenue, Lansdowne; Guy F. Bauer, 219 South Farragut Terrace, and James H. Bell, 1815 Land Title Building, Philadelphia. The company is capitalized at \$30,000 and proposes to manufacture gas and electrical fixtures and supplies.

THE SOUTHWESTERN UTILITIES COMPANY of Alva, Okla., has been incorporated by Albert Manuel, president of the Kansas Electric Utilities Company, Dayton, Ohio, and Noel R. Cascho and W. A. Parr of Alva, Okla. The company is capitalized at \$500,000 and proposes to construct and operate street railway and lighting properties in numerous Oklahoma cities and towns.

CHARLES V. HOFFMAN, INC., has filed articles of incorporation under the laws of the State of New Jersey with a capital stock of \$25,000. The company proposes to build and sell power plants and electrical and other machinery. The incorporators are: Charles V. Hoffman of Bound Brook, N. J.; Louis L. Browne of Newburgh, N. Y.; Everett B. Hendrickson of Ridgewood, N. J., and others. The office of the company is located at 239 Washington Street, Jersey City, N. J. Herbert C. Gilson is agent.

Trade Publications

REFLECTORS.—The National X-Ray Reflector Company of Chicago has issued leaflet, serial No. 161, entitled "It's New Too Late."

STEAM TRAPS.—The Farnsworth Company, Conshohocken, Pa., is distributing book descriptive of Farnsworth tilt steam traps.

RHEOSTATS.—The Central Scientific Company, 460 East Ohio Street, Chicago is distributing bulletin No. 19, descriptive of its laboratory rheostat.

"TELEFAULT."—W. N. Matthews Bro., Inc., of St. Louis, Mo., is distributing a mailer descriptive of its Woodpecker "Telefault" for locating trouble.

AUTOMATIC CONTROL.—The General Electric Company of Schenectady, N. Y., distributing a leaflet descriptive of automatic control for small direct-current motor.

HEATERS.—Hotpoint "Hedlite" heaters are illustrated and described in a folder now being distributed by the Hotpoint Electric Heating Company of Ontario, Canada.

RAILWAY ENGINEERING DATA.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has prepared a bulletin on railway engineering data.

LOCOMOTIVES.—Internal-combustion locomotives are illustrated and described in record No. 85, now being distributed by the Baldwin Locomotive Works of Philadelphia, Pa.

MOTOR-GENERATOR SETS.—Bulletin No. 181, superseding bulletin No. 156, describing motor-generator sets for all purposes, has been prepared by the Crocker-Wheeler Company of Amper, N. J.

SAFETY DEVICES.—The V. V. Fittin Company, 1910 North Sixth Street, Philadelphia, has prepared a forty-page catalog covering new types of V. V. fittings, safe devices and vapor-proof fittings. The bulletin is carefully illustrated, listed and indexed.

HOISTING MACHINERY.—The Shepa Electric Crane & Hoist Company, Monto Falls, N. Y., has prepared a pamphlet of hoisting machinery for industrial work. Hoists for various purposes are described and supplemented with illustrations giving valuable dimensional data.

CAR LIGHTING.—The Electric Storage Battery Company of Philadelphia has prepared a bulletin on the chloride accumulator for car lighting. This company has also prepared a bulletin on the "Exid" battery for starting, lighting and ignition service. A parts price list is given in the book.

SOLVAY ALKALI.—The Solvay Process Company, Syracuse, N. Y., has prepared new edition of its blue book entitled "Solvay Alkali." This book deals with various forms and uses of alkali and contains notes on the alkali industry, various chemical and commercial tables useful for the consumers.

ELECTRIC PLANT.—The Main Electric Manufacturing Company of Pittsburgh, Pa., has prepared bulletin No. 30, which is report of the Carnegie Institute of Technology. This report includes information regarding a series of tests performed on a 750-watt generator made by the Main Electric Manufacturing Company.

PROJECTORS.—The Crouse-Hinds Company of Syracuse, N. Y., has prepared bulletin No. 303, descriptive of its new Imperial floodlight projector. The feature of this bulletin is that it also lists, in addition to the established line, 1000-watt projectors in types and arrangements for both marine and land use. The bulletin also contains illumination and lamp statistics of value.

HYDROELECTRIC AND STEAM POWER PLANTS.—Viele, Blackwell & Buck, consulting engineers and constructors, 49 Wall Street, New York City, has prepared a bulletin descriptive of the engineering and construction work which the firm has carried on. Photographs are shown of various plants in the United States, Canada and Mexico. The bulletin is well prepared and handsomely illustrated.

STORAGE BATTERIES.—Bulletin No. 60 descriptive of Edison storage batteries for industrial transportation, has been prepared by the Edison Storage Battery Company, Orange, N. J. Many uses of the electric tractors using Edison storage batteries are illustrated and described in this book. General data and trade dimensions of Edison storage batteries for industrial purposes, practice, storage-battery locomotives, etc. are also given.

New England States

BROCKTON, MASS.—The contract for electrical work for the new ward for the Brockton Hospital has been awarded to the Main Electric Company at \$2,200.

FRANKLIN, MASS.—The Union Light & Power Company has petitioned the Gas and Electric Light Commissioners for permission to issue \$153,000 additional capital stock, and proceeds to be used for extensions to plant and service.

GLOUCESTER, MASS.—The Board of Aldermen has adopted an ordinance authorizing the Gloucester Electric Company to install 41 incandescent lamps of 400 cp. mounted on iron poles on Main Street from to Washington Street.

PITTSFIELD, MASS.—The contract for building an extension to the power station of the Pittsfield Electric Company has been awarded to the Stone & Webster Engineering Corporation, 147 Milk Street, Boston. Power equipment, it is understood, has not yet been purchased.

SOMERVILLE, MASS.—Plans have been adopted by the Board of Aldermen for the arrangement of the street lamps on College Avenue, Elm Street and Highland Avenue near Davis Square and on Broadway from the Boston line to Marshall Street, and providing for suitable lamps to be set on short ornamental standards.

STOCKBRIDGE, MASS.—C. D. Parker & Company of Boston, Mass., who control and operate the Lee (Mass.) Electric Company and Great Barrington (Mass.) Electric Light Company, have purchased the property of the Stockbridge Lighting Company. The three companies are to be operated on co-operative basis.

Middle Atlantic States

BROOKLYN, N. Y.—The Edison Electric Illuminating Company has awarded a contract for extensions and improvements to the Sixty-sixth Street power plant, to cost not over \$15,000. M. R. Jahnke, 360 Pearl Street, is architect.

MONROE, N. Y.—The Orange & Rockland Electric Company has recently closed contract with W. A. Harriman to furnish electricity for lamps and motors for the ten estate and the Sterling mines for a period of ten years. The company has recently purchased the property of the Buttermilk Falls Electric Company at High Falls and the Bear Mountain Inn, and will eventually light Palisades entire.

OLEAN, N. Y.—Arrangements are being made by the Olean Electric Light & Power Company for extensions and improvements to its system, including the erection of a 5-circuit transmission line from the Olean power station, one circuit to extend to Salamanca, the other to Bradford. The company will also install a 3500-hp., 60-cycle steam turbine, which will double the output of its plant. Contracts have been awarded for work.

NEWTON FALLS, N. Y.—The Newton Falls Paper Company is contemplating the construction of a hydroelectric plant, to cost about \$50,000. Charles E. Easton, Herman Building, Watertown, is engineer.

NEW YORK MILLS, N. Y.—A petition has been filed with A. L. Murdock, town clerk, by the taxpayers requesting the Town Board to establish a new lighting district and a portion of the town not now covered by lighting district No. 1.

CALDWELL, N. J.—The contract for the erection of an addition to the power plant at the county penitentiary has been awarded by the County Commissioners to William G. Sharwell, 377 North Fifth Street, Newark, at \$75,000.

CHELSEA, N. J.—John Stafford of Philadelphia, Pa., has awarded a contract for power and heating system for his hotel, to be erected on the beach front, to Lewis Tanner, 1723 Ludlow Street, Philadelphia, at \$185,000.

GLOUCESTER CITY, N. J.—The City Council has awarded a contract to the Public Service Electric Company for lighting the streets of the city for a period of five years. A new street-lighting system consisting of 109 lamps of 600 cp., 40 lamps of 100 cp. and 73 lamps of 32 cp., making total of 222 lamps, will be installed.

KEYPORT, N. J.—The installation of a new fire-alarm system is under consideration by the Borough Council.

ORANGE, N. J.—Negotiations are under way between the Merchants' Association and the City Commissioners for the installation of new street lamps on Main Street. Extensions to the street-lighting system, it is said, will require an increase in the generating capacity of the municipal electric-lighting plant.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

POMPTON LAKES, N. J.—By the acquisition of a water power site on Pompton Lake the Borough Council plans to abolish the present steam-driven pumping station at the municipal water-works plant and to install a hydroelectric plant, the initial installation to cost about \$35,000. The proposed new plant will supply electricity for lamps and motors for municipal service.

FORT MIFFLIN, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 13 for construction of chief gunners' quarters, including heating, electric wiring, etc., at the naval ammunition depot at Fort Mifflin. Drawings and specifications (No. 2486) may be obtained on application to the bureau or the commandant of the navy yard at Philadelphia.

LEBANON, PA.—The Lebanon Valley Electric Light Company has contracted with the Lebanon Valley Iron & Steel Company to supply energy for a 500-kw. converter in the steel plant of the latter.

PHILADELPHIA, PA.—A new boiler plant, one story, to cost about \$10,000, will be erected at the Girard Point works of the Pennsylvania Railroad Company.

READING, PA.—The Metropolitan Electric Company has entered into a contract to supply 300 hp. to operate the plant of the Whitehall Manufacturing Company.

BALTIMORE, MD.—Application has been made for a permit to build a one-story power house on Oak Street, between Twenty-third and Twenty-fourth Streets, for Goucher College. The building will be 40 ft. by 64 ft. and will cost about \$9,600. Ellicott & Emmart are architects. Contract has not yet been awarded.

WHEELING, W. VA.—Work has been started on the construction of a new power plant for the La Belle Tin Works, to replace the old plant, which is inadequate. A large generator will be installed to provide temporary power to operate the works until the station is completed.

NORFOLK, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 13, for furnishing and installing eight electric hoists, monorail tracks, supports, switches, turntables and trolley rails in the new foundry at the navy yard, Norfolk, Va. Drawings and specifications (No. 2481) may be obtained on application to the above bureau or the commandant of the navy yard named.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 15, for supplying to the various public buildings under the control of the Treasury Department hand, electric, portable vacuum cleaners during the fiscal year ending June 30, 1918. For details see Searchlight Section.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for equipment at the various navy yards and naval stations as follows: South Charleston, W. Va., Schedule 1378—Five motor-driven, head-gear, 12-in. lathes, five head-gear, 24-in. engine-driven lathes, two constant-speed drive milling machines, one electrically-driven planing machine, two motor-driven, vertical milling machines, one 100-in. vertical boring and trimming mill, one motor-driven, three-spindle drill press, two 6½-in. electrically-driven vertical shapers. Philadelphia, Pa., Schedule 1377—One motor-driven, 24-in. bevel-gear planer. Portsmouth, N. H., Schedule 1367—325 fire-control telephone jacks. Various, Schedule 1367—Miscellaneous type B, water-tight annunciators, miscellaneous water and non-water-tight vibrating bells, miscellaneous pear push buttons, miscellaneous portable firing salvo buzzers, 4400 rubber ear cushions, 136 magneto testing generators, 800 non-water-tight telephone plugs, 120 portable telephone testing sets, miscellaneous portable ventilating sets, 550 fire-control telephones, miscellaneous ship's service telephones. Applications for proposal blanks should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: F. o. b. works, Schedule 1390, finders, range and transmission systems, 36 each; Pearl Harbor, H. T., Schedule 1379, one motor-

driven centrifugal pump, two gasoline motor cars. Boston, Mass., Schedule 1391, 133,000 double tubular connectors; Schedule 1376, 7000 ft. 3 and 4-conductor interior communication cable, 500 ft. armored controller searchlight cable. Schedule 1374, miscellaneous twisted pair telephone cable; miscellaneous rubber-insulated lighting and power wire. Various, Schedule 1375, 130,000 ft. insulated antenna wire; Schedule 1376, miscellaneous rubber-insulated, single lighting and power wire; miscellaneous flexible brush holder cable, miscellaneous single-cord, ignition cable, miscellaneous rubber-insulated interior communication cable, miscellaneous plain, armored and leaded telephone cable, miscellaneous silk-covered bell cord, 220,000 ft. fire control telephone cord, miscellaneous incandescent lamp cord, 472,000 ft. plain bell wire, miscellaneous single, plain and armored, twin-conductor and flexible single-conductor light and power wire, miscellaneous cotton and silk-covered flat magnet wire. Portsmouth and Boston, Schedule 1374, 70,000 cu. ft. double-cord, ship lighting cable. Mare Island, Cal., Schedule 1374, 200 lb. annunciator wire. Charleston, S. C., Schedule 1374, 5000 ft. solid fixture wire. Norfolk, Va., Schedule 1374, 6000 ft. rubber-insulated pothead wire. Boston and Charleston, Schedule 1374, miscellaneous rubber-insulated telephone wire. Application for proposal blanks should designate the schedule desired by number.

North Central States

GLADSTONE, MICH.—The Marble Arms & Manufacturing Company is planning to build a plant to manufacture motors and generators.

LOUISVILLE, KY.—The Roy C. Whayne Supply Company of Louisville is reported to be in the market for a locomotive crane, two or more traveling cranes, steam or electric, to handle 1½ cu. yd. to 1½ cu. yd. orange-peel buckets at 25 ft.; also two stiff-leg traveling derricks, 75-ft. boom, capable of operating a 4-cu. yd. clamshell bucket; two 1½ or 1½-yd. orange-peel buckets, and two 4-cu. yd. clamshell buckets.

LAPORTE, IND.—The electric plant of the Laporte Gas & Electric Company was destroyed during a severe windstorm on July 23.

BROCKTON, ILL.—The installation of a municipal electric-light plant in Brockton is under consideration. The village authorities would like to receive from manufacturers catalogs of complete plants or separate apparatus. Preliminary information will be furnished for making estimates. For further information address P. V. Deames.

HARTFORD, WIS.—Bids will be received by the city of Hartford until Aug. 7 for furnishing 40 cast-iron ornamental standards, including globes and film sockets for lamps of 100 cp.

ADAMS, MINN.—The Western Electric Company has secured the contract for the installation of an ornamental lighting system in Adams.

DULUTH, MINN.—The City Council has granted the Duluth Street Railway Company permission to erect two feed wires of 500,000 cm. capacity each in a double cable over the Aerial Bridge across the Duluth ship canal to connect with the circuit of the Park Point Traction Company, which was recently taken over by the Duluth Street Railway Company. After connections are made the power plant of the Park Point Traction Company will be used only in emergencies.

GRAND RAPIDS, MINN.—Bids will be received by the Commissioners of Itasca County, Court House, Grand Rapids, until Aug. 13 for construction of a fireproof hospital, including general construction, heating, electric work, elevator, hospital, laundry and kitchen equipment. Bids will be received on the entire work and separately. Plans and specifications may be obtained at the office of F. H. Mosse & Company, architects, Rochester, Minn., upon deposit of \$10.

KASSON, MINN.—Bids will be received by the Village Council until Aug. 10 for construction of municipal building, including general construction, plumbing, heating and electric wiring. Plans and specifications are on file at the office of Purcell & Elmskie, Auditorium Building, Minneapolis, Minn., and People's Gas Building, Chicago, Ill., and at the office of the recorder in Kasson.

ST. CLOUD, MINN.—Bids will be received by the State Board of Control, State Capitol, St. Paul, until Aug. 14, for the complete rock-crushing plant and equipment for the Minnesota Reformatory at St. Cloud. The Charles L. Pillsbury Company of St. Paul and Minneapolis is engineer.

ST. CLOUD, MINN.—Bids will be received by the State Board of Control, State Capitol, St. Paul, until Aug. 14, for complete installation of mechanical equipment of quarters "E," Minnesota State Reformatory, at St. Cloud. The Charles L. Pillsbury Company of St. Paul and Minneapolis, is engineer.

WILLMAR, MINN.—Bids will be received by the Minnesota State Board of Control, State Capitol, St. Paul, until Aug. 14 for the following work at the State Hospital at Willmar: Construction of cottages 1 and 2 for men, addition to laundry building, addition to power plant, addition to slaughter house, alterations to service building, new sidewalks and tunnel ventilators and refrigerators, including heating and ventilation, plumbing and electrical work. Plans and specifications may be seen at the office of the Board of Control, at the office of C. H. Johnston, architect, St. Paul, and the St. Paul, Minneapolis and Duluth Builders' Exchanges.

FORT MADISON, IOWA.—Bids will be received at the office of C. T. Hull, county auditor, Fort Madison, until Aug. 7 for construction of drainage pumping station as follows: (1) For furnishing material and construction of pumping station and appurtenances; (2) furnishing and installing two 42-in. centrifugal pumps; (3) two 300-hp. motors, including transformers and auxiliary apparatus; (4) wiring and electric control devices; (5) piping and valves; (6) furnishing material and labor for pumping and for the heating and water supply installation; (7) furnishing and installing a priming device; (8) a 10-ton traveling crane; (9) furnishing and installing hydraulic instruments for measuring the head and capacity of same. Plans and specifications may be obtained from the Edmund T. Perkins Engineering Company, 1210 First National Bank Building, Chicago, Ill., and Illinois State Bank Building, Quincy, Ill., and C. T. Hull, county auditor, Fort Madison, upon deposit of \$20.

MONDAMIN, IOWA.—Bonds to the amount of \$12,000 have been voted for the installation of an electric-light and power plant.

FARGO, N. D.—The contract for the construction of the main building and power plant of the Equity Packing Company has been awarded to T. P. Powers & Company at \$186,700. The main building will be 84 ft. by 215 ft., four stories and basement, and the power house 61 ft. by 85 ft.

BONESTEEL, S. D.—Bonds to the amount of \$15,000 have been voted for the installation of an electric-light plant.

VERMILION, S. D.—Bids will be received at the office of the president of the State University at Vermilion until Aug. 21 for construction of an engineering building and women's building for the State University. Separate bids to be submitted for heating, wiring and plumbing. Plans and specifications may be seen at the office of Holmes & Flinn, Chicago, Ill., and Sioux Falls, S. D.

RIVERTON, NEB.—Bonds have been authorized for the installation of an electric-light plant in Riverton.

KANSAS CITY, KAN.—The City Commissioners have granted the Standard Electric Light Company permission to furnish electricity to light the Central Avenue Bridge.

Southern States

CHARLOTTE, N. C.—The Southern Power Company is contemplating extending its electric transmission lines to Greenville, S. C., at a cost of about \$30,000.

GREENSBORO, N. C.—Bids will be received by the Commissioners of Guilford County, Greensboro, until Aug. 21 for construction, including heating, elevator and plumbing and jail equipment, for court house and jail building to be erected in Greensboro. An appropriation of \$250,000 has been voted for the work. Plans and specifications may be obtained on application to Harry Barton of Greensboro, architect, upon deposit of \$25.

HIGH POINT, N. C.—The City Council is considering the question of installing an electric generating plant to maintain the municipal lighting system. Energy is now purchased from the North Carolina Public Service Company of Greensboro.

COLUMBIA, TENN.—The plant of the Columbia Water & Light Company was badly damaged by an explosion on July 20. A new engine and generator will be ordered at once.

MOBILE, ALA.—The Mobile Electric Company is contemplating extending its electric transmission lines to Blakely and Pinto Islands to supply electricity to various industrial properties in those places. The cost of the extension is estimated at \$20,000.

BATESVILLE, ARK.—The City Council has authorized an appropriation of \$25,000 for improvements to the electric-light and water-works systems.

RUSSELLVILLE, ARK.—The Arkansas Light & Power Company is making improvements to its local plant, including the installation of a 1000-hp. turbo-generator.

MANGUM, OKLA.—The City Council has closed a contract for equipment to double the capacity of the municipal electric-light plant, at a cost of about \$50,000. The plans provide for the installation of two oil-burning engines, one 150 hp. and the other 200 hp. The cost of the equipment is estimated at \$33,300, and the pole lines and distributing system at from \$10,000 to \$15,000.

MIAMI, OKLA.—The Triangle Mines Company, recently organized, with a capital stock of \$50,000, to develop lead and zinc mines, is contemplating the construction of three mills to have a daily capacity of 300 tons. The plans provide for a central power plant to operate all mills. Oil engines will probably be used. N. C. Barry is president.

NEWKIRK, OKLA.—The local electric plant was recently destroyed by a tornado.

BEAUMONT, TEX.—The Beaumont Shipbuilding & Drydock Company, recently incorporated with a capital stock of \$300,000, proposes to construct a shipbuilding plant on Island Park. The plans provide for the erection of a mill building, 250 ft. by 60 ft., several smaller buildings and a power house 40 ft. by 25 ft. Within a few months the company will build a drydock. C. O. Oakum is vice-president and general manager.

HOUSTON, TEX.—The Houston Light & Power Company has secured a contract to supply energy of 400 hp. to the local plant of the Texas Chemical Company, a subsidiary of the Stauffer Chemical Company. Arrangements have also been made by the Houston company to furnish from 200 to 400 kw. to the Texas Portland Cement Company in Houston.

Pacific and Mountain States

COLVILLE, WASH.—The Commissioners of Stevens County have granted the Stevens County Power & Light Company a franchise to erect a high-tension transmission line from Chevelah to Browns Lake. The company will furnish energy to operate the tramway and the machinery in the plant of the Northwest Magnesite Company.

INDEX, WASH.—Surveys have been completed by G. N. Miller, engineer, Burke Building, Seattle, for the installation of the proposed new lighting system in Index, at a cost of about \$12,000.

KEYPORT, WASH.—The contract for the installation of a 200-kw. steam plant for a government radio station in Keyport has been awarded to Charles C. Moore & Company, Mutual Life Building, Seattle.

PASCO, WASH.—The Pacific Power & Light Company will begin work at once on the construction of a new central switching station for its new 66,000-volt system to be installed in Pasco.

PORT ANGELES, WASH.—The Olympic Power Company has recently secured a contract to furnish 4000 kw. to operate a paper mill under construction here.

PROSSER, WASH.—The Pacific Power & Light Company has petitioned the Commissioners of Benton County for a franchise and right of way for the construction and operation of electric transmission lines in and near Prosser. V. L. Lewis is local manager.

SEATTLE, WASH.—J. F. Duthie & Company, shipbuilders, have been awarded a contract by the French government for two 8800-ton steel ships, to cost about \$3,500,000. The vessels will be equipped with 3000-hp. turbine engines.

SEATTLE, WASH.—The date for opening bids for the construction and delivery of a complete hydroelectric light and power plant has been extended from Aug. 3 to Aug. 20 by the Board of Public Works. The original date for opening the bids was July 20.

SPOKANE, WASH.—Steps have been taken by the Civic Club for the installation of a new street-lighting system from the north end of the Monroe Street Bridge to Mallon Avenue.

WHITE BLUFFS, WASH.—The Pacific Power & Light Company has recently secured a contract to furnish electricity to operate the city pumping plant. The contract provides for the removal of the company's distributing system from the main streets to the alleys. Other improvements to the local lighting system, it is understood, will be made.

ASTORIA, ORE.—The Port Commission has recently awarded the contract for installing electrical equipment for Port of Astoria coal bunkers to the Ewart Electric Company of Astoria. The commission is considering making arrangements with the Pacific Power & Light Company to supply energy (1000 hp.) to meet the needs of the Port of Astoria docks.

PENDLETON, ORE.—The installation of a new street-lighting system and the removal of the poles and electric wires from Main Street are contemplated by the Pacific Power & Light Company. The cost of the system is estimated at from \$7,000 to \$8,000.

LOS ANGELES, CAL.—Plans have been filed by the Llewellyn Iron Works, 1100-1218 North Main Street, for the construction of an addition to its works, 50 ft. by 100 ft., and a power house, 35 ft. by 80 ft. The company manufactures elevators, tanks and structural steel.

LOS ANGELES, CAL.—The general contract for the construction of the reinforced concrete power house to serve the new mercantile buildings now being erected on West Seventh Street has been awarded to the Davidson Construction Company. The building will be 40 ft. by 95 ft., with chimney 150 ft. high. Dodds & Richards are architects.

MARIPOSA, CAL.—A franchise has been granted the San Joaquin Light & Power Company of Fresno to supply electricity in Mariposa.

VALLEJO, CAL.—The Vallejo Light & Power Company has been granted permission to erect and operate electric transmission lines in Solano County.

KIMBERLY, IDAHO.—A certificate of public convenience and necessity has been granted to the Idaho Power Company for the installation of an electric-lighting system in the town of Kimberly.

WALLACE, IDAHO.—The Shoshone County Power Company has petitioned the Public Utilities Commission for permission to extend its electric transmission line from Wallace to Murray, where it proposes to furnish energy for 10 miles of placer mining claims, owned by the Yukon Gold Company, which is owned by the Guggenheim interests.

Canada

NEW WESTMINSTER, B. C.—The Westminster Power Company has applied to the comptroller of water rights for approval of plans of the project to be constructed for the diversion of water from the Meshiloet River, Young Creek, Brant Creek, Norton Creek, Hixon Creek, Barn Lake, Lake Anne, Norton Lake, Joseph Lake and Young Lake. The company proposes to supply electricity for lamps and motors within the districts of New Westminster, and Vancouver, including more than 20 municipalities.

PORT MANN, B. C.—The Canadian Northern Railway Company is building shops in Port Mann and work of installing machinery is under way. Electricity for operating the plant and lighting the shops will be generated at the company's plant.

BEETON, ONT.—The engineers of the Hydro-Electric Commission of Ontario estimate that it would cost \$15,000 to erect a electric transmission line to and install lighting system in Beeton.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Aug. 8, for furnishing two centrifugal pumps, engine-driven, galvanized chain railing fittings, brass whistles, brazing spelter, cable, motor, transformer, rotary switches, condulets, cable grips, etc. For further information relating to circular (No. 2142) address Major I. Brown, general purchasing officer.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Aug. 15 for furnishing rods, steel rail switch stands, electric cable, brass tubing fusible plugs, refrigerating apparatus, etc. Plans and information relating to the circular (1157) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York City, Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

HONOLULU, T. H.—Congress has appropriated \$80,000 for lighting the entrance and entire channel of Pearl Harbor. Bids will be asked for as soon as plans have been completed and approved.

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Record of Electrical Patents

Notes on United States Patents
issued on July 17, 1917

1,233,296. HIGH-TENSION INSULATOR; Arthur O. Austin, Barberton, Ohio. App. filed May 19, 1913. Suspension or pin type.

1,233,339. CHAIN GUIDE FOR PULL SOCKETS; David D. Gordon, Chicago, Ill. App. filed Nov. 21, 1916. Means for attaching chain guides to pull sockets.

1,233,346. CONTROL SYSTEM; Arthur J. Hall, Wilkinsburg, Pa. App. filed May 25, 1914. Control of phase converters such as are employed for converting alternating-current single-phase energy into polyphase energy.

1,233,353. DYNAMO-ELECTRIC MACHINE; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed March 23, 1914. Improvement.

1,233,354. DYNAMO-ELECTRIC MACHINE; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed March 30, 1914. Special reference to alternating-current motors of the commutator type.

1,233,363. APPARATUS FOR ELECTROLYTICALLY RECOVERING METALS; George A. James, San Francisco, Cal. App. filed Oct. 14, 1916. Relates to an improved apparatus for recovering metals, particularly precious metals, from comminuted material containing the same.

1,233,364. ELECTRIC SWITCH; Oscar Johnson, Chicago, Ill. App. filed July 5, 1913. Means for controlling electrically propelled vehicles such as street and inter-urban cars.

1,233,370. CONTROL FOR ELECTRICAL SYSTEMS; Charles F. Kettering, Dayton, Ohio. App. filed Nov. 11, 1912. Movable element buoyantly supported within a container, but having no permanent or positive connection therewith, which is automatically actuated to vary the resistance relative to a given electrical condition or circuit.

1,233,395. ELECTRIC HOT PLATE OR HEAT UNIT; James C. Patten, Kokomo, Ind. App. filed Aug. 30, 1915. Improvements.

1,233,415. ELECTRICAL INSULATION; William H. Steinberg, Milwaukee, Wis. App. filed March 1, 1915. Improved binder for combination with a suitable base material, such as comminuted asbestos.

1,233,434. ARC-WELDING APPARATUS; Emerson S. Zuck, Wilkinsburg, Pa. App. filed Dec. 4, 1915. For welding hollow bodies, such as boiler tubes and the like, to boiler fire sheets or other adjacent plates.

1,233,443. SIGNALING APPARATUS; Harold G. Brown, Westminster, England. App. filed Nov. 11, 1912. Improvements.

1,233,475. INSULATOR; Christopher C. Hudson, Niceville, Fla. App. filed Oct. 21, 1916. Wherein retaining fingers for a conductor are employed and wherein means are employed for normally closing the space between the fingers.

1,233,486. ELECTRICAL INSULATOR; Fred M. Locke, Victor, N. Y. App. filed Aug. 28, 1916. Produces a more stable and permanent boron glass of high silica content.

1,233,538. CONCEALED WIRE CHAIN; Flora S. Alden, Boston, Mass. App. filed Nov. 6, 1915. Producing the conduit or hollow links from two halves separated.

1,233,559. REMINDER CLOCK; Augusta Y. Darche, Chicago, Ill. App. filed June 26, 1916. Hour-hand arbor carries a contact arm adapted to close a circuit through an alarm by coming in contact with a pin selectively set by the operator when the alarm is desired.

1,233,566. ETHYLENE GENERATOR; Walter K. Freeman, New York, N. Y. App. filed June 19, 1913. Improvements.

1,233,568. BUSBAR INSULATOR AND SUPPORT; Frank E. Gettis, Chicago, Ill. App. filed July 31, 1916. Use of an internal reinforcing member for the porcelain or other friable material which constitutes the body of insulation.

1,233,569. APPARATUS FOR DRIVING MACHINES; Benjamin Graemiger, Zurich, Switzerland. App. filed May 5, 1914. A metal alloy of great strength and which is a very bad electrical conductor is employed for the separating partition between the driving and driven members.

1,233,584. MEANS FOR TRANSFERRING HIGH-POTENTIAL ELECTRIC CURRENTS AS ARCS; Carl G. Koppitz, Wilkinsburg, Pa. App. filed Sept. 19, 1913. Means for increasing the conductivity of the air at the arcing points by creating partial vacua thereat.

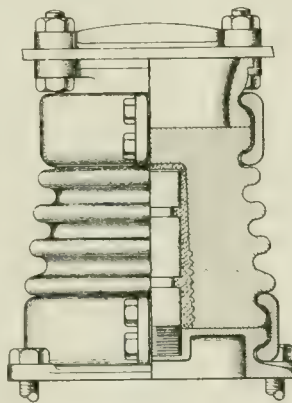
1,233,597. FLUSH SWITCH; William J. Newton, Lynbrook, N. Y. App. filed May 6, 1915. Improvements on type which is now in use.

1,233,671. ELECTRICAL SYSTEM OF DISTRIBUTION AND REGULATING APPARATUS THEREFOR; John W. Jepson, New York, N. Y. App. filed March 9, 1908. Voltage regulator for service on lamp circuits on railway cars.

1,233,673. ICE SHAVER; Frank B. Kinney, Syracuse, N. Y. App. filed April 28, 1917. Improvements.

1,233,679. ELECTRICAL SIGNAL TRANSMITTER; Judson McFell, Chicago, Ill. App. filed Aug. 19, 1914. Improvements on existing systems.

1,233,688. ELECTRIC WELDING MACHINE; Thomas E. Murray and Harry R. Woodrow, New York, N. Y. App. filed Feb. 19, 1917. Apparatus for producing toothed gears by electrically welding the teeth to a supporting member.



1,233,568—Busbar Insulator and Support

1,233,689. PROCESS OF AND APPARATUS FOR ELECTRICALLY MAKING HOLES IN METAL BLOCKS OR PLATES; Thomas E. Murray, Jr., Brooklyn, N. Y. App. filed April 24, 1917. For example, the insertion of rivets connecting such plates or blocks together.

1,233,720. FUSE PLUG; Sidney T. Sjöberg, Minneapolis, Minn. App. filed Feb. 21, 1916. Multiple-fuse plugs.

1,233,746. THERMOSTATIC CIRCUIT BREAKER; Niels Bendixen, Copenhagen, Denmark. App. filed Jan. 2, 1917. Uninclosed liquid-containing receptacle, also an inclosed one, the former being the more exposed and therefore more immediately responsive to a sudden change that may be imposed upon it.

1,233,796. LAUNDRY APPARATUS; Halvor H. Lyche, Chicago, Ill. App. filed July 17, 1916. Washing machines.

1,233,798. SAFETY LOCKING DEVICE FOR ELEVATORS; Alexander T. Mackie, Boston, Mass. App. filed July 22, 1914. Automatic safety control.

1,233,807. METHOD OF MAKING INSULATED WIRES; Robert H. Read, Washington, D. C. App. filed Jan. 3, 1914. Relates to fireproof insulated conductors of the general type.

1,233,808. SHEATHED HEATER WIRE AND METHOD OF MAKING SAME; Robert H. Read, Washington, D. C. App. filed June 9, 1917. Effectually excludes air and moisture and effects this result by filling

the pores of the asbestos with a mineral oxide, such as finely divided silica or alumina.

1,233,838. ELECTRIC OVEN; Josiah Bradley, Brooklyn, N. Y. App. filed March 21, 1916. For use in bottle capping and sealing machines.

1,233,852. LIQUID RHEOSTAT; George H. Dorgeloh, Schenectady, N. Y. App. filed July 30, 1914. Set of auxiliary electrodes which are more closely spaced than the main electrodes and connected in parallel with the latter, but not immersed until the resistance has been reduced.

1,233,854. MOTOR-CONTROL SYSTEM; John Eaton, Schenectady, N. Y. App. filed April 23, 1915. Improvements.

1,233,863. CONTROL SYSTEM; Karl A. Simon and Arthur J. Hall, Wilkinsburg, Pa. App. filed June 9, 1914. Adapted to compensate automatically for the inherent phase distortion and reduction of voltage of the phase converter under conditions of load, irrespective of whether it be a motor load or a generator load.

1,233,877. VARIABLE-SPEED CONTROLLER; Clark T. Henderson, Milwaukee, Wis. App. filed July 29, 1913. Employed to drive variable-speed mechanisms.

1,233,890. ELECTRIC-WIRE EMBEDDER; Fred W. Luerbeck, Knox, Ind. App. filed Jan. 10, 1917. Current will be directed successively through short sections of the wire, thereby requiring a small current.

1,233,899. DYNAMO-ELECTRIC MACHINE; Alfons H. Neuland, New York, N. Y. App. filed July 29, 1915. Means for adjusting and regulating the speed and torque of the machine.

1,233,900. ALTERNATING-CURRENT MOTOR; Alfons H. Neuland, New York, N. Y. App. filed Aug. 7, 1915. Means for varying the power factor, thereby permitting the motor to correct the power factor of the supply system.

1,233,952. AUTOMATIC CONTROL OF PHASE CONVERTERS; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed April 18, 1914. Relates to the automatic regulation of electro-dynamic phase converters in such a manner as to cause them to deliver balanced voltages under load.

1,233,953. REGULATOR FOR PHASE BALANCERS; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed April 19, 1916. Consists of an arrangement for controlling the direction and magnitude of the excitation applied to the booster-field coils of phase balancer so that the same may be applied to a polyphase system in which a single-phase load is apt to be taken from more than one phase of the system.

1,233,959. MOTOR CONTROLLER; Herbert G. R. Bennett, Youngstown, Ohio. App. filed March 12, 1915. Improvements.

1,233,968. ELECTRIC HEATER; Charles F. Bradburn, Belmer, Ont., Can. App. filed July 7, 1916. To facilitate the distribution of heat by means of convection or draft tubes, forming channels, these tubes or channels establishing convection currents and directing the same to such places as may be desired.

1,234,028. ELECTRIC LIGHTING APPARATUS FOR VEHICLES; William H. Honsberger, Welland, Ontario, Canada. App. filed Sept. 29, 1916. Headlamps.

1,234,060. INCANDESCENT ELECTRIC LAMP; George M. J. Mackay, Schenectady, N. Y. App. filed April 30, 1913. Nitrogen.

1,234,063. RAIN SIGNAL; Frederick A. Meng and Lee G. Schrader, Flint, Mich. App. filed May 18, 1916. Improvements.

1,234,069. ELECTRIC SWITCH; Arvid H. Nero, New Britain, Conn. App. filed Oct. 28, 1915. Flush switch of the push-button type commonly employed to control lighting circuits.

1,234,099. RECTIFYING SYSTEM FOR HIGH-TENSION ALTERNATING CURRENTS; John H. Lendi, Chicago, Ill. App. filed Jan. 24, 1916. Combines the high-tension windings of the polyphase transformer so as most effectively to utilize the waves in the combined unidirectional current.

1,234,100. RENEWABLE INCLOSED FUSE; William J. Morgan, St. Louis, Mo. App. filed July 2, 1914. To provide means making it impossible to attach a fuse link of a greater capacity than that for which the fuse is designed.

Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN

Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, AUGUST 11, 1917

No. 6

Converting Energy Into Profits

CONVERTING electrical energy into real profits in the income account is a man's size job these days. More than one public utility company has had some entries in recent months which have been unmistakably and uncomfortably scarlet in color. There is no disguising the fact that the central station must earn money to live; it cannot just pull through and meet its obligation to give good service to the public, it cannot live from hand to mouth and preserve its credit. Gross business it has in plenty, but a reasonable percentage of the turnover is the fair and earned return of the security holders. The margin of safety above this means too much to the property, too much to the community, to be treated lightly.

There was never a time when it was more important to maintain a good financial showing than in this year of uncertainty. The community is growing; the property has to grow, not with the community, but in advance of the community. The central station keystone is that when the community wants service service it shall have. Of course, the local community stands aside now for the national exigency, but it is still undebatable that the central station enjoys rights of a local monopoly; it is protected and it accepts an obligation which it cannot surrender. In fulfilling this obligation it has to go usually far afield from its own community, it accepts another burden which has also moral and legal angles. Its foremost obligation may be to serve the public, its next is undoubtedly to guard the assets of those whose investment makes it possible to serve. And its only way of guarding the assets is so to manage that they shall earn a return. Service good, assets safe, return fair is the standard.

The reason why all of this has new importance is that in a time when it is harder to work profits out the demands upon the companies, both of the day and the future, are greater than ever before. Production must be stimulated. When consumption catches up with production the logical reply is greater production. But greater production is not a matter of ordering a suit of clothes from a bolt of cloth. It is a question of planning farther ahead than the electrical industry has ever had to look before. To-day in turbines of some sizes it means an order for 1919 or 1920 delivery.

Gross business alone is never the criterion set up by the bankers who guard the purse strings of the investing public. The country is full of concerns which show volume of gross business, imposing totals of actual and book assets, but a balance on the wrong side of the ledger. When European nations sent their first orders to this side of the Atlantic in 1914 and 1915 a war

order was looked upon as a sure thing in Wall Street. It was not always that, it was sometimes a liability. The economic requirement of central station operation is adequate net revenue. Its standing as a borrower cannot be held inviolate without that. Its necessary provision for the future cannot be made without it.

Economy in Meter Reading

WHEN one considers the ever-increasing amount of clerical work which accumulates in the office of every central station he instinctively wonders how much of it is absolutely necessary. A certain minimum amount of bookkeeping is very obviously required. Other additional amounts are demanded by the necessity of classifying information and providing proper facilities for the growth of the business, but over and above all these it seems extremely likely that no inconsiderable mass of clerical work is due to blind following of perhaps unwise precedents. The matter of reading meters and of billing in central station practice is one which deserves rather close attention, particularly with reference to the overhead charges involved in the process.

A question that often arises is concerned with the frequency of meter reading and consequent billing as a factor in costs. To read a customer's meter and send the results from the office costs a certain definite amount which can be reckoned up without any particular difficulty. In certain classes of business and in some communities this overhead charge may be a material fraction of the monthly bill. At what point should a just balance be struck between this cost, the interest on the customer's money brought quickly to hand, and the moral risk involved in less frequent meter readings? We have a suspicion that in the current practice of some companies the balance is on the wrong side and that real efficiency demands less frequent readings and balancings than are now customary. In fact, some companies have already found this to be the case and are moving toward measures of reform. The question is an individual one which must be settled on its own merits by every central station manager. The gains to be made by paying a certain amount for the privilege of quicker collections is a comparatively easy thing to reckon. The possibility of bad bills involved by too infrequent meter readings cannot be reckoned directly, but only on the basis of experience with the consumers. One wise old manager remarked not long ago that the average customer was more honest and more inclined to play fairly with the company than was generally supposed. Unquestionably, infre-

quent meter readings may cause some small accounts to be lost altogether, but if the lessened meter and billing charges on the average tend to a favorable balance sheet the moral risk may perhaps be forgotten as it is in many another business. At all events, the subject is one which deserves more thorough consideration than it has generally had, and we trust that our readers who have experimented along this line will give their fellows the benefit of their experience. In these days of increasing costs every means of keeping down unnecessary expense deserves prompt and thorough study.

Federal Aid for Vocational Education

THE Carnegie Foundation for the Advancement of Teaching, which is always prosecuting inquiries in American teaching, has recently published its Bulletin No. 10, on the subject of federal aid for vocational education in general, and on the history of agricultural college federal grants in particular. The historical material presented indicates that numerous attempts to establish agricultural colleges by federal aid have been made during the last hundred years. The most successful effort culminated in the Morrill bill for land-grant colleges, in 1862. The original plans and purposes of these federally endowed institutions seem to have been vague. They appear to have grown up in obedience to individual management, following the lead of existing customs, rather than under a definitely assigned plan. Only in the last twenty years have the agricultural colleges been able to persuade American farmers that the subjects taught had practical value on the farm.

Looking back on the historical picture presented by the bulletin, it is no wonder that events had a trend that way. Agriculture is an industry of enormous and fundamental importance to every nation. It is extremely ancient and intensely complex. There is immense opportunity for science to improve it; but so many factors enter into agricultural production that the influences of scientific knowledge and investigation can only reveal themselves gradually. Not until it is clear that scientifically trained farmers beat rule-of-thumb-trained farmers can there be an economic demand for the agricultural college graduates. In the absence of an economic demand, it is unreasonable to expect a call for scientific farm education. When the demand has once manifested itself federal endowment will not be indispensable. The states and towns will supply the need.

The bulletin goes on to show the danger that besets the path of recent federal aid for other kinds of vocational education, under the law of 1917. The act provides for federal expenditures on trade and industrial teaching, increasing from \$1,500,000 in 1918 to \$7,000,000 in 1926 and subsequent years. There are two separate questions involved here. One is the propriety of applying federal money and administration to industries in the jurisdiction of the several states. The other is the expediency of applying taxes to the support of vocational schools without a clearly defined plan and

program. In regard to the latter question there is enormous need for technical and vocational training of youths who have the ambition to be foremen in industry. For every engineer who is competent to plan and supervise the construction of plant there is need for, say, twenty foremen, to direct perhaps three hundred workmen, in the industrial work of the plant. This need exists not merely in one or two industries, but in a large number of industries. The demand for scientifically trained workmen cannot be created by fiat. It can only come economically, after the scientifically trained men shall have proved that they can outdo the rule-of-thumb-trained men. Once that proposition is clearly established in each industry, federal support will no longer be a necessity.

As to the former question, there is of course always the danger, in a country like ours, of invoking federal taxes for state needs and of creating burdensome unnecessary interference with state or local administration. The hope for checking waste in such matters is to make the federal income tax apply in small measure to small incomes, whereby the average man comes to feel that federal taxation affects him personally in appreciable degree. If the federal funds raised succeed in establishing, economically and manifestly, the industrial utility of scientifically trained workmen, the money will be well expended.

Tests of a Uniflow Engine

OUR readers will be interested in the efficiency test of a uniflow engine reported in another column. The uniflow type of reciprocating engine is especially designed to maintain a steady temperature gradient in the cylinder and to operate with low constant losses, and by means of an unusually simple valve gear, over a considerable range of load. The test before us is specially striking because it was made on an engine which had been working for many months in a steel mill. It was a single-cylinder machine directly connected to a 200-kw. generator and operating at 200 r.p.m. with steam pressure between 135 lb. and 150 lb. per sq. in. (9.49 kg. per sq. cm. and 10.5 kg. per sq. cm.). The vacuum was not particularly good, only 26 in. (66 cm.), and the running conditions for efficiency none of the best. Considering all these conditions, the results reached were highly satisfactory for a simple condensing engine working over a wide range of power. Particularly noteworthy is the exceptionally uniform efficiency obtained through a range running from quarter load to one and a quarter times full load. The variation of efficiency between these limits was approximately 10 per cent. The average consumption of dry steam per indicated horsepower at full load was down to the very creditable figure of 15 lb. (6.8 kg.), and comparing this result with that obtained in shop tests it is apparent that the working of the engine at the last was perhaps even a little better than before it had been put through its forced run for sixteen months, giving the equivalent of two and a half years' operation on the ordinary ten-hour-a-day basis. The results show

very plainly that the development of new ideas in engine construction may well prove a winning game, despite the common belief that the reciprocating engine has been pushed to about its ultimate development.

Transmission-Line Charging Currents

IN LONG-DISTANCE power-transmission three-phase systems the working voltage must necessarily be high in order to keep the cost of the conductors within proper economic limits. Consequently the charging current in amperes on each line may be considerable, with all the loads thrown off, even although the capacitance of each kilometer, to neutral or zero potential, may be less than one-hundredth of a microfarad. These charging currents represent a very considerable apparent power in kilovolt-amperes, although the active power at no load may be very small. In some cases the change in voltage and in current at the generator station between no load and full load may be comparatively small, the change being met by the power factor of the system. The apparent power may be nearly the same throughout, but the active power will change from a small to a large quantity.

In the ideal case of three symmetrical working aerial-line wires supported on poles or towers, with no other conductors parallel thereto, such as ground wires or telephone wires, the linear capacitance of each wire of the system is easily found from textbooks or tables, and the linear charging current is the product of the linear capacitance, the star voltage and the impressed alternating angular velocity. If, however, the line wires are dissymmetrically arranged, or if there are other parallel wires in their vicinity, or again if one of the working wires is grounded, then the linear capacitances and the charging currents of the system are no longer easily found. In many practical cases the computation of these quantities becomes very complicated, especially when a number of wires are carried side by side on the same poles. The laws governing such cases were first enunciated by Maxwell and were extended by Heaviside.

The article by R. H. Marvin, the first part of which we publish this week, discusses the Maxwell method in detail. It has the merit of dealing with specific cases in which the observed actual charging currents are compared with the computed values. It appears that in nearly all practical cases the observed values some-

what exceed the computed values. In fact, the computed values are limiting minima, and the actual conditions always tend to exceed them. The formulas of Maxwell only consider the linear capacitance between wires or their images in air. In addition, there is the capacitance of the insulators themselves and the capacitance between the wires and the poles or towers considered as conducting supports. When there are many parallel wires on the poles the corrections for these extra capacitances of supports may be negligible, but in the opposite case the corrections may be appreciable. Mr. Marvin's article is useful in calling attention to these discrepancies.

Upkeep of Industrial Lighting Systems

ANOTHER of Professor Clewell's suggestive papers will be welcomed by those in charge of industrial lighting plants. It is well known to illuminating engineers that many an installation thoroughly satisfactory at first proves in the long run inefficient. Part of the difference may be charged up perhaps to the psychological factor which makes the human mind discontented with its wonted conditions, but there is in addition a very real depreciation in service due to lack of care and the inevitable incidence of dirt. It is this question of upkeep which Professor Clewell particularly discusses. According to the data which he has accumulated on a typical factory case it pays, from the standpoint of efficiency versus cost of upkeep, to clean lamps and reflectors about every two weeks. Where dirt is more than usually severe the interval should be shorter than this; where less severe it may be somewhat longer. From a practical standpoint the fact which stands out conspicuously is that if the clean lamp in its reflector is operating on the basis of 1 watt per candle as short a period as three weeks without cleaning may reduce the lamp to a rating of about 2 watts per candle. If it were suggested to the factory manager at the present time to use lamps having so low a rating he would be astonished and incensed; yet from ignorance of the facts losses of this magnitude may be going on right under his nose all the year round. The whole matter is gone into by Professor Clewell on a careful and scientific basis which ought to leave no more excuse for the bad maintenance of a good installation than there is for an installation in itself positively bad.

NOW that the lighting companies are convinced that the business is largely one of service, the question of the proper location of the offices is of considerable importance. Customers do not care to go into the manufacturing part of the city where the plant is located to pay their bills. Nor do they care to walk to one end of the town. Besides, if the sale of appliances, the orders for service, etc., are to come in freely, the office must be placed in the "path of least resistance." An analysis of some of the best opinions on this topic will be found in the com-

The Coming Issues

ing issue. As a bridge between the industrial lighting series by Prof. C. E. Clewell and the municipal lighting series by J. R. Cravath, which will start in the Sept. 1 issue, there will be an article next week on a novel method for lighting an underground passageway whereby the effect is one of sunlight. A third article will describe the success experienced in St. Louis in selling ranges. These will all be in addition to the regular departments devoted to operating practice, commercial service and to the news, including that of the trade.

Operation and Upkeep of Factory Lighting Systems

Value of Upkeep of Lighting Systems—Table of Utilization Efficiencies—Notes on Systematic Maintenance—Items in the Operation of Various Lamps That Determine Operating Charges

BY C. E. CLEWELL

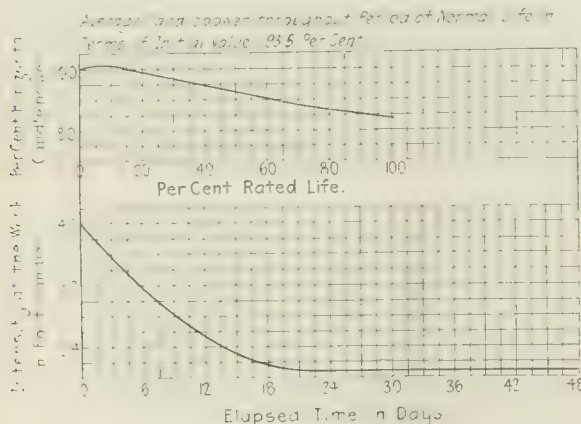
Assistant Professor of Electrical Engineering, University of Pennsylvania

SUMMARY.—This article contains a discussion of some of the important phases of practical operation and upkeep in the factory lighting equipment. At the outset it is suggested that an allowance be made in every new system for the natural deterioration which must be expected owing to gradual decreases in the candlepower of lamps with time of service, to accumulations of dirt on lamps and reflectors, and to the gradual decrease in the reflecting efficiency of metal or glass reflector surfaces and of ceilings and walls. Mention is made of the value to a plant of the establishment of a regular maintenance division for attention to lamp renewals and reflector cleaning, and in this connection reference is had to the magnitude of the illumination losses that result if this kind of work is neglected. Methods of simplifying access to overhead lamps for renewal and cleaning are explained, and precautions to be taken in the use of glass reflectors with overhead lamps so as to reduce the accident risk to workmen beneath in case a reflector breaks are suggested. The author explains why so many well-designed lighting systems which are entirely satisfactory at the start soon become totally inadequate through the neglect of the various points brought out in this article.

THE utilization efficiency of a lighting system is defined as the ratio of the total luminous flux effective on a reference plane (in factory lighting, a plane passing through the work) to the total luminous flux generated by the bare lamps of the systems. This means that a system with a utilization efficiency of 50 per cent directs one-half of the generated light flux to the work. The other half is lost as far as the working surfaces are concerned, being absorbed by the reflector, possibly by dirt on the lamps and reflectors, and by walls and ceiling and other surrounding objects.

INITIAL AND AVERAGE PERFORMANCE OF SYSTEM

The accompanying table¹ gives values of this factor for systems of tungsten lamps, which are calculated on a basis of the simple relation shown in the equation:



FIGS. 1 AND 2—HORIZONTAL CANDLEPOWER PERFORMANCE OF MAZDA LAMP THROUGHOUT NATURAL LIFE; PERFORMANCE CURVE OF LAMP AND PRISMATIC GLASS REFLECTOR SHOWING EFFECT OF DIRT

¹As given in Bulletin 20 of the National Lamp Works of the General Electric Company.

$$E = \frac{L \times K}{A \times 100}, \text{ or } K = \frac{E \times A \times 100}{L}$$

where E is the average measured intensity of the illumination on the working plane, L the total lumens per lamp, K the utilization efficiency expressed as per cent, and A the average floor area in square feet illuminated by each lamp.

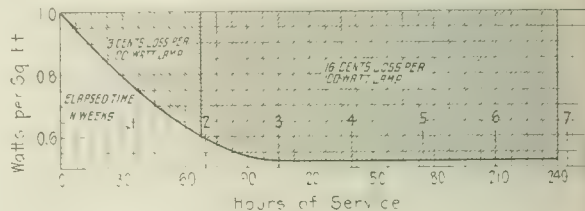


FIG. 3—PERFORMANCE CURVE SHOWN IN FIG. 2 WITH NEW CO-ORDINATES TO SHOW LOSSES IN WATT-HOURS DUE TO DIRT ACCUMULATIONS

The values of K as usually published represent the conditions of the system when first installed; that is, when the lamps are new and when both lamps and reflectors are clean. It should be noted also that since K depends to some extent on the color of walls and ceiling, the conditions of the surroundings should be known before this constant is selected for use in a practical case. The table shows in a striking manner the higher values of K for the larger installations than for those cases where only a few lamps are used to illuminate a small area.

The fact that the value of K may be from 30 to 60 per cent greater with white walls than for dark surroundings in some installations and for some types of reflectors shows at once that if a system of lamps is installed in a new building the gradual deterioration in the color of walls and ceiling, due to accumulations of dust and dirt, will reduce the effectiveness of the

TABLE OF UTILIZATION EFFICIENCIES*

Type of Installation	REFLECTOR	
	Enameled-Steel Dome	Enameled Steel or Pyro Glass Bowl
One unit	28	24
One row of five units	42	36
Two rows of two units	48	41
Two rows of three units	52	44
Three rows of three units	56	47
Three rows of four units	60	49
Four rows of four units	63	51
Four rows of eight units	67	54
Eight rows of eight units	71	57

*Units spaced 1.5 to 1.6 times their height above the working surface.

lamps with time of service. To the factor of absorption by surroundings there must be added the material, although not very large, decline in the candlepower of a lamp below its initial value, as shown for tungsten lamps by the curve in Fig. 1. This decrease in candlepower, it will be noted from the curve, is such for this

type of lamp as to reduce the candlepower about 15 per cent below its initial value at the end of its natural life.

The other very important item of deterioration is that due to accumulations of dirt on the lamps and re-

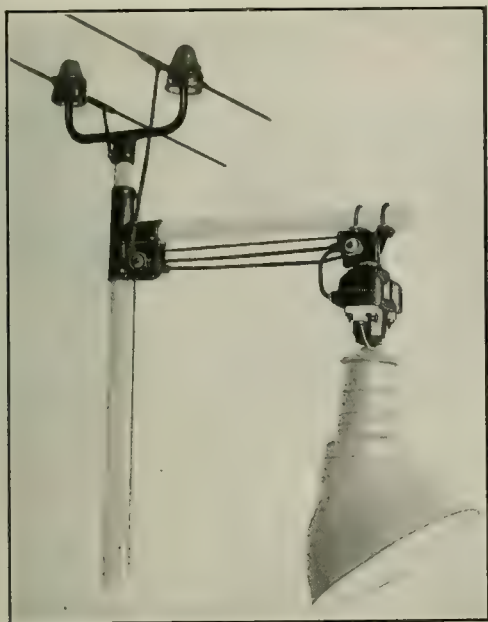


FIG. 4—THOMPSON AUTOMATIC DISCONNECTING HANGER, STANDARD SEMI-INCLOSED TYPE FOR INDOOR OR OUTDOOR SERVICE

flectors themselves. The curve in Fig. 2 is plotted from actual test observations made under factory conditions, and in this case it is evident that the decrease in candlepower is likely to be very rapid under typical shop surroundings. The curve shows in this case a fall in the intensity on the working plane of nearly 50 per cent in twenty-one days. These items all go to lower the value of the utilization efficiency throughout the regular performance of any factory lighting system, and hence it is very desirable to allow for these conditions in the original calculation of the lamps necessary to supply sufficient illumination for any particular shop work.

LOSSES FROM LACK OF FREQUENT CLEANING

In Fig. 3 the curve of Fig. 2 is plotted with a new set of co-ordinates, so as to show the order of magnitude of the losses which may occur from dirt on lamps and reflectors. On the basis of 4 effective lumens per watt, the maximum ordinate of the curve, to the left, is made equal to 1 watt (per square foot) on this new scale, and on the assumption that the lamps burn five hours a day the new scale of abscissas is such that thirty hours are equivalent to six days in Fig. 2. The area of the shaded portion of the curve, which represents the losses in intensity due to dirt, is thus directly equal to watt-hours (per square foot).

In Fig. 3 the amount of the shaded area, beginning at the extreme left, which corresponds to 3 cents has been calculated on a basis of 2 cents per kilowatt-hour for energy and maintenance and for a single 100-watt tungsten lamp. Where the loss of light represents an expenditure for energy and maintenance equal to 3 cents, as shown, this loss is approximately equal to a fair value for the cost of cleaning the lamp and reflector. This point occurs at the end of about fourteen

days. At the end of seven weeks, if the unit is not cleaned, the loss per 100-watt lamp amounts to about 19 cents. Obviously, if the energy rate is greater, this loss will be correspondingly greater.

It is interesting to note that when the light has fallen to a value of about one-half its original value—that is, at the end of three weeks—the lamps are operating as the equivalent of a system of units which produce about 2 effective lumens per watt, and if the lamps are rated at, say, 1 watt per candle, they are equivalent after three weeks to lamps with a rating of about 2 watts per candle. Hence any system which deteriorates according to this curve after three weeks of service is costing nearly double the amount for light which is necessary. Furthermore, the management could afford to clean its lamps and reflectors at intervals of about two weeks, because after two weeks the combined cost of cleaning plus the loss in light since the previous cleaning will exceed the value of these two items at the two-week point.

Incidentally, the system, if made up of, say, 1000 tungsten 100-watt lamps and if operating as shown in the curve of Fig. 2, represents, after three weeks, a loss of something like \$5 a day, or roughly \$1,500 per annum, with the combined energy and maintenance charge equal to 2 cents per kilowatt-hour. In other words, the lighting for a floor area of about 100,000 sq. ft. (9290 sq. m.), or about 300 ft. (91.4 m.) on a side, would represent a loss of nearly \$1,500 per annum if the lamps and reflectors were not cleaned at sufficiently short intervals. Of course, even if cleaning is scheduled for every two weeks, this loss, though considerably reduced, is not entirely obviated, since the average intensity during two weeks will be somewhat less than the initial value.

NOTES ON SYSTEMATIC MAINTENANCE

A scheme which has worked out successfully is to assign the work of lamp upkeep to a regular lamp de-

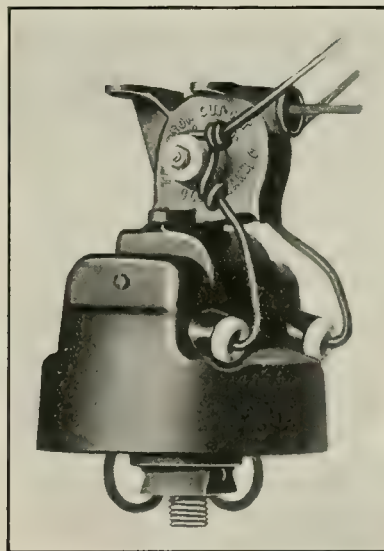


FIG. 5—DEEP CANOPY OR STORM-JACKET TYPE OF THOMPSON HANGER WITH PROTECTION AGAINST SLEET FOR YARD SERVICE

partment, a good plan in such an event being to have every lamp and reflector inspected each day, and on the basis of this inspection to have all burned-out lamps renewed on the same day and to see to it that all inci-

dental repairs on switches, sockets, mercury-vapor and arc lamps are promptly made. In addition to the success of this scheme in maintaining all lamps in good condition from day to day, such an orderly procedure makes it possible to keep a record of all supplies used for this work, and on a basis of this record a monthly and an annual summary of the upkeep cost can be made. This has the obvious advantage of affording a check on whether this maintenance work is being properly done.

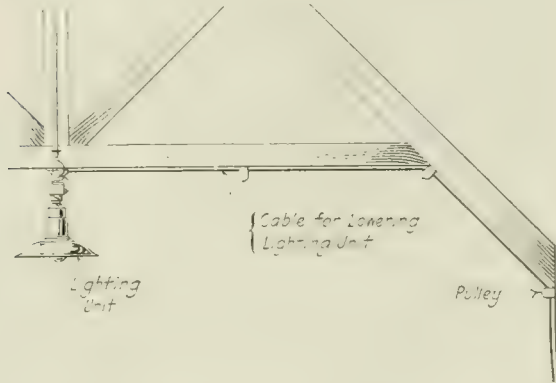


FIG. 6—SCHEME SUGGESTED FOR THE USE OF AUTOMATIC DISCONNECTING HANGERS FOR INTERIOR WORK WITH MAZDA OR OTHER TYPES OF LAMPS

The use of the overhead system of lamps has the advantage of placing the lamps out of the reach of the workmen, and theft of lamps is thus reduced. On the other hand, however, the work of renewing lamps and getting at reflectors for cleaning is somewhat complicated by the added difficulty experienced by the maintenance men in reaching the units. For mounting heights of 12 ft. (3.7 m.) a stepladder may be used, and even for 16 ft. (4.9 m.) with open roof trusses a regular ladder may be employed. With lamps at a greater height the difficulty increases considerably.

For the larger units some form of automatic disconnecting hanger^a is useful, as indicated by Figs. 4 and 5. Fig. 6 is a suggestion of how such a hanger may be employed with pulleys where the lamps are mounted at central points in the aisles. The tops of overhead traveling cranes are also a favorite means for getting at high lamps, although this is a dangerous procedure and one to be discouraged. Two maintenance men are shown in Fig. 7, the one to the right standing on an adjoining mezzanine floor and the other exchanging a reflector for cleaning, from the top of a crane which runs over an aisle 20 ft. (6.1 m.) below. The general conditions shown by this view, such as the proximity of crane trolley wires, low girders, etc., indicate the danger of such a method.

ORDERLY WORK RECOMMENDED

There are, of course, some shops where the number of lamps is so small as to make a separate well-organized maintenance division for lighting out of the question. For the larger shops, however, such a division becomes increasingly important. For the successful conduct of the work it is recommended that the stock room be planned in such a manner that all supplies will be kept in an orderly fashion and that a scheme be devised for checking supplies so that the somewhat irregular calls for renewals and repair parts may be recorded systematically. Under one system in use each

ITEMS IN THE OPERATION OF MAZDA LAMPS

Fixed Charges:

Interest on total investment.
Depreciation on wiring and on non-renewal part of equipment, i.e., except lamps.
Labor for cleaning lamps and reflectors (monthly).^d

Maintenance:

Lamp renewals.
Repairs on sockets, switches, replacing fuses, etc.

Energy:

Energy cost at given rate per kilowatt-hour.

ITEMS IN THE OPERATION OF MERCURY-VAPOR LAMPS

Fixed Charges:

Interest on total investment.
Depreciation on wiring and on non-renewal part of equipment, i.e., except tubes.
Labor for cleaning tubes and reflectors (monthly).

Maintenance:

Tube renewals.
Repairs on lamps, switches, replacing fuses, etc.

Energy:

Energy cost at given rate per kilowatt-hour.

ITEMS IN THE OPERATION OF ARC LAMPS

Fixed Charges:

Interest on total investment.
Depreciation on wiring and on non-renewal part of equipment, i.e., except carbons.
Labor for cleaning globes (monthly).^d

Maintenance:

Lamp trimming.^e
Repairs on switches, lamps, replacing fuses, etc.

Energy:

Energy cost at given rate per kilowatt-hour.^e

lamp trimmer has a numbered hook for his box of new carbons, and beneath this there is a pan for all the old pieces, so that the foreman can ascertain the point

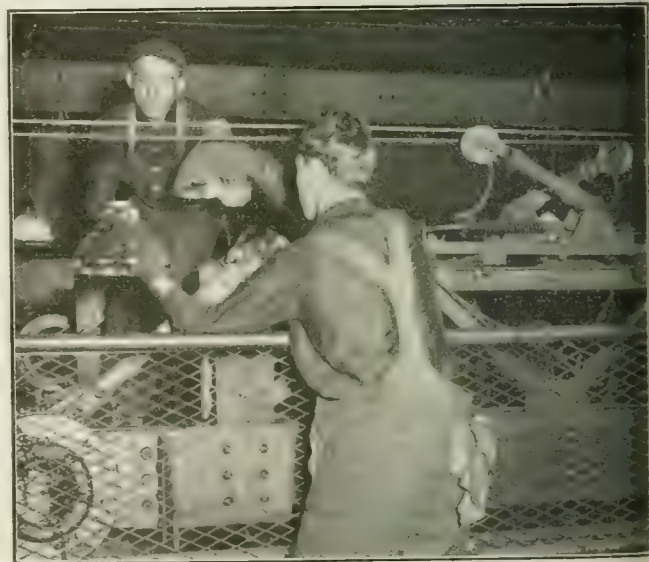


FIG. 7—DANGER IN USE OF CRANE AND MEZZANINE FLOOR IN CHANGING REFLECTORS FOR CLEANING

at which trimming is done and know whether waste is taking place.

Where glass reflectors are used with lamps overhead,

^dNote that the labor charge for lamp and reflector cleaning is placed under fixed charges. In doing so it is assumed that the equipment will be cleaned at regular intervals (for example, once a month) independently of the number of hours the lamps burn.

^eIf globe cleaning is performed at the time of trimming the lamps, it then becomes a function of the number of hours which the lamps burn and should be included as one of the items under maintenance.

^fIn a subsequent article these maintenance items will be the subject for a further analysis.

they should be protected, for the safety of workmen beneath, as shown in Fig. 8, which gives an idea of how a wire-mesh screen may be woven about each reflector in an inexpensive but effective way. This wire screen is attached to the shade holder, and if the glass is broken the wire retains the pieces of glass as shown, thus preventing them from falling on the heads of workmen who may be below.³

The prevention of lamp theft is a troublesome item to

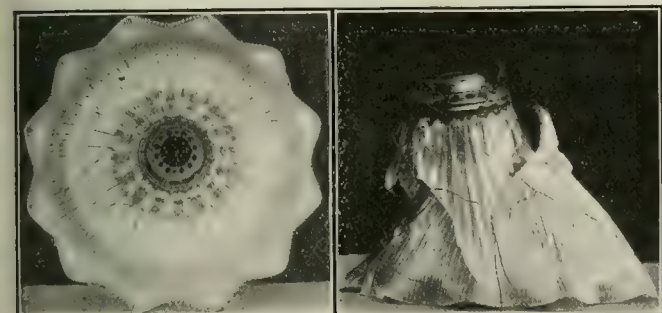


FIG. 8—MESH-WIRE SCREEN WOVEN ABOUT GLASS REFLECTOR; ACTION OF WIRE MESH IN RETAINING PIECES OF BROKEN GLASS

deal with in a large plant. Various lock sockets have been devised, but in general their use impedes the work of maintenance to such an extent when renewals are made or when reflectors are exchanged for cleaning that they become a nuisance rather than a help. Again, if a disconnecting hanger is employed for individual units, so that the maintenance man may lower the lamps from high points to a position within his reach from the floor, unprincipled employees may, with equal ease, lower the lamps and remove them.

The data at the top of the opposite page show the various items associated with factory lighting operation and upkeep, and also show how these items may be grouped under the headings of fixed charges, maintenance and energy. The total annual operating charges are found by adding the items under these three heads in any practical case.

BOSTON COMPANY URGES ADEQUATE RESERVE PLANT

Recommends Emergency Connections and at Least One Extra Unit Rated as High as Largest Unit in Plant—Forcing Turbines Not Practicable

Experience and tests have shown the Boston Edison company that it is necessary to have ample reserve capacity rather than to depend on the overload capacity of turbines, according to testimony given before the Massachusetts Gas & Electric Commission by L. L. Elden, electrical superintendent of the company. The benefit of emergency connections was also emphasized, it being pointed out that the Interborough Rapid Transit Company of New York depends on the connections with the New York Edison Company to supply any deficiency in power. The transit company is connected with the Edison Electric Illuminating Company of Brooklyn for the same reason.

The necessity for adequate reserve was especially emphasized lately when the largest unit (35,000 kw.) and two smaller units (7500 kw. each) in the Phila-

delphia plant became inoperative during a peak load of 135,000 kw. Street-lighting service had to be discontinued for one night and part of another. It was also brought out in the testimony that the Cleveland municipal plant, which has no reserve equipment, gives such unreliable service that consumers now connected with the private electric service company's plant will not consider municipal plant service.

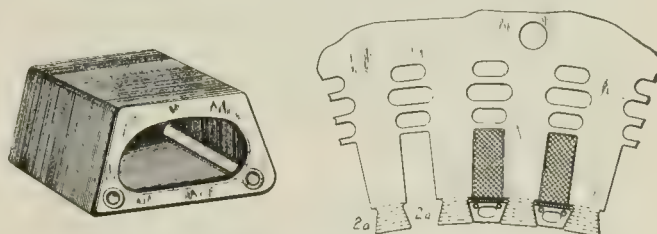
For many years the Boston company has felt that reserve capacity equivalent to the largest unit on the system is sufficient, though it should never be less. The risks of the electric service business have grown so, however, with the increase in size of apparatus and with the increase of operating voltage that this company no longer feels safe with one extra unit. Mr. Elden considers that where a company is operating two systems—that is, at two different voltages—a spare unit should be provided for each system.

While turbo-generators may develop ratings higher than normal for short periods with normal steam pressure and vacuum, the over-rating should not be depended on for reserve capacity as it is limited by the size of the condenser outlet, the ability of the pumps to remove the condensate and the condition of the turbine blades and condenser tubes. When variable-speed condenser auxiliaries are used, operating at over-rating is more likely to be possible. In practically every test the Boston company has made to operate at over-rating, it has been successful only for five to ten minutes; then the condensers fill up with water because the pumps are unable to dispose of the condensate fast enough. As a result the vacuum drops or is lost entirely. Furthermore, these over-ratings are obtained only at 100 per cent power factor, whereas the usual operating power factor is never so high.

SHORT-CIRCUIT REACTANCE WEDGES FOR DYNAMOS

A Method That Permits of Ready and Rapid Winding of the Coils and Maintains Them Securely in Position

Prof. A. B. Field proposes in patent No. 1,227,414 the use of laminated wedges of trapezoidal form so as to provide a characteristic for dynamo-electric machines ordinarily subject to dangerous short-circuit stresses. The wedge for the armature slots is laminated and substantially trapezoidal in form, having large flat surfaces and a longitudinal aperture therethrough for



TRAPEZOIDAL WEDGE FOR DYNAMO-ELECTRIC MACHINE

purposes of ventilation. It will be noted from the accompanying illustrations that the coils are thus disposed at an appreciable distance from the machine air gap proper, thereby considerably increasing the effective air gap and internal reactance of the machine and excluding the working conductors for the cross-flux in the tops of the slots.

³Fig. 8 is shown through the courtesy of the Westinghouse Electric & Manufacturing Company. The reflector shown is a case of breakage in actual service.

PERFORMANCE OF UNIFLOW ENGINE IN STEEL MILL

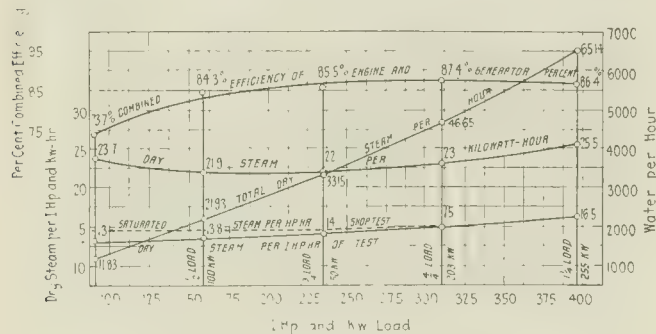
High Economy Shown Even Under Light and Over-load Conditions—Valves Found in Good Condition After Nearly 10,000 Hours' Operation

Present prices of material and labor make it so essential to consider every means of increasing plant economy and securing the maximum benefit out of the invested money that the advantages of the uniflow engines should not be overlooked. This type of prime mover should have special consideration where units of 500 kw. or smaller are to be used, when the load is liable to fluctu-

During the entire test indicator cards and electrical readings were taken every two and one-half minutes, and all gages and temperature readings were taken every five minutes. The vacuum was determined by a mercury column connected to the exhaust line close to the engine cylinder. The pressure-gage indications were checked by thermometer readings. The quality of steam was determined by a Carpenter throttling calorimeter. Crosby outside-spring steam indicators were employed. The voltmeters and ammeters from which the electrical load readings were taken were of a standard make and comparatively new. As they had been recently calibrated they were assumed to be correct during the test. The total steam at all loads was accounted for by condensing the exhaust in a surface condenser and weighing the condensate. As all jacketing steam for the engine cylinder passed through the cylinder with the live-steam supply, there was no trap discharge other than that from the oil separator in the exhaust between the engine and condenser. This discharge was retained, and the total for each load test was weighed and charged against the engine.

Each load was of sufficient duration (extended to one and one-half hours on the heavier loads) to insure accuracy. Owing to the construction of the rheostat used (installed in cooling pond) it was possible to maintain practically uniform load throughout the entire period, so that little or no difference was shown in the mean effective pressure on the indicator cards. With commercially dry saturated steam, supplied from a 200-hp. Badenhausen water-tube boiler, the engine showed the economy given in the accompanying table.

For the first few months the unit was operated non-condensing, during which time the condenser and auxiliaries were being installed. After the installation of



TEST CURVE OF UNIFLOW ENGINE

ate considerably, and when condensing and non-condensing operation may be alternately required.

After sixteen months' service the uniflow engine installed in the steel plant of the L. F. Shoemaker Company, Pottstown, Pa., was tested by the engineers of the steel company and showed very high economy (see accompanying data) especially at small loads. This unit had been operated six days per week and twenty-two hours per day during the greater part of the time, or the equivalent of two and one-half years' service with ten-hour-day operation. The very high economy at small loads is worthy of particular attention, especially when it is referred to on the basis of steam consumption per kilowatt-hour. A particularly interesting feature of the test data, aside from the maintained economy, is the improved economy obtained after the equivalent of two and one-half years based on a ten-hour day, as indicated by the dotted steam-consumption curve. This curve shows the results of a test of this particular engine on the builder's test block previous to shipment.

CONDITIONS UNDER WHICH TESTS WERE CONDUCTED

The test was made with conditions not so ideal as those that prevailed during the field test after installation, as the load was absorbed by a prony brake which made it almost impossible to carry the loads with the same uniform steadiness as with the electrical load during the field test.

Just previous to the test, which was made at quarter, half, three-quarters, full and one and a quarter times full load, indicator cards were taken at different loads and minute adjustments were made on the valve and reach rods to obtain proper and uniform steam distribution. This was done to compensate for adjustments in the valve-gear rocker-arm boxes which had been made during the operation of the engine while in service. Tests of the valves prior to making the adjustments and immediately after the completion of the test showed them to be absolutely steam-tight.

RESULTS OF TEST ON STEEL MILL UNIFLOW ENGINE

	LOAD				
	1/4	1/2	3/4	Full	1 1/4
Average steam pressure at throttle valve (lb.)	154.3	152.0	154.4	153.0	155.5
Average vacuum at exhaust nozzle (in.)	26.13	26.0	26.0	26.0	26.0
Average mean effective pressure (lb. per sq. in.)	13.0	22.75	33.82	44.93	57.0
Average indicated hp	90.9	159.0	235.0	311.0	396.0
Average moisture in steam delivered to engine (per cent)	0.2	0.11	0.085	Dry	Dry
Total dry steam consumed by engine per hour (lb.)	1183.0	2193.0	3315.0	4665.0	6514.0
Average dry steam consumption per indicated hp.-hr. (lb.)	13.03	13.8	14.1	15.0	16.44
Prevailing load on generator at switchboard (kw.)	50.0	100.0	150.0	203.0	255.0
Average dry steam consumption per kw.-hr. (lb.)	23.7	21.9	22.1	23.0	25.50
Combined engine and generator efficiency (per cent)	73.7	84.3	85.5	87.4	86.10

the condensing apparatus the automatic by-pass valves furnished with the engine were placed in operation. With these valves the engine may be operated condensing or non-condensing as local conditions require, it being possible to start the engine with or without vacuum.

The by-pass valves do not operate at every stroke of

the engine during either condensing or non-condensing operation, but only during the change of operating condition. By means of the adjusting screw controlling the tension of the springs they may be made to operate at any desired degree of vacuum from 10 in. or 12 in. (25.4 cm. or 30.5 cm.) up to maximum or perfect vacuum.

The engine which was tested is an Ames-Stumpf uniflow engine having a 19-in. (48.3-cm.) diameter cylinder with 24-in. (59.9-cm.) stroke. The engine is direct-connected with a 200-kw., 250-volt direct-current

Crocker-Wheeler generator, which furnishes energy for electric cranes, heavy punches, shears and general motor loads and in addition all energy for the entire lighting system. The load is extremely variable, there being frequent flash-load fluctuations from one-half load to 25 per cent overload. The unit operates at 200 r.p.m. with pressure at the throttle valve ranging from 135 lb. to 150 lb. (9.5 kg. to 10.5 kg. per sq. cm.), with practically uniform vacuum, and is rated at 320 indicated horsepower, with 150 lb. (10.5 kg. per sq. cm.) vacuum, cutting off at one-fifth of the stroke.

Transmission-Line Charging Currents—I

Method of Using Capacity and Potential Coefficients to Determine Charging Currents in Three-Phase Lines— Application of Maxwell's Formulas

BY R. H. MARVIN

WITH the extensive transmission systems now in use the charging currents due to the electrostatic capacity of the conductors are of such magnitude as to be of considerable importance. In the normal operation of the system these currents are approximately balanced. Their value can be calculated with sufficient accuracy by simple and well-known formulas. But frequently one of the conductors becomes connected to the earth through the failure of an insulator or the breaking of the line. With a grounded neutral system this causes a short-circuit. With a non-grounded or isolated system it may be possible to continue to operate, at least temporarily, but the charging currents are much increased and the currents in the different phases are decidedly unbalanced. Then also various forms of arcing-ground suppressors have been devised for the protection of lines, which temporarily ground the system.

The calculation of the charging currents with one conductor grounded is at best somewhat complicated. The height of the conductors above the ground, and the effect of the overhead ground wire, must be taken into account. An attempt is made in this article to give a definite and systematic method of making the calculations. Several examples will be worked out and the results compared with those obtained by actual test. The discussion is limited to three-phase lines as they are used on practically all modern systems. The changes necessary in the formulas to adapt them to two-phase or single-phase lines will be readily apparent.

CALCULATION OF CAPACITY COEFFICIENTS

The capacity of a conductor is defined as its charge when its own potential is unity and that of all surrounding conductors is zero. Considering a system of any number of conductors, which are numbered 1, 2, 3, . . . *n*, assume the first conductor receives a positive charge *C*_{1,1} sufficient to raise it to unit potential, and that all the others are meanwhile maintained at zero potential. There must also be an equal and negative charge distributed over the other (*n*—1) conductors. The negative charge on the second conductor will be called *C*_{1,2}, on the third conductor *C*_{1,3}, on the *n*th conductor *C*_{1,*n*}. As the positive and negative charges are equal

$$C_{1,1} + C_{1,2} + C_{1,3} \dots + C_{1,n} = 0.$$

In a like manner, if the second conductor is raised to a potential of one, all the others being at zero potential,

$$C_{2,2} + C_{2,1} + C_{2,3} \dots + C_{2,n} = 0.$$

Similar equations exist for the other conductors.

The quantities *C*_{1,1}, *C*_{2,2}, . . . *C*_{*n*,*n*}, are coefficients of self-induction, while *C*_{1,2}, *C*_{2,3}, etc., are coefficients of mutual induction. It can be readily shown that the mutual effects are equal, so that *C*_{1,2} equals *C*_{2,1}, *C*_{2,3} equals *C*_{3,2}, etc. It should be noted that if the coefficients of self-induction are positive, then all the coefficients of mutual induction are negative. This affords a valuable check on numerical work.

Assuming that the conductors are simultaneously charged to potentials, *v*₁, *v*₂, *v*₃, . . . *v*_{*n*}, the charge *q* on any conductor is that due to its own potential plus that due to the potentials of all the others. Thus:

$$\begin{aligned} q_1 &= C_{1,1}v_1 + C_{1,2}v_2 + C_{1,3}v_3 \dots + C_{1,n}v_n, \\ q_2 &= C_{1,2}v_1 + C_{2,2}v_2 + C_{2,3}v_3 \dots + C_{2,n}v_n, \\ q_n &= C_{1,n}v_1 + C_{2,n}v_2 + C_{3,n}v_3 \dots + C_{n,n}v_n. \end{aligned}$$

If the capacity coefficients* are known, the charge on any conductor due to any system of potentials can be found. The differential coefficient of the charge with respect to time gives the charging current.

The method which will be given for deriving the capacity coefficients involves the use of potential coefficients, so a brief explanation of these will be given. Assume a system of *n* insulated conductors, having charges of *Q*₁, *Q*₂, *Q*₃, . . . *Q*_{*n*}, respectively. The potential of conductor No. 1 due to its own charge only may be expressed as *p*_{1,1}*Q*₁, the potential of conductor No. 2 due to the charge on No. 1 as *p*_{1,2}*Q*₁. The total potential of each conductor is the sum of all the separate effects. Let *V*₁, *V*₂, *V*₃, . . . *V*_{*n*}, be the resulting potentials of each conductor, then

$$\begin{aligned} V_1 &= p_{1,1}Q_1 + p_{1,2}Q_2 + p_{1,3}Q_3 \dots + p_{1,n}Q_n. \\ V_n &= p_{1,n}Q_1 + p_{2,n}Q_2 + p_{3,n}Q_3 \dots + p_{n,n}Q_n. \end{aligned}$$

The quantities *p*_{1,1}, *p*_{2,2}, . . . *p*_{*n*,*n*} are called potential coefficients of self induction, and *p*_{1,2}, *p*_{1,3}, etc., potential coefficients of mutual induction.

To derive the potential coefficients of a transmission line the method of images will be used. That is, the surface of the earth is replaced by an imaginary conductor of the same dimensions as the real conductor,

*For the general theory of capacity coefficients see Clerk Maxwell, "Electricity and Magnetism," Vol. I, and J. H. Jeans, "The Mathematical Theory of Electricity and Magnetism."

but placed as far below the earth's surface as the actual conductor is above it, and having an equal and opposite charge. This reduces the problem of finding the potential at any point between the wire and the earth to that of finding the potential at any point between two parallel wires.

In Fig. 1 let A and B be the sections of two parallel

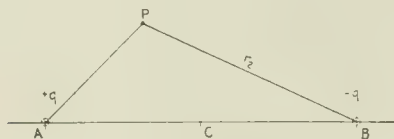


FIG. 1—METHOD OF FINDING POTENTIAL AT ANY POINT BETWEEN WIRE AND EARTH

wires perpendicular to the plane of the paper. The wires are assumed to be so small that they may be regarded as lines. Let the charge on A be $+q$ absolute electrostatic units per centimeter length, and on B , $-q$ units. Join A and B and let the point C bisect this line. From any point P outside the conductors, draw PA and PB . Let $AC = c$, $AP = r_1$, $BP = r_2$.

The force at any point outside an infinitely long charged wire is $-dV/dr = 2q/r$, where V is the potential of the point in absolute electrostatic units, and r its distance from the center of the wire. Then the difference of potential between P and C due to the charge on A only is

$$V_p' - V_c' = - \int_c^{r_1} \frac{2q}{r} dr = -2q \log_e \frac{c}{r_1}.$$

Similarly the potential at P due to B only is

$$V_p'' - V_c'' = \int_c^{r_2} \frac{2q}{r} dr = -2q \log_e \frac{c}{r_2}.$$

The potential v at P due to both charges is the sum of these values. Hence,

$$v = (V_p' - V_c') + (V_p'' - V_c'') = 2q \log_e \frac{r_2}{r_1}$$

in absolute electrostatic units.

The preceding expression consists of two factors—the charge q and $2 \log_e \frac{r_2}{r_1}$. The latter factor, which is

the quantity by which the charge is multiplied to give the potential at P , is the potential coefficient of the conductor and its image with respect to P . It is the sum of the potential coefficients of the conductor to the point and the image to the point. If the point P be taken on the surface of the conductor—that is with r_1 equal to the radius of the conductor and r_2 the distance between the center of the conductor and the center of its image—the potential coefficient of the conductor and its image to itself is obtained. If P is taken at the center of an adjacent conductor, the potential coefficient of the conductor and its image to this is obtained.

In this discussion it is assumed that the spacing of the conductors from each other and from the earth is so large compared to their radii that the charge may be considered as being uniformly distributed over the surface of the conductor. With the spacings usual on transmission lines this assumption involves no appreciable error.

COEFFICIENTS FOR CONDUCTORS PARALLEL TO EARTH

The potential and capacity coefficients will now be derived for four parallel cylindrical conductors run-

ning parallel to the earth. This condition covers the case of a three-phase line with overhead ground wire. For any smaller number of wires it is only necessary to omit in the determinants the potential coefficients of the missing wires.

For simplicity and convenience the expression for the potential coefficient will be written, $\log \frac{r_2}{r_1}$. The use of common logarithms and the omission of the factor 2 is allowed for in the final calculation of the capacity coefficients by a factor A which also converts the results from absolute electrostatic units per centimeter to farads per kilometer or per mile.

The conductors are numbered 1, 2, 3, 4, and their images 1', 2', 3', 4'. The radii of the conductors are a_1, a_2, a_3, a_4 . The distances between the centers of the conductors are represented by (1, 1'), (1, 2), (1, 2'), etc., the two numbers in the parenthesis indicating the conductors between the centers of which the distance is measured. (See Fig. 2.)

No particular units have been specified for the radii of the conductors and their spacing, owing to the fact that these quantities enter into the formulas only as ratios, and therefore any unit of length can be used if the same unit is used for all. This is a great convenience as the dimensions may be taken in either the English or metric systems.

The potential coefficients of each conductor and its image to itself are:

$$P_{1,1} = \log \frac{(1, 1')}{a_1}, \quad P_{2,2} = \log \frac{(2, 2')}{a_2},$$

$$P_{3,3} = \log \frac{(3, 3')}{a_3}, \quad P_{4,4} = \log \frac{(4, 4')}{a_4}.$$

The potential coefficients of each conductor and its image to each of the other conductors are:

$$P_{1,2} = \log \frac{(1, 2')}{(1, 2)}, \quad P_{1,3} = \log \frac{(1, 3')}{(1, 3)},$$

$$P_{1,4} = \log \frac{(1, 4')}{(1, 4)}, \quad P_{2,3} = \log \frac{(2, 3')}{(2, 3)},$$

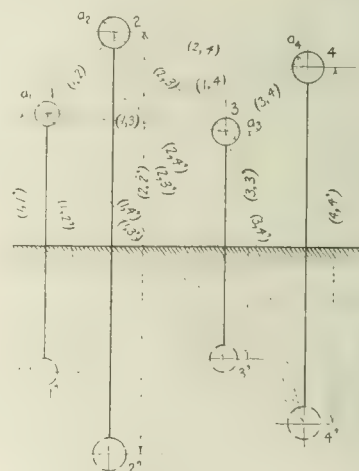


FIG. 2—POTENTIAL AND CAPACITY COEFFICIENTS DERIVED FOR FOUR PARALLEL CYLINDRICAL CONDUCTORS PARALLEL TO EARTH

$$P_{2,4} = \log \frac{(2, 4')}{(2, 4)}, \quad P_{3,4} = \log \frac{(3, 4')}{(3, 4)}.$$

A capital letter has been used for the coefficients which include the effect of both the conductor and its image in order to distinguish them from the potential coefficients used by Maxwell and others which consider the

effect of one conductor only and are usually denoted by a small letter.

Assuming that charges Q_1 , Q_2 , Q_3 and Q_4 are given to the respective conductors, producing potentials V_1 , V_2 , V_3 and V_4 , the following relations exist:

$$V_1 = P_{11}Q_1 + P_{12}Q_2 + P_{13}Q_3 + P_{14}Q_4$$

$$V_2 = P_{21}Q_1 + P_{22}Q_2 + P_{23}Q_3 + P_{24}Q_4$$

$$V_3 = P_{31}Q_1 + P_{32}Q_2 + P_{33}Q_3 + P_{34}Q_4$$

$$V_4 = P_{41}Q_1 + P_{42}Q_2 + P_{43}Q_3 + P_{44}Q_4$$

If these equations are now solved for the Q 's, the coefficients of the V 's will be the capacity coefficients desired. This is most readily done by determinants.

Let

Then

$$D = \begin{vmatrix} P_{11} & P_{12} & P_{13} & P_{14} \\ P_{21} & P_{22} & P_{23} & P_{24} \\ P_{31} & P_{32} & P_{33} & P_{34} \\ P_{41} & P_{42} & P_{43} & P_{44} \end{vmatrix} \quad Q_1 = \begin{vmatrix} V_1 & P_{12} & P_{13} & P_{14} \\ V_2 & P_{22} & P_{23} & P_{24} \\ V_3 & P_{32} & P_{33} & P_{34} \\ V_4 & P_{42} & P_{43} & P_{44} \end{vmatrix} \div D$$

Expanding,

$$Q_1 = \frac{P_{22}P_{33}P_{44}}{D} V_1 - \frac{P_{12}P_{33}P_{44}}{D} V_2 - \frac{P_{22}P_{34}P_{44}}{D} V_3 + \frac{P_{12}P_{34}P_{44}}{D} V_4$$

From this expression the capacity coefficients can be written readily as follows. When doing this it is necessary to multiply by the factor A , already mentioned to allow for the use of common logarithms and to give the result in farads per kilometer or mile. Thus:

$$C_{11} = \frac{A}{D} \begin{vmatrix} P_{22} & P_{23} & P_{24} \\ P_{32} & P_{33} & P_{34} \\ P_{42} & P_{43} & P_{44} \end{vmatrix}$$

$$= \frac{A}{D} \{ P_{22}P_{33}P_{44} + 2P_{23}P_{24}P_{34} - P_{24}^2P_{33} - P_{22}P_{34}^2 - P_{23}^2P_{44} \}$$

$$C_{12} = -\frac{A}{D} \begin{vmatrix} P_{12} & P_{13} & P_{14} \\ P_{32} & P_{33} & P_{34} \\ P_{42} & P_{43} & P_{44} \end{vmatrix}$$

$$= -\frac{A}{D} \{ P_{12}P_{33}P_{44} + P_{14}P_{23}P_{34} + P_{13}P_{24}P_{34} - P_{14}P_{23}P_{34} - P_{12}P_{24}P_{34} - P_{13}P_{23}P_{44} \}$$

In a like manner:

$$C_{13} = \frac{A}{D} \{ P_{12}P_{23}P_{44} + P_{14}P_{23}P_{34} + P_{13}P_{24}P_{34} - P_{14}P_{23}P_{34} - P_{12}P_{24}P_{34} - P_{13}P_{23}P_{44} \}$$

$$C_{14} = -\frac{A}{D} \{ P_{12}P_{23}P_{34} + P_{14}P_{22}P_{33} + P_{13}P_{23}P_{44} - P_{14}P_{23}P_{33} - P_{12}P_{24}P_{33} - P_{13}P_{22}P_{44} \}$$

The expressions for Q_2 , Q_3 and Q_4 give

$$C_{22} = \frac{A}{D} \{ P_{11}P_{33}P_{44} + 2P_{13}P_{14}P_{34} - P_{14}^2P_{33} - P_{11}P_{34}^2 - P_{13}^2P_{44} \}$$

$$C_{23} = -\frac{A}{D} \{ P_{11}P_{23}P_{44} + P_{12}P_{14}P_{34} + P_{13}P_{14}P_{24} - P_{14}^2P_{23} - P_{11}P_{24}P_{34} - P_{12}P_{13}P_{44} \}$$

$$C_{24} = \frac{A}{D} \{ P_{11}P_{13}P_{44} + P_{12}P_{14}P_{33} + P_{13}^2P_{24} - P_{13}P_{14}P_{23} - P_{11}P_{24}P_{33} - P_{12}P_{13}P_{44} \}$$

$$C_{33} = \frac{A}{D} \{ P_{11}P_{22}P_{44} + 2P_{12}P_{14}P_{24} - P_{14}^2P_{22} - P_{11}P_{24}^2 - P_{12}^2P_{44} \}$$

$$C_{34} = -\frac{A}{D} \{ P_{11}P_{23}P_{44} + P_{12}P_{14}P_{23} + P_{13}P_{14}P_{24} - P_{13}P_{14}P_{23} - P_{11}P_{23}P_{24} - P_{12}^2P_{44} \}$$

$$C_{44} = \frac{A}{D} \{ P_{11}P_{22}P_{33} + 2P_{12}P_{13}P_{23} - P_{13}^2P_{22} - P_{11}P_{23}^2 - P_{12}^2P_{33} \}$$

$$D = P_{11} \left\{ P_{22}P_{33}P_{44} + 2P_{23}P_{24}P_{34} - P_{24}^2P_{33} - P_{22}P_{34}^2 - P_{23}^2P_{44} \right\}$$

$$- P_{12} \left\{ P_{12}P_{33}P_{44} + P_{14}P_{23}P_{34} + P_{13}P_{24}P_{34} - P_{14}P_{23}P_{34} - P_{12}P_{24}P_{34} - P_{13}P_{23}P_{44} \right\}$$

$$+ P_{13} \left\{ P_{12}P_{23}P_{44} + P_{14}P_{22}P_{34} + P_{13}P_{24}P_{34} - P_{14}P_{23}P_{24} - P_{12}P_{24}P_{34} - P_{13}P_{22}P_{44} \right\}$$

$$- P_{14} \left\{ P_{12}P_{23}P_{34} + P_{14}P_{22}P_{33} + P_{13}P_{23}P_{24} - P_{14}P_{23}^2 - P_{12}P_{24}P_{33} - P_{13}P_{22}P_{34} \right\}$$

For three conductors the capacity coefficients are obtained by omitting from the determinants the coefficients of the fourth conductor. Thus:

$$C_{11} = \frac{A}{D} \{ P_{22}P_{33} - P_{23}^2 \}$$

$$C_{12} = -\frac{A}{D} \{ P_{12}P_{33} - P_{13}P_{23} \}$$

$$C_{13} = \frac{A}{D} \{ P_{12}P_{23} - P_{13}P_{22} \}$$

$$C_{22} = \frac{A}{D} \{ P_{11}P_{33} - P_{13}^2 \}$$

$$C_{23} = -\frac{A}{D} \{ P_{11}P_{23} - P_{12}P_{13} \}$$

$$C_{33} = \frac{A}{D} \{ P_{11}P_{22} - P_{12}^2 \}$$

$$D = P_{11} \{ P_{22}P_{33} - P_{23}^2 \} - P_{12} \{ P_{12}P_{33} - P_{13}P_{23} \} + P_{13} \{ P_{12}P_{23} - P_{13}P_{22} \}$$

In the expansion of D the quantity in the first parenthesis will be the same as that obtained in the parenthesis when expanding C_{11} ; the second parenthesis will be the same as for C_{12} ; the third as in C_{13} , and the fourth as in C_{14} . This simplifies the calculation considerably.

Only the capacity coefficients between the conductors and the ground remain to be found. They are readily obtained on the basis that the sum of all the capacity coefficients is zero. Denoting these values by C_{1g} , C_{2g} , C_{3g} , C_{4g} ,

$$C_{11} + C_{12} + C_{13} + C_{14} + C_{1g} = 0$$

Hence:

$$C_{1g} = -(C_{11} + C_{12} + C_{13} + C_{14})$$

In a like manner:

$$C_{2g} = -(C_{12} + C_{22} + C_{23} + C_{24})$$

$$C_{3g} = -(C_{13} + C_{23} + C_{33} + C_{34})$$

$$C_{4g} = -(C_{14} + C_{24} + C_{34} + C_{44})$$

The value of the factor A to give the capacity coefficients in any desired unit for any unit of length may be readily derived. The most useful values are given in the following table:

To Reduce to	A	Log A
Farads per kilometer.....	$2.4127 \cdot 10^{-8}$	2.38251—10
Farads per mile.....	$3.8830 \cdot 10^{-8}$	2.58916—10

The remainder of this article, which will be published in a subsequent issue of the ELECTRICAL WORLD, indicates the method of computing the charging currents of a three-phase circuit when one phase is grounded. Two cases are considered, one when the conductors are not transposed and the other when the conductors are transposed a complete number of turns. Several typical examples are worked out, and the results obtained by calculation are compared with test data.

SPECIAL TESTING APPARATUS OF BOSTON EDISON COMPANY

Description of Condenser, Rheostats and Resistance Units Used in the Standardizing and Testing Department

BY C. L. KASSON

Several special pieces of testing apparatus have been constructed during the past year in the standardizing and testing department of the Edison Electric Illuminating Company of Boston. Among these are a 30-microfarad condenser, a series and a multiple carbon rheostat, a 15-amp. test load, a 60-amp. test load and a 20-amp. testing rheostat. The condenser is shown as

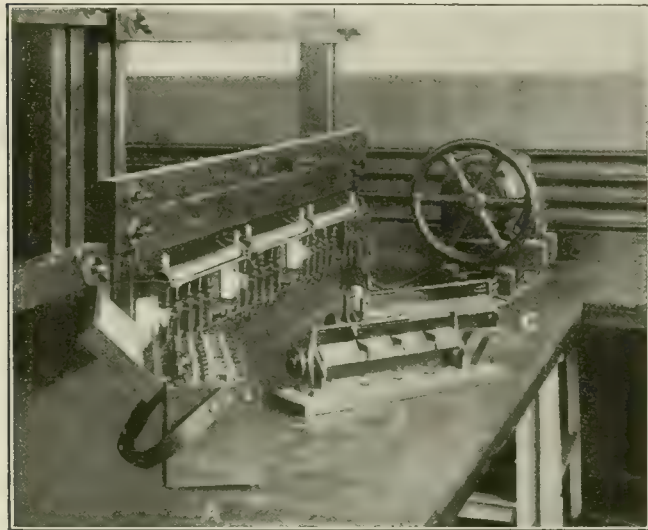


FIG. 1—SPECIAL CONDENSER (A); MULTIPLE CARBON RHEOSTAT (B), AND SERIES CARBON RHEOSTAT (C), USED IN TESTING LABORATORY OF BOSTON COMPANY

A in Fig. 1. This consists of thirty 1-microfarad, 300-volt paper condenser units assembled in a mahogany box, provided with nine single-pole, double-throw switches in the top under the cover. These condensers are divided into three groups of 10 microfarads each. Each group has three switches, so wired that they control 1, 3 and 6 microfarads respectively. When the switch is thrown one way the condenser is charged, and when it is thrown the other way the condenser is discharged. With this grouping it is possible to use the condenser for experimental work on single or three-phase circuits, and in series or multiple on single-phase circuits. The box is provided with removable cover, which protects the switches and terminals, and with a strong carrying strap. The outside dimensions are: length, 12.5 in. (31.75 cm.); width, 6 in. (15.24 cm.); height, 7 in. (17.78 cm.), and its weight is 20 lb. (9 kg.).

A multiple carbon rheostat B and a series design C are also shown in Fig. 1. Both of these rheostats are made of about 115 carbon blocks 1.5 in. (3.81 cm.) square and 0.25 in. (0.64 cm.) thick, carried in a small angle-iron frame insulated with asbestos and supported at the ends with suitable brass castings. These castings rest on a wooden base covered with asbestos and are tied across the top by a rod. The blocks are squeezed together by a screw and small hand-wheel in one of the end castings. The series rheostat has one insulated copper contact sliding on the tie rod, which can be inserted anywhere in the carbon pack. The multiple rheostat has several semi-fixed copper contacts in the carbon

pack connected in multiple to heavy copper lead strips on the base. The series rheostat will handle currents up to about 100 amp. and the multiple one up to 400 amp., when the total watts do not exceed approximately 800 and the time of operation is not too long. For long-time work the wattage should not exceed about 400 unless the rheostat is cooled by a blast of air from a fan. These rheostats weigh about 15 lb. (6.75 kg.).

In Fig. 2 at A and B are shown a 15-amp. and a 60-amp. testing load. The former consists of three fabric resistance units rated at 5 amp. each at 110 volts, mounted in light tubular frames hinged together. The resistance units are insulated from the frame and terminals are brought out at the top. The three frames are hinged so that when open the rheostat stands with the resistance units vertical and when folded flat it packs into a light, thin metal carrying case. The three resistance units can be used individually or in multiple.

The design marked B of Fig. 2 consists of six 10-amp. fabric-resistance units mounted in three frames, as described before. These units can be used individually or in series, series-multiple or multiple. The carrying case of the 15-amp. rheostat measures 9.5 in. (24.13 cm.) long, 2.5 in. (6.35 cm.) wide, 9.5 in. (24.13 cm.) high, and that of the 60-amp. 12.5 in. (31.75 cm.) long, 3.5 in. (8.89 cm.) wide, 9.5 in. (24.13 cm.) high. The weight of the former rheostat, including case, is 4 lb. (1.8 kg.) and of the latter is 8 lb. (3.6 kg.).

The unit marked C in Fig. 2 is a 20-amp. meter-testing rheostat for testing station ammeters, indicating wattmeters, watt-hour meters, relays, etc. This is composed of eight fabric-resistance units ranging from 5 amp. capacity to 0.5 amp. at 110 volts, all mounted in a steel and brass frame with an asbestos board front. This front carries switches and terminals for the wires from the source of power, current and potential wires to the meter under test, and wires to a small slide-wire, fine-adjustment rheostat. The switches include one

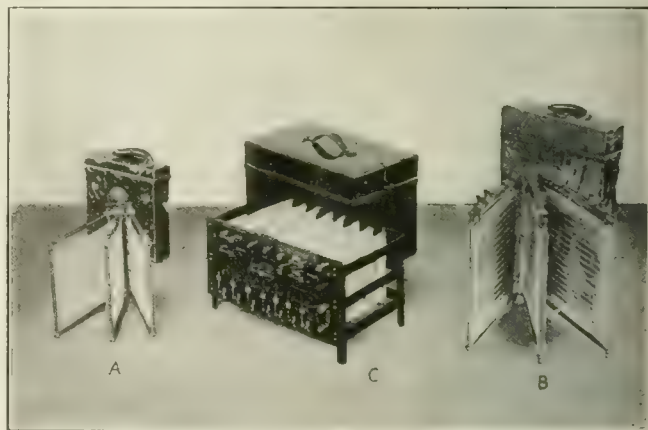


FIG. 2—A 15-AMP. AND A 60-AMP. TESTING LOAD (A AND B) AND 20-AMP. METER-TESTING RHEOSTAT (C) USED BY BOSTON COMPANY

double-pole, double-throw, power-reversing switch, a short-circuiting one for the current terminals, a double-pole, single-throw switch for the potential circuit, and a single-pole, single-throw switch for each of the eight resistance units. This rheostat is light, non-inflammable and compact. It is provided with a metal carrying case, whose dimensions are: length, 16 in. (40.64 cm.); width, 9.5 in. (24.13 cm.); height, 10.25 in. (31.8 cm.). The weight of rheostat and case is 15 lb. (6.75 kg.).

Coal Rates and New-Business Policy

Reports from Central Western Cities Show a Wide Diversity in Effect of War-Time Conditions Upon Present Plans and Arrangements for the Future—Situation in Michigan, Cleveland and Columbus

COAL conditions, the great demand for energy from power consumers already on the lines, the drift of discouraged isolated-plant owners to central station service and the varying effect of war in different communities have combined to affect the attitude of companies in Central Western cities on the subject of new business. The heavy loads upon generating apparatus and the impossibility of getting new equipment promptly are factors which many companies have had to take into definite account in framing their new-business policy for 1917 and the ensuing year.

Investigation of conditions in Central Western cities by the ELECTRICAL WORLD shows that these factors, affecting companies differently according to the effect in their individual communities, make it possible to classify the central stations roughly in four distinct groups. The factors are somewhat intermingled as to the relative degree of influence on company policy, but they give approximately these classes:

CLASSIFYING THE PROPERTIES

First, properties which have been forced by heavy demands from power users virtually to decline new business of any material amount. This is because of unparalleled magnitude of growth in the last three years; it represents in some cases the absorption of new generating capacity ordered in anticipation of future development which was not realized in 1914. Surplus equipment has been fully absorbed, and the overloaded condition of plants is accelerating the process of physical depreciation, while it is feared that rates have not been advanced sufficiently to overcome abnormally rapid deterioration.

Second, properties which are taking the new business that is offered without solicitation, but are not developing new-business connections or prospects with so much energy as heretofore; in short, are taking what comes easily but are not going far, if any distance, from existing lines. Even such business as is taken under these circumstances is not always welcomed by the operating department, which rather discourages additions to existing loads.

Third are the central stations in districts whose industries and financial welfare are affected adversely by war. Such properties have in the population which they serve not only a lack of special industrial stimulus and profit due to war; they have also the increased cost of living which is an inevitable result of war and touches every home. In communities of this character the war restricts luxury buying, it means economy in expenditure, but it makes the necessity of new-business solicitation urgent for the future if not for the present. In other words, normal rate of growth is maintained less easily and, looking to the future, the business of the type which requires solicitation over a long period is still open to argument.

Fourth is the class of plants in communities which have abounded with war prosperity and sense no de-

cline in activity because this country has entered the conflict, but expect rather a continued speeding up of every industry. These properties faced such enormous demands for power early in the European war development that they planned for additional capacity on a large scale and have found their expansion plans more than justified. In these communities there is no sign of curtailment in demand.

UNDERLYING QUESTIONS

In all of the characteristic properties outlined in the foregoing there is an element of misgiving because of coal conditions; of uncertainty because of the unknown status which the labor problem will hold; of doubt as to what level costs will reach; of still unsatisfied questions about rates, and of inclination to reach farther and farther ahead in planning to shape the generating and distribution systems for the future.

Specific reports given to the ELECTRICAL WORLD in some of the cities visited on a recent trip of investigation follow:

RUSHING ADDITIONAL CONSTRUCTION, SAYS MR. TIPPY

C. W. Tippy, general manager Consumers' Power Company, Jackson, Mich., made the following statement to the ELECTRICAL WORLD:

The Consumers' Power Company serves about seventy-five cities and towns interconnected by transmission lines and scattered over the greater part of Michigan. The energy is generated by hydroelectric stations on the more important rivers, backed up by steam plants in the various cities.

The amount of coal we use will depend, of course, in a great measure on the character of the season and the amount of energy which can be generated in the hydroelectric plants. We regard the coal situation as very serious and hope to come into the winter with a liberal supply of coal in stock. We were greatly hindered last year in securing our coal supply by the embargoes placed at the different points. We were able to overcome this for a time by buying coal in different sections of the country until embargoes were placed in these districts.

If the railroads can provide locomotives to handle cars, it will do much to relieve the situation. It looks as if the policy of holding down the earnings of the railroads is, in a great measure, to blame for this congestion, as it has kept the roads from growing with the demands of the country. There appears to be much unnecessary travel which might be eliminated and thus release locomotives and track capacity to expedite the movement of freight.

Coal production appears to be the greatest in our history, but the requirements of industry and the individual consumers have outstripped production. A generation ago the average family was satisfied to have one or two rooms heated, but now the average family is not satisfied unless the whole house is heated by a furnace. This greatly increases the use of coal for domestic consumption and enters largely into the problems of transportation during the winter months.

It is not to be doubted that railroad conditions are much better now than they have been for some time so far as coal movement is concerned. At the same time, it should be remembered that this is the easy period of the year for handling freight. When the extreme cold of winter hits us, it greatly reduces pulling capacity of the locomotives, and

thus greatly increases the problems of the railroads in handling freight.

Our business continues to grow. We are taking on all new business that is offered when it is along our existing lines. The increase in June over last year shows about the same growth as in the earlier months. Merchandising business is excellent and we are making a very satisfactory showing in the sale of sweepers, washing machines, fans and irons. Our plants are virtually loaded to capacity and we are rushing construction on three additional hydroelectric stations and also installing two 10,000-kw. units in steam in order to take care of the demand. We do not see any indication of letting up in business activities.

We have had to increase our optional and power rates on account of the higher operating costs due to coal, labor and materials. This increase has been held entirely to optional rates, not disturbing franchise rates. The increase in primary power rates is larger in percentage than the optional commercial lighting rates, or secondary power, where the average rate earned was higher. The advance ranges from 10 per cent to 30 per cent, averaging perhaps 20 per cent on all classes of business affected.

In increasing our rates we have gone directly to the consumers with a complete explanation as to the necessity of the increase, explaining that we are giving them the benefit of our hydroelectric generation and not asking the amount which would be necessary if we generated entirely by steam. In most cases our customers have accepted the increase, fully realizing the conditions confronting us.

The obligation of furnishing service rests upon central stations, and it is possible that it may be necessary for them to cut off certain classes of business, such as signs and display lighting, in order to save fuel.

CONDITIONS IN COLUMBUS

The Columbus (Ohio) Railway, Power & Light Company states that the higher coal cost was felt by the company in August, 1916, and it was some months afterward before it was decided to increase power and light rates so as to meet the higher operating expenses. At the beginning it was supposed that conditions were temporary; it was not believed that they would last or become so much more serious.

W. A. Wolls, manager of the new-business department, states:

A new increased schedule of rates was sent to the patrons of the company affected on May 28, and the schedule became effective on June 21. Our letter accompanying a copy of the schedule to our patrons showed that the company consumed annually over 110,000 tons of coal. It showed that in the nine months just preceding the company had borne silently the burden of steadily increasing coal cost, which in that period amounted to over 100 per cent. In the last three months of this period the increase was 140 per cent.

It had been our hope, the letter to patrons stated, that the abnormal coal cost might be only temporary and that the price would have receded before that date. We stated that we would be very glad upon request to furnish figures applying the new rates to the amount of energy furnished in any past month, to serve as an example for estimating future business. To this letter we received some replies but not many.

Although Columbus has not been stimulated by war industries, the people accept the fact of increased coal cost. The higher rates are not applied to residence or charitable institution consumers, but reach generally the power and commercial lighting classes.

In our new schedule we did not introduce coal clauses, as the public utility law evidently requires specific rates, and coal clauses make the rate indefinite and depend upon a coal cost which could not be determined in advance.

Because of the local condition that the industries of Columbus are not those of war, we abandoned an elaborate house-wiring campaign when this country became involved in a state of war. We are accepting business which comes and are continuing to solicit power business of the class which will not require serving until some future date near

the end of the present year. Although our power plants are being operated virtually at capacity, our new generating station is scheduled to be completed in the fall and will give us a new margin of energy to sell.

LOOKING AHEAD IN CLEVELAND

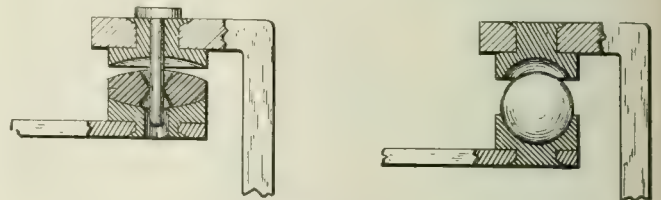
In preparing for the coming winter the Cleveland Electric Illuminating Company has bought a tract of land adjoining the location of its Seventieth Street generating station and is clearing it for use as an addition to the coal-storage yard. This will about double the coal-storage capacity of the company. Arrangements have already been completed for laying tracks to the new land and the material is on hand. Ordinarily the company plans to hold one month's supply in reserve, but an effort will be made during the next fall and winter to maintain the supply at two months' requirements.

So great has been the demand for energy for industrial purposes that the present generating capacity is virtually sold. Several months ago the company dismissed a number of employees in the new-business department, and it has not announced a time when solicitation for contracts will be resumed. No public announcement has been made by the company that new contracts cannot be taken, as in the case of the municipal plant in Cleveland, but that is understood to be the present situation.

Additional generating apparatus has been ordered for delivery up to and including 1919 to cover the estimated larger requirements of this period. It is felt that no decrease in the demand for energy is to be expected during the present calendar year at any rate and that any let-up in consumption by one group of customers will be offset by increased requirements from others.

Vibrator Contacts for Tirrill Regulator

A loose contact member to avoid pitting due to arcing is provided for the make-and-break circuit of Tirrill regulators in patent No. 1,223,143, issued to Stephen F. Briggs of Milwaukee, Wis. This contact member is free to turn by the action of the contact points thereon



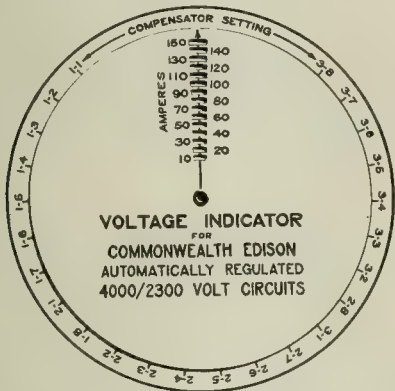
LOOSE CONTACT MEMBER USED TO AVOID PITTING

to change the point of arcing and distribute it over a broad surface during a succession of operations. Preferably the lower contact point has its upper surface concave instead of convex, and the intermediate contact member has a convex upper and lower surface. The opening thus formed is of an hourglass shape to permit a slight rocking of the intermediate contact member in its concave seat and also to permit it to turn. A further modification of this is where the intermediate contact member is in the form of a ball or sphere confined between the spherically convex surfaces of the contact points. With this construction there is no necessity for the use of an insulating pin as the space between the contact points is insufficient to permit the spherical contact member to pass through.

HAND CONTROL OF VOLTAGE

Calculator Devised for Determining Amount of Line-Drop Compensation Necessary

In plants where the automatic control of voltage is employed the most common causes of poor regulation are burning of regulator contacts, dirt between contacts, excessive friction of moving parts, strained and broken contractor springs, broken wires, and an accidental change of compensation at the time of cleaning contact makers. Whenever one of these troubles arises or the regulator control has to be taken out of service for any reason, it is necessary to control the voltage by hand. To do this properly an operator must know how much to allow for line drop. Even if the constants of each circuit were known, not enough time is afforded in emergencies to calculate drop. While some companies furnish their operators with charts which give this information directly, it is usually inconvenient to use them, since a chart is required for each circuit,



CELLULOID DEVICE FOR INDICATING VOLTAGE

and they are, besides, easily damaged by handling and must be changed whenever the length or characteristics of the corresponding circuit are altered.

To avoid these shortcomings and difficulties the Commonwealth Edison Company of Chicago, which has the largest number of circuits in the world, is using celluloid voltage calculators like the one shown here in each of its sixteen substations serving 4000/2300-volt circuits. The calculator consists of two parts—a stationary disk and a concentric movable one. Rectangular slots are provided in the rotatable disk along one radius, and opposite these are values indicating loads from zero to full load. Around the stationary disks, to correspond to the outer slot in the movable disk, are values indicating settings commonly employed with voltage-regulator contact makers. Below these values, along radial lines, and arranged in such a way as to correspond to the remaining slots on the movable disk, are values indicating the corresponding voltages which must be maintained at the station end of circuits with different loads to secure constant voltage at the delivery ends. With this calculator an operator does not have to know the length or characteristics of various circuits. All the information needed is the contact-maker setting and the percentage of full-load current flowing in the line. Then the upper dial is turned until the contact-maker setting appears in the upper slot. Below, opposite the percentage of full-load current, appears the voltage which must be maintained at the station end of the line.

Strictly speaking, this calculator is not correct for circuits having high reactance and changing power factor, since it was designed to do what the compensated type of contact maker does, and no more. Where a calculator is required to determine the voltages which would be maintained at the station end of a line by a line-drop compensator under different loads it should be a simple matter to modify the scheme just described. It may be pointed out in this connection that the additional cost and complication of line-drop compensators was not warranted on the Chicago network because of the way in which the relatively large amount of underground cable with its small interaxial spacing of conductors affects the relation of the reactance to the resistance of the circuits. With the existing characteristics of the circuits and the loads it has been found that if the voltage regulation is maintained within sufficiently close limits for the lighting or high-power-factor load it will be within the limits required by the public utilities commission for the power load. Consequently the contact maker is set to correspond to the average power factor or actual power factor of the lighting load, the power-current regulation being allowed to be what it will.

Extensive tests made on different circuits under different loads proved that the possible error of the calculator is not more than the possible error of station-indicating voltmeters and ammeters, the error due to operators reading them, and the error in the increment of change in the compensating taps of the compensating coils of the contact makers. During the two years that the calculators have been in use they have given very satisfactory service. They have relieved the operators of the need to use less convenient methods of controlling regulators by hand, have made it possible to detect abnormalities of operation, and have permitted the operators to check the operation of the automatic regulator control. As a result, the uniformity of service has been improved. The calculators used in Chicago measured 4¼ in. (10.9 cm.) by 6 in. (15.2 cm.). While they are made of celluloid, it would be less expensive and more desirable, where only a few calculators are to be made, to employ millboard instead of celluloid, and make them a little larger.

Method for Welding Thin and Scaly Metals

The invention of Carl B. Auer of Wilkesburg, Pa., patent No. 1,229,700, is directed in particular to the welding together of the sheets and ribbons of metal which quickly tarnish in the air and which therefore become covered with a film or scale that seriously interferes with ordinary welding methods. Thin metal sheets and ribbons may be easily welded together by ordinary processes of incandescent electric welding if their surfaces are clean. However, great difficulty is found in cleansing ribbons of nickel-chromium alloys which are now extensively used in making electric resistance elements, for the reason that the oxide scale on these alloys frequently cannot be removed by ordinary rubbing with emery paper. By the simple expedient of embossing the thin strips by means of a pair of pliers furnished with closely studded small projections it is found that the surfaces can be readily welded together.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

COSTS OF MATERIALS PRINTED IN ORDER TO INSPIRE ECONOMY

Eastern Company Compares Present Costs with Last Year's Prices—How the Value of the Dollar Has Shrunk

In the June issue of *Service*, a publication of the Public Service Company of New Jersey, there appeared the accompanying partial list of items used by many departments of the company. The prices marked represent the present cost of what \$1 worth of these items cost about one year ago. These prices were printed to impress upon the minds of the employees the economical use that must be made of these materials. In the article several suggestions were also made. It was pointed out that all odds and ends must be gathered up instead of leaving them behind on the job. Small hardware should be handled carefully. More material should not be requisitioned than is actually needed. Wire should be measured carefully, so that as little as possible is cut to scrap.

One dollar's worth of:	Now Costs	One dollar's worth of:	Now Costs
Fuse plugs.....	\$1.75	Asbestos lining, 3-in.....	\$4.10
Brackets, galvanized.....	1.74	Boiler tubes.....	2.71
Cheese cloth.....	1.68	Lag screws.....	2.68
Iron castings, shakers.....	1.67	Cable.....	2.55
Varnished insulating cloth.....	1.65	Carriage bolts.....	2.50
Engine oil.....	1.64	Wire W. P. T. B.....	2.47
No. 1075 insulators.....	1.63	Braces (cross-arm).....	2.45
Shovels.....	1.61	Condenser tubes.....	2.25
Cotton waste.....	1.60	Rope, manila.....	2.23
Solder.....	1.57	Bolts, galvanized machine.....	2.1
Iron pipe, black.....	1.54	Shellac.....	2.26
Iron pipe, galvanized.....	1.46	Lead sheaving.....	2.19
Fuses.....	1.43	Pole steps.....	2.06
Pike poles.....	1.33	Conduit, galvanized.....	2.06
Varnished tape.....	1.33	Guy clamps.....	1.95
Cant hooks.....	1.25	Round washers.....	1.88
Fire extinguishers, Pyrene.....	1.14	Square washers.....	1.85
Pins, locust.....	1.10	Raw linseed oil.....	1.80

ASCERTAINING CAUSE OF BAD VOLTAGE REGULATION

Regulator in a Large Manufacturing Plant Was Found to Be Placed in Wrong Section of System—Remedy Easily Applied

BY A. C. HEWITT

Bad voltage regulation was experienced for several years by a large manufacturing plant which had a connected load of about 1400 hp. in motors, and which is at the end of a 22-mile (35.4-km.) transmission line. This line consisted of three No. 2 copper wires carrying current at 22,000 volts, feeding several factories along the line. The plant in question demanded an average of 300 kw. Installed there were two hoist motors that operated intermittently with a maximum instantaneous load on each of about 100 kw. The momentary voltage fluctuations due to the hoists were not so serious in themselves as was the prolonged drop from 7.30 a. m. to noon and from 1 p. m. to 4.30 p. m., as is shown in chart No. 1. From this chart it can also be

seen that the voltage ran very high during the night.

The power plant furnishing energy to this line consisted of five 500-kva. water turbines in one building, with a 1500-kva. steam turbine plant as an auxiliary located about 1000 ft. from the water-power plant. The transformers, switchboard and voltage regulator are located in the water-power plant, as this plant was the first one constructed by the power company. After the steam plant was built, a substation containing arresters and transformers was built to handle all the outgoing

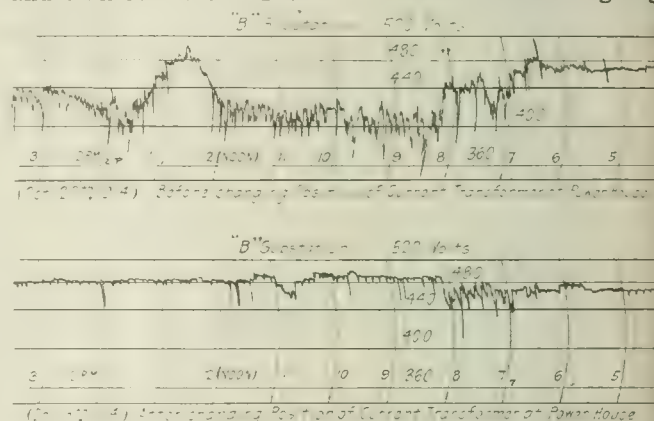


FIG. 1—VOLTAGE AT END OF TRANSMISSION LINE BEFORE AND AFTER CHANGING POSITION OF CURRENT TRANSFORMER

power from both plants. The voltage regulator was a standard Tirrill regulator suitable for handling several generators operating with two exciters. The regulator had a compensating device which would boost the voltage when the load increased. The compensator was set so as to maintain steady voltage at the center of the distribution system. When the steam plant was added,

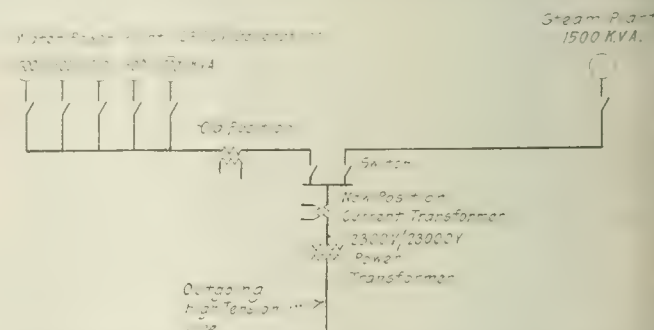


FIG. 2—POSITIONS OF COMPENSATING CURRENT TRANSFORMER BEFORE AND AFTER THE CHANGE

the steam turbine got its excitation from the exciters in the water plant and was therefore supposed to be controlled by the voltage regulator in this plant.

After a careful investigation of the conditions it was found that the regulator was placed in the wrong section of the system, as shown in Fig. 2. Apparently, during reconstruction, the engineers ignored the voltage regulator when the steam plant and substation were constructed, thinking that because the regulator con-

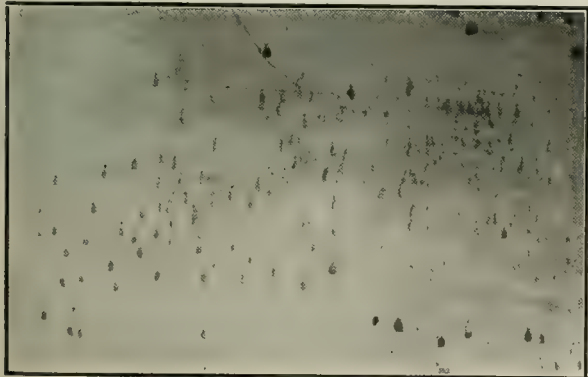
trolled the exciter voltage it therefore controlled the voltage of the main generators. However, the water turbines were operated with locked gates and the governor allowed to take care of all variations in the load carried. Since a current transformer controlled the voltage regulator so that the voltage would rise as the load increased, and vice versa, thereby automatically compensating for variations in transmission losses, and since this current transformer was placed on the outgoing line from the water plant instead of the outgoing lines from the substation, the regulator simply maintained a steady voltage at the power plant instead of at the center of the distribution system. As the center of distribution was 10 miles (16 km.) from the power house, the result was a very irregular voltage at the extreme end of the transmission line. The condition was soon remedied and the result was much better voltage regulation, as shown in the chart taken after the change.

MAP USED FOR KEEPING "TAB" ON TRANSFORMERS

Routes of Circuits Indicated Thereon—Tag Attached at Each Transformer Position to Give Information Regarding Rating, Etc.

BY N. NESBITT TEAGUE
Augusta-Aiken Railway & Electric Corporation, Augusta, Ga.

The Augusta-Aiken Railway & Electric Corporation has mounted a map of its system on a strip of beaver board and indicated the position of each transformer thereon with tacks to which tags are attached. Each tag contains information as to size, kva., company number, etc., affording ready information for transformers that are to be replaced for burn-outs or to be regrouped without referring to the history cards. Differently colored tags are used, green representing underground



TAGS REPRESENT TRANSFORMERS ON THIS MAP

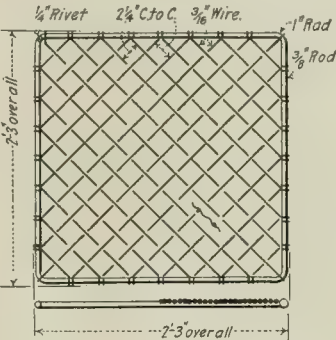
transformers, white indicating the 2300-volt overhead type, yellow the 13,200-volt type, and red the 44,000-volt transformers. If more information is desired, reference is made to the history cards, which are kept up to date. When setting or removing any transformer the line department turns in a special card giving information on the changes made. Apparatus that is in stock or in the repair shop is indicated in the lower right-hand corner of the map. The method of indicating transmission and distribution details was developed under the supervision of J. J. Borger, general superintendent of the electrical department.

INNER COVER USED FOR RECTANGULAR MANHOLES

Made of Interlaced Wire Stretched Over a Frame, It Is Designed to Prevent the Manhole Cover from Falling Into the Hole

BY R. A. PAINE, JR.

The Edison Electric Illuminating Company of Brooklyn, N. Y., has recently designed and placed on its system an improved form of inner cover for square and oblong manhole castings.



WIRE-MESH FRAME FOR MANHOLE OPENING

This is used in order to prevent the cover from dropping into the manhole. The cover consists of a rim of 3/8-in. (9.5-mm.) galvanized-steel rod across which 3/16-in. (4.8-mm.) galvanized-steel wire is stretched diagonally at 2-in. (5.1-cm.) intervals in both directions and interlaced. The wire is turned over the rim before galvanizing.

The screen has several advantages over the old inner cover. The old inner cover was made of cast iron with several small holes to allow for ventilation. These holes quickly became stopped up, and often the entire space between the inner and outer covers became filled with dirt and trash which prohibited ventilation. This was particularly objectionable in the winter, when the dirt would be frozen, making it very difficult to open the manhole. The new screen allows any dirt, etc., which may come through the holes in the outer cover to go through it to the bottom of the manhole. When men are working in a manhole and it is not necessary to be constantly passing material in and out the screen is placed in position as a protection to the workmen. The screen will withstand a load of 400 lb. (181.4) kg. placed at its center, without dangerous deflection.

QUICK WORK MOVING TRANSFORMER STATION

300-Kva. Outdoor Substation Disassembled, Removed to New Location and Installed in Remarkably Short Time

BY E. B. HOOK, JR.

Superintendent of Construction Georgia Railway & Power Company

The Georgia Railway & Power Company recently had occasion to install a 300-kva. outdoor transformer station in extraordinarily quick time. A large government institution in Atlanta desired to discontinue its steam-driven electrical plant and use central station service. The construction department was ordered to build a transmission line and erect the desired substation within the week. This work usually requires from two to three weeks under most favorable conditions, and, as usual on rush jobs, it was found impossible to secure delivery of transformers or the fabricated steel angle iron to support the buses.

Another customer in the vicinity of Atlanta had recently failed in business and closed down its plant. The

transformers at this plant were just of the rating desired, so it was decided to move the entire station over to the new customer, a distance of some 7 or 8 miles (11.3 km. or 12.9 km.). Accordingly, two picked crews were mobilized and sent out to disassemble and move the station. A specially built, underslung steel wagon of 12-ton (10.8-t.) capacity was used with four mules for hauling the three 100-kva. transformers at one load. The steel work of the station and the buses, insulators, lightning arresters and switches were loaded into two large trucks. In this manner the complete substation was disassembled, loaded and moved away in less than half a day and completely installed at the new location two days later.

SALVAGING PIPE FITTINGS

Muriatic-Acid Bath in Combination with a Steam Coil Removes Thick Coat of Scale

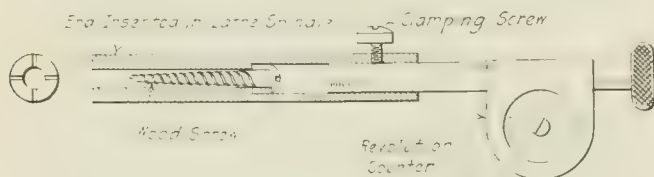
Old pipe fittings removed in rearranging the piping layout at the Galesburg (Ill.) central station were on their way to the junkman when it was decided to clean them and save them for future use if possible. They had all seen years of service and were heavily coated with scale, which forms readily at Galesburg, owing to undesirable water conditions. To remove this an apparatus consisting of a steel oil barrel with the head cut out and a steam coil laid inside it was rigged. Above the barrel was placed a chain hoist. The pipe fittings were placed one by one in this barrel, which was filled with a twenty-to-one solution of muriatic acid, and steam was admitted to the coil. This acid cooking process softened the scale so that it could be easily removed. After the bath and the cleaning process the fittings were painted and were again ready for service. With prices of iron at the present level the saving thus effected amounted to a very comfortable sum.

COUNTING THE TURNS

Method of Attaching Revolution Counter to Head of Lathe Used in Winding Coils

BY R. L. HERVEY

Since it is usually difficult to keep count of the number of turns of wire applied to large coils, such as are used for motor fields or induction coils, a method is suggested herewith which makes use of a simple me-



PLUG FOR ADAPTING REVOLUTION COUNTER TO LATHE SPINDLE

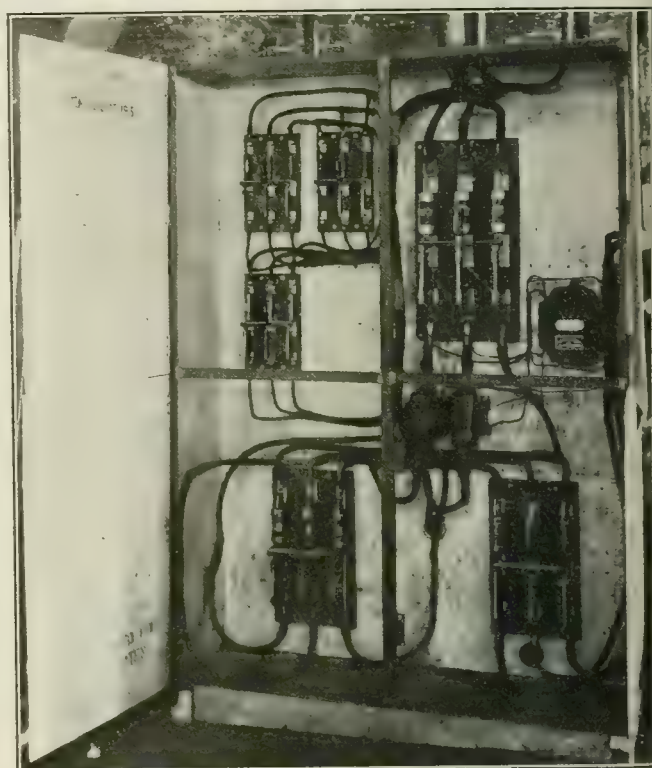
chanical counter. An ordinary revolution counter can be employed. To attach it to the lathe spindle use can be made of a round-fiber or hard-wood plug which will just fit into the outside end of the lathe spindle. A hole should be drilled through the center of the plug large enough to receive the point of an ordinary wood screw and then counterbored to receive the tip of the revolution counter. Slots should then be sawed as indicated in the end of the plug which enters the spindle. To hold the plug firmly in place a wooden screw should

then be inserted as shown and turned until the end of the plug expands and grips the inside of the spindle. The speed counter can be held in place by a small machine screw. The body of the counter will be kept from turning by gravity. When winding at high speeds, however, a weight should be attached to the counter to prevent its turning.

CABINET FOR FACTORY SERVICE

Relatively Inexpensive Switch Cabinet Used by Company to Insure Low First Cost

To reduce the investment required for factory customers to change over from steam-driven equipment to motor service, the Cumberland County Power & Light Company of Portland, Me., devised an inexpensive fuse, switch and meter cabinet which is illustrated herewith. The cabinet is built of galvanized-iron plate mounted on



INEXPENSIVE FUSE, SWITCH AND METER CABINET

1½-in. (38.1-mm.) by 3/16-in. (4.76-mm.) angle-iron framing and is equipped with four hinged front doors. Slate panels are provided at the back to carry the switches, fuses and meters. The over-all dimensions of the cabinet are 6 ft. (1.83 m.) by 7 ft. (2.13 m.) by 18 in. (46 cm.). The particular cabinet illustrated controls five induction motors aggregating 150 hp. in rating and provides space for three additional motor switches capable of handling a connected load of 75 hp. A smaller cabinet designed for accommodating the local shop-lighting fuses and switches is shown at the right. The cost of the power cabinet with switches arranged as at present, but with three more power circuit recording wattmeters added, will amount to about \$220. These cabinets have been found particularly useful for serving motors which have been installed in shops where emergency service is required as well as in other installations where the first cost of more elaborate equipment would have appeared too large in the eyes of the factory owner.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat

CONSUMER EXPENSES IN
CITIES OF SMALL POPULATION

Data Published by Western Company Showing a
Part of the Costs That Should Go to Make
Up the Minimum Charge

The table herewith, which is taken from a recent issue of the *Au Sable News*, published by the Consumers' Power Company, Jackson, Mich., shows the expenses in twelve cities served by the same company which are directly and entirely attributable to consumer costs. Such costs should be a part of the minimum charge, according to the rulings of commissions, which have held that the minimum bill should cover consumer costs and fixed charges plus a charge for the actual service used. The items which go to make up consumers' costs in this table are: Setting and removing meters, repairs of services, repairs to customers' meters, inspection of customers' premises, customers' installations, salaries and expenses of meter indexers, salaries and expenses of accounting department, sal-

year and per month and the percentage of the total cost in each city. It is interesting to observe the close relation between each city's percentage of total consumers and its percentage of consumer expenses. City "D," for instance, has 11.7 per cent of the consumers and incurred 11.58 per cent of the consumer expenses. The consumer cost per consumer per month is shown to be 28 cents. This figure compares rather favorably with similar costs recently brought out in establishing a minimum charge in a large city. The consumer cost per consumer per month there was about 33 cents.

FREE FLOODLIGHTING TO
IRRADIATE "OLD GLORY"

New Jersey Company Offers Energy Gratis to All
Patrons Desiring to Employ It for Such
Patriotic Purpose

Immediately on the declaration of war by the United States a patriotic scheme of floodlighting the American

CONSUMERS' EXPENSES IN TWELVE CITIES SERVED BY SAME COMPANY
Showing Cost Per Consumer Per Year and Per Cent of Total

CITY	"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"	"I"	"J"	"K"	"L"	Total
Number of Consumers.....	2,626	2,870	1,249	6,691	14,911	5,871	6,102	1,230	4,534	2,624	2,271	6,216	57,195
Percent of Total.....	4.59	5.01	2.18	11.70	26.07	10.26	10.67	2.15	7.93	4.59	3.97	10.88	100
Setting and Remov- ing Meters.....	.23	.14	.35	.16	.14	.08	.20	.08	.19	.17	.23	.10	.15
Percent of Total.....	6.85	4.64	4.98	12.21	22.72	5.74	13.79	1.09	9.72	5.13	5.99	7.14	100
Repairs Services.....	.08	.08	.13	.12	.22	.18	.05	.006	.03	.05	.10	.04	.11
Percent of Total.....	3.22	3.77	2.17	11.38	47.70	15.80	4.25	.12	2.22	1.79	3.43	4.15	100
Repairs Cus- tomer's Meters.....	.64	.37	.44	.37	.59	.38	.44	.43	.70	.32	.52	.44	.49
Percent of Total.....	6.06	3.80	1.94	8.80	31.41	8.02	9.72	1.90	11.34	3.03	4.26	9.72	100
Inspection Cus- tomer's Premises.....	.20	.01	.10	.28	.15	.23	.23	.10	.15	.06	.14	.19	.17
Percent of Total.....	5.25	.04	1.27	18.60	21.70	13.38	14.07	1.27	6.82	1.78	3.28	12.54	100
Customer's Installation.....	.51	.23	.06	.33	.38	.42	.46	.07	.36	.07	.04	.30	.34
Percent of Total.....	6.95	3.45	.41	11.50	29.68	12.90	14.66	.45	8.62	.99	.41	9.98	100
Salaries and Exp. Meter Indexers.....	.25	.22	.15	.27	.22	.19	.21	.23	.19	.27	.16	.20	.22
Percent of Total.....	5.20	5.01	1.55	14.61	26.56	9.19	10.51	2.29	6.92	5.02	3.02	10.12	100
Salaries and Exp. Accounting Dept.....	.99	.70	1.01	.65	.82	.81	1.09	.72	.84	.59	1.15	.57	.81
Percent of Total.....	5.63	4.33	2.73	9.45	26.42	10.22	14.37	1.68	8.23	3.62	5.63	7.69	100
Salaries and Expense Collection Bureau.....	.46	.20	.34	.34	.28	.14	.25	.17	.18	.50	.30	.15	.26
Percent of Total.....	8.15	3.86	2.91	15.27	27.40	5.36	10.16	1.39	5.66	8.80	4.58	6.46	100
Commercial Office Rent.....	.89	.42	.63	.39	.43	.73	.29	.58	.32	.31	.46	.38	.46
Percent of Total.....	9.96	4.57	3.03	10.05	24.33	16.55	6.89	2.74	5.59	3.12	4.02	9.15	100
Commercial Office Supplies and Exp.....	.50	.59	.50	.42	.24	.23	.35	.36	.30	.28	.84	.34	.35
Percent of Total.....	6.55	8.44	3.13	14.00	17.87	6.80	10.60	2.24	6.75	3.62	9.49	10.51	100
Total of Above Items.....	\$4.87	\$2.98	\$3.74	\$3.34	\$3.46	\$3.42	\$3.60	\$2.76	\$3.28	\$2.61	\$3.97	\$2.75	\$3.38
Percent of Total.....	6.63	4.42	2.42	11.58	26.72	10.38	11.35	1.77	7.72	3.53	4.67	8.81	100
Cost per Consumer per Month.....	\$.405	\$.248	\$.311	\$.278	\$.288	\$.285	\$.300	\$.230	\$.273	\$.217	\$.330	\$.229	\$.281

EXPENSES DIRECTLY ATTRIBUTABLE TO CONSUMER COSTS

aries and expenses of collection bureau, commercial office rent, commercial office supplies and expenses.
The table shows the average number of consumers in each city for the year and each city's percentage of the total. The table also shows the cost per consumer per

flag was conceived by a small New Jersey property, namely, the Commonwealth Electric Company of Summit, N. J. The company advertised that it would light free by means of floodlamps all American flags in the city if a requisition for such lighting was made. This

free supply of energy was for the period of war only, and it was stipulated that the equipment used should first be passed by the lighting company.

While the company must approve the type of reflector used, it does not demand that the reflector be purchased from it, although so far the reflectors have been purchased from the company, which sells them at the regular list price. Already there are seven installations, with more in sight, and all of them are used by men who will almost certainly find other employment for them after the war. In all, there are ten reflectors in use.

Each installation has an outside switch whereby the company's patrolman can turn on the lamps and the police department turn them off at midnight. The police department is employed to turn off the lamps at a rate of 25 cents per month per installation, which is paid by the owner of the flag.

While the company sells its equipment at retail, it makes the installation at cost price. The energy used by the floodlamps is carried on a separate account and deducted from the total so that it will not show up as line loss. The lamps are tapped from the secondaries of the line transformers.

COST OF CONSUMERS'

SERVICE CONNECTIONS

Data on the Handling of This Difficult Task in the Territory of a Public Service Company Covering 100 Square Miles

BY WALTER E. BEATY

Since the territory served by the lines of the Union Gas & Electric Company of Cincinnati covers almost 100 square miles (259 hectares), handling service connections is difficult. Except in the downtown district the service work is done by crew with automobile trucks. The men who run the service lines also set the meters and make final connections. This method of handling the work has been found satisfactory in practice, and is thought to be more efficient than the plan which employs several sets of men on the job where the time lost in going from place to place is a large part of the day's work. One of the main troubles formerly encountered in operating under this plan was the damage to meters. The men either handled them carelessly or piled material on them in loading the trucks. All meters are now carried in light sheet-iron boxes which are padded inside. These fully protect the meters.

In the table, prepared some time ago, cost data are given on the expense of connecting service lines and meters. The total cost of operating a three-man gang, including the expense of a $\frac{1}{2}$ -ton (0.45-t.) truck, was \$12.75 per day, or almost \$1.40 per hour. It is also of interest to note in this connection that the average cost of labor to install the various types of services does not vary as much as the cost of material. In October, for instance, the cost of labor per service for the different types was: Two-wire, less than 100 ft. (30 m.) long, \$1.25; two-wire, more than 100 ft. long, \$1.30; three-wire, less than 100 ft. long, \$1.22, and three-wire, more than 100 ft. long, \$1.27. Taking the material costs for the same month on the same group of services, the results were as follows: Two-wire, less than 100 ft. long, \$3.32; two-wire, more than 100 ft. long, \$5.95; three-

wire, less than 100 ft. long, \$4.63, and three-wire, more than 100 ft. long, \$7.68. These data indicate that while it costs more for material to install a three-wire service, the labor cost is practically the same as it is for a two-wire service.

The wire used in standard services is No. 8, triple-braid, weatherproof. This size was chosen because it was considered the smallest wire that had sufficient mechanical strength and at the same time was large enough to carry the average load in such installations. The average length of services is between 90 ft. and 100 ft. (27 m. to 30 m.). The maximum connected load allowed on a two-wire service is thirty-two 50-watt equivalents; that is, 1.6 kw. Lighting loads in excess

COST OF SERVICE CONNECTIONS AT CINCINNATI

Month	Feet of Wire Strung	Price of Wire per Pound in Cents		Number of Services	Average Feet per Service	Average Cost per Service	Average Cost per Wire, Foot
April	25,406	0.185	Two-wire services under 100 ft.	69	128	2.65	0.02
			Two-wire services over 100 ft.	24	252	3.75	0.01485
			Three-wire services under 100 ft.	30	218	3.82	0.01748
			Three-wire services over 100 ft.	8	383	8.36	0.02134
Total and total average				131	187	3.47	0.015
August	34,981	0.2532	Two-wire services under 100 ft.	84	130	3.94	0.0803
			Two-wire services over 100 ft.	37	253	5.50	0.0217
			Three-wire services under 100 ft.	48	204	5.05	0.0247
			Three-wire services over 100 ft.	12	384	8.62	0.0224
Total and total average				181	191	4.67	0.024
October	37,363	0.2725	Two-wire services under 100 ft.	130	130	3.94	0.0303
			Two-wire services over 100 ft.	27	253	5.50	0.0217
			Three-wire services under 100 ft.	48	204	5.05	0.0247
			Three-wire services over 100 ft.	10	384	8.62	0.0224
Total and total average				215	173	4.60	0.0264

of this amount must be placed on three-wire services. The potential drop in the average service lines, therefore, would not be over 2 per cent with all lamps operating.

Local conditions have important bearings on the service costs. The lines, for instance, of the central station at Cincinnati are on the main streets. Alleys are uncommon and could not be used for distribution circuits because they lack continuity of layout. The typical service, therefore, runs from a pole in front of the house across the lawn to the attic or second story of the building. Over 95 per cent of services installed in the past few years are overhead and are for residences.

RANGE SERVICE BROADENS

CENTRAL STATION PEAK

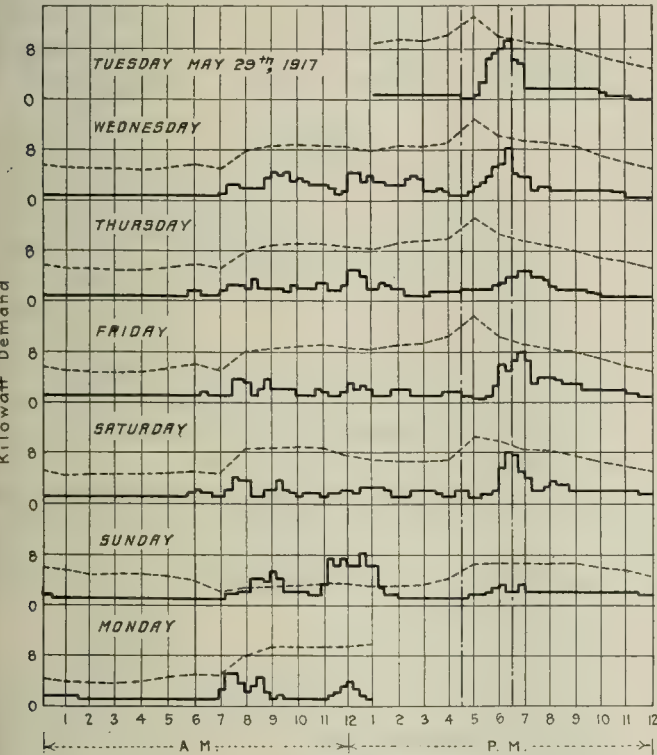
Figures Obtained from Twelve-Apartment Building at Indianapolis Show Average Monthly Requirement for Cooking and Lighting

Data on the use of electrical energy in an all-electric apartment house in Indianapolis brought to light rather unusual relations between the demand and connected load, between the apartment house peak and the central station peak, and at the same time indicated an unexpected low energy consumption per apartment.

The apartment building in question consists of twelve five-room apartments. The equipment of each apartment consists of the following:

One electric range.....	4,300 watts
Fourteen forty-watt lamps.....	560 watts
One percolator	1,650 watts
One iron	
One toaster	
Total connected load per apartment.....	6,510 watts
Total connected load for twelve apartments.....	78,120 watts

In addition to this the realty company owning the building has connected twenty hall and basement lamps,



aggregating 500 watts, and two vacuum cleaners rated at 0.5 hp. each, making an additional connected load of 746 watts. The total connected apartment house load is therefore 78,866 watts. The amount of energy consumed over a period of practically seven months ended in May, 1917, was 7056 kw.-hr.

During that period there was the equivalent of seven flats vacant for one month, so that the total occupancy amounted to seventy-seven "flat months" in that period. The average consumption per apartment per month was therefore 91.63 kw.-hr. This total, of course, includes the energy used for hall and basement lighting and for the vacuum cleaners. Deducting 120 kw.-hr. for this service shows that it required an average of 81.63 kw.-hr. per apartment per month for cooking and lighting in this building.

The results of a demand test covering Saturday (a short day), Sunday (usually a heavier day) and Monday as well as Thursday and Friday (ordinary days), are shown on the curves herewith. These curves indicate that the maximum demand from the 78.86-kw. installation was 10 kw., which occurred between 5.45 and 6.30 p. m. on May 29, 1917. These data indicate a maximum demand factor of 12.7 per cent and a load factor based on demand of 15.1 per cent.

In the curves the heavy black lines indicate the daily conditions in the apartment building, including all elec-

tric service as reported by a graphic wattmeter. The lighter curve, which is superimposed without taking account of its kilowatt value, shows the relation between the occurrence of the apartment house peak and the system peak in the week of heaviest demand during 1916. This system load curve indicates that the peak of the Merchants' Heat & Light Company, from which the service was taken, comes between 4.30 and 6.30 p. m. The fact that the evening range load comes at a somewhat later time indicates a broadening of the peak rather than a definite increase.

In analyzing these curves R. A. MacGregor, sales manager of the Merchants' Heat & Light Company, called particular attention to the demand factor, the apparent broadening effect of the electric range load on the system peak, the satisfactory load factor and the low average energy consumption per apartment per month. With the rate now in effect at Indianapolis it is possible for a residence customer to purchase the 92 kw.-hr. for cooking, lighting, sweeping and ironing for \$3.58 per month.

ACCOUNTING METHODS OF GREAT CONVENIENCE

New Jersey Companies Keep Monthly History of All Accounts, with the Necessary Data for Billing Customers

There is shown in the accompanying illustration a page from one of the customers' accounts books of two affiliated New Jersey companies that operate in very small communities, the Lakewood & Coast Electric Company, Point Pleasant, N. J., and the Commonwealth Electric Company, Summit, N. J. Each page contains space for five customers. Each record contains the monthly history of the account to date and gives all the data necessary for billing. One of the features of this method is the posting of delinquent accounts. At the extreme right is found the total delinquent amount owing at any one time, and by tracing this line up it

Service No.	Name and Address and Description of Service	Date	Meter Reading	Consumption	Am't.	Due	Balance	Inst.	Payment	Delin't	Delin't
		Jan.									
		Feb.									
		Mar.									
		Apr.									
		May									
		June									
		July									
		Aug.									
		Sept.									
		Oct.									
		Nov.									
		Dec.									
		Jan.									
		Feb.									
		Mar.									
		Apr.									
		May									
		June									
		July									
		Aug.									
		Sept.									
		Oct.									
		Nov.									
		Dec.									

PAGE FROM CUSTOMERS' ACCOUNTS BOOK

can easily be seen whether or not the account is one month or two months old or still older.

It is understood that slight changes will be made in this form with the beginning of the new year. The changes will be almost entirely to make room for additional information regarding the customer's connected load.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

VERSATILE FUNCTIONS OF THE PLIOTRON OSCILLATOR

It Can Be Employed Readily for the Production of Large Currents or High Potential at High Frequencies

THE pliotron is an unusually versatile device. In the *General Electric Review* for August, 1917, William C. White has an article which, while not dwelling on this point, shows how a single pliotron can be employed, on the one hand, to obtain 25 amp. at 100,000 to 1,000,000 cycles and, on the other hand, 12,000 volts at 100,000 cycles. The device, it is pointed out, is proving itself very useful in calibrating, testing, etc., where a relatively small amount of electrical energy is sufficient. In a resonance circuit the current will rise until the losses become equal to the input energy. With practical circuits the lower limit of power factor obtainable is about one-half of 1 per cent, unless unusual precautions are taken. This means that the maximum resonance current produced is about 200 times the value of the true energy current fed into the resonance circuit. Therefore, where large currents are desired from a small quantity of energy, the total volt-amperes of the circuit must be kept small, and this condition requires that for such a resonance circuit a large capacity and small inductance must be used. The diagram of an arrangement to produce currents of from 10 amp. to 25 amp. from one pliotron tube at frequencies between 100,000 cycles and 1,000,000 cycles is shown in Fig. 1.

There is another principle which must be kept in mind. If the amount of electrical energy which can be furnished by a certain source is limited by the definite amount of primary power available, or by the losses in transmission, it is important so to adjust the resistance of the load to the voltage of the supply that the energy is most economically utilized. In the present case, this means that the resistance of the heavy-current circuit

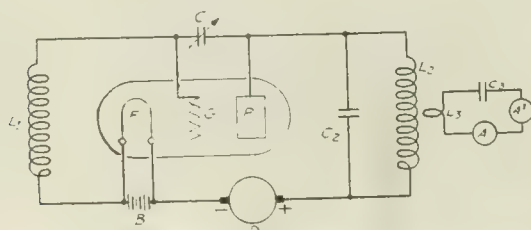


FIG. 1—ARRANGEMENT FOR PRODUCTION OF LARGE CURRENT AT HIGH FREQUENCY

must be given the apparent value most suitable for insertion in the pliotron circuit. This adjustment of apparent resistance is accomplished by electromagnetic coupling or transformer action.

Suppose it is desired to calibrate a hot-wire ammeter

by means of direct comparison with a standard. These two ammeters are represented by A and A_1 and are connected in series as part of a resonant circuit, the inductance and capacity of which are shown at L_3 and C_3 , respectively. The product of the values of L_3 and C_3 to

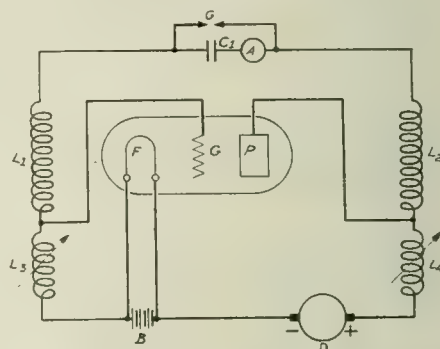


FIG. 2—PLIOTRON OSCILLATOR ARRANGEMENT FOR THE PRODUCTION OF HIGH VOLTAGES

be used for any particular case is found by the usual resonance formula:

$$f = \frac{1}{2\pi\sqrt{LC}}$$

As mentioned in a previous paragraph, a low power-factor and volt-ampere product is desirable; and therefore the inductance value of L_3 is made the minimum possible, consisting usually of only one or two turns of heavy conductor. With the range of frequencies specified, this gives values for C_3 of the order of about 0.1 microfarad. In this heavy-current circuit it is of course very necessary to use condensers of low energy loss and to reduce the ohmic resistance of the conductors to a minimum.

The inductance L_3 obtains energy by electromagnetic coupling from the coil L_2 which is located in the plate circuit of the pliotron.

By means of an adjustment of the values of L_1 , L_2 and C_1 , the pliotron system can be made to set up a high-frequency current corresponding in period to the tuned heavy-current circuit.

Owing to the relative values of L_2 and L_3 , the apparent resistance in the plate circuit of the heavy-current load circuit is greatly multiplied, but still is not of a sufficiently high value to absorb all the available energy. To further increase this apparent resistance, a variable capacity, C_2 is shunted about the inductance L_2 . Then, by simultaneous variation of these two factors, the apparent resistance of the load can be adjusted to give the largest energy output available.

The heavy-current output is dependent upon the voltage of the direct-current source D , a useful range being between 200 and 750 volts.

Pliotrons may be operated in parallel to produce a load current larger than that obtainable from one tube.

In order to cause the production of high voltage in a resonance circuit, the conditions are almost the reverse of those in a heavy-current circuit; that is, with a fixed value of inductance and capacity to give the desired frequency, the capacity must be small and the inductance large, relatively speaking. There is a practical limit, however, to this increasing of inductance and lowering of capacity, and it is reached when the distributed capacity effect in the inductance becomes comparable to the capacity of the condenser used for resonance. A plotron oscillator arrangement for the production of high voltages is shown in Fig. 2.

Generators, Motors and Transformers

Functioning of Repulsion Motors.—L. C. BARBILLION.

—The author gives a new diagrammatic scheme for the performance of repulsion motors. The method that he follows would apply equally to all alternating-current motors of the collecting-ring type and makes it possible to obtain diagrams for the numerous varieties of such motors that are in use.—*Revue Gén. de l'Elec.*, June 23, 1917.

Heating of Dynamo-Electric Machines with Various Loads and at Different Speeds.—MAGNUS MACLEAN and D. J. MACKELLAR.—The series of tests described in this paper were carried out at the Royal Technical College,

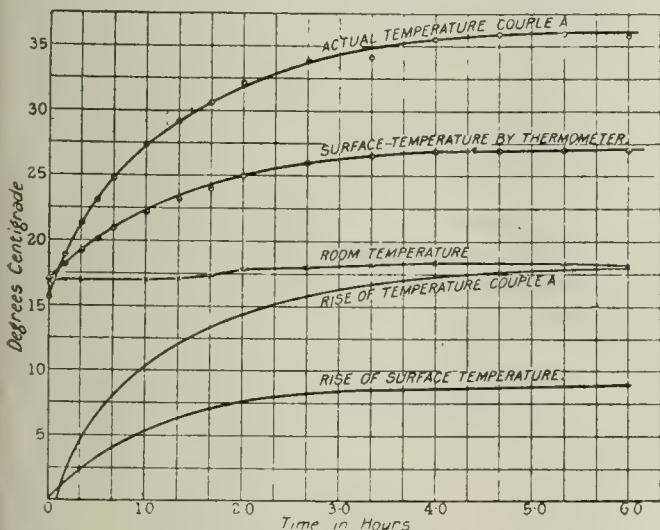


FIG. 3—RESULT OF TEST FOR TEMPERATURE RISE WITH GENERATORS RUNNING LIGHT

Glasgow, with the primary object of obtaining information as to the effect of armature current and armature peripheral velocity on the temperature rise of the various parts of direct-current machines. Such an investigation even for a single machine is necessarily long, and in the present instance the tests have been perforce confined to the determination of temperatures and temperature rises of a field coil of a direct-current machine of the small open-type class, run at various speeds and under different load conditions, in some cases as a motor, in others as a generator. The results have been where possible compared with those previously obtained for a larger machine and also with the published results of other observers. The machine on which the tests were performed is a rotary converter having an output of 25 kw. when driven as a direct-current generator at 500 volts. This machine is

mounted on a single bed-plate with a similar machine, the two machines being mechanically connected by a flexible coupling. The second machine was employed as a driving motor in those cases in which the machine under test was run as a generator. Each machine has a sheet-iron fan mounted on the slip-ring end of the armature. The fans have each a diameter of 480 mm. There are sixty-four straight radial blades having a depth of 60 mm. and a width of 25 mm. The external diameter of the armature is 292 mm. The machines are designed to run at 1500 r.p.m. at 500 volts direct current. In starting a test initial readings were taken of the room temperature and of the galvanometer deflection for each of the thermo-couples. The field current was switched on, and simultaneous readings of the field-coil ammeter and voltmeter were taken. When the machine was run as a motor it was necessary for starting purposes to have maximum field current, but as soon as the starter handle had been moved to the last contact the field-coil current was as rapidly as possible adjusted to the value required for the test. The field-coil current was maintained as nearly as possible at the value throughout the test. In the early part of each test sets of readings were taken at frequent intervals. As the temperature changes became less rapid these intervals were extended. Each set of readings consisted of (1) armature current, (2) armature volts, (3) field-coil current, (4) field-coil volts, (5) speed of machine in r.p.m., (6) galvanometer deflections for thermo-couples, (7) room temperature by thermometer, (8) surface temperature by thermometer.—*London Electrician*, July 6, 1917.

Lamps and Lighting

Tungsten Filaments.—W. BÖTTGER.—Paper read before the Deutsche Bunsen Gesellschaft. Description of the process of the firm of Julius Pintsch, due to O. Schaller and Orbig. Powdered tungsten, 2 per cent of thoria and some binding agent are kneaded into a paste from which threads are squirted. These threads are preheated and then rapidly raised to higher temperature by being passed through a hot zone at 2400 deg. or 2600 deg. C. at a rate which is smaller than the velocity of crystallization. The resulting wire, only a few hundredths of a millimeter in diameter and octagonal rather than circular in section, consists of crystals many meters in length.—*Phys. Zeits.*, March 1, 1917.

The Purple Color of Lamp Globes.—M. LUCKIESH.—The presence of the often noted purplish tint of lamp globes has been shown to be due to manganese. This article calls attention to the fact that the introducing of manganese to neutralize the greenish tint due to slight quantities of iron oxide may reduce the light transmission factor from 10 to 25 and even 55 per cent, there having been found specimens having 85 per cent reduction. The recommendation is therefore made that in outdoor illumination glassware the manganese be omitted from the formula.—*General Elec. Review*, August, 1917.

Artificial Illumination of Factories.—Conclusion of the discussion of this subject. The relative importance of illumination in various parts of a factory is considered, the structure being for this purpose divided into three sections—(1) the floors or portions of floors on which operatives work; (2) the passages, staircases, vestibules and other places in which operatives circu-

late but do not work, and (3) the courtyards and their accessories. The illumination of the workrooms is classified under four headings: (1) General illumination, in which the light produced is uniform everywhere; (2) general local illumination, in which the light produced is approximately uniform in one or more regions of the place in question; (3) local illumination, in which every light source has for its object the illumination of a part of a machine without reference to the action of any other light source; (4) general illumination combined with local illumination. The report of an Italian commission on factory lighting is summarized in this article. One conclusion arrived at is that, except as regards cost of installation, it is inadvisable to draw distinctions between direct, indirect and semi-indirect systems of lighting. The value of the illumination is independent of the nature of the light.—*Rivista Tecnica d'Elettricità*, June 14, 1917.

Generation, Transmission and Distribution

Corona Effect and Rectification of Current in Hydrogen.—An article describing new comparative experiments with the phenomenon of corona in the air and in hydrogen at different pressures. The apparatus employed was a reproduction of Ryan's arrangement, in which a wire and a cylinder are coaxial. For the same gas the effects observed varied with the polarity of the wire and led to characteristics distinctly different. There was no relation found between relative characteristics with two different gases. A method by which corona in hydrogen may be used for the rectification of current is indicated by the author.—*Revue Gén. de l'Elec.*, July 7, 1917.

Sphere Gaps for Lightning Arresters.—V. E. GOODWIN.—The aluminum or electrolytic type of lightning arrester is recognized as being the most efficient type of arrester by virtue of its high discharge rate, large heat-absorbing capacity and its ability to discharge lightning disturbances without interfering with line conditions, owing to the quick action of the aluminum cell. The addition of sphere gaps to the arrester for alternating-current circuits increases the speed with which the arrester discharges lightning impulses and consequently further increases the efficiency of the arrester. The description of the application of the sphere gap given in the article therefore records a marked improvement in the art of protecting electrical apparatus against lightning.—*General Elec. Review*, August, 1917.

Electrochemistry and Batteries

Charging Storage Batteries of Electric Vehicles.—J. J. KLINE.—The construction of the storage cell and its chemical, thermal and electrical actions on charge and discharge are briefly reviewed in the introduction of this article, in order to make more readily intelligible the description and discussion of the constant-potential system of charging which form a large part of the article. After a very complete treatment of the constant-potential system, there appear descriptions of the charging apparatus, including switchboards, automatic switches, individual charging sets, automatic charger, etc.—*General Elec. Review*, August, 1917.

Units, Measurements and Instruments

A New Meter for High-Voltage Energy.—P. F. DUFOUR.—A description of a high-tension electricity

meter patented by the author which has the distinguishing feature of possessing only low-tension apparatus without a transformer, the customer's transformer being made to fill the rôle of measuring transformer. This appliance, on account of being less costly than those generally in use, will permit the installation of double meters, against which the expense has always operated, despite their advantages.—*Revue Gén. de l'Elec.*, June 30, 1917.

Installations, Systems and Appliances

The Use of Low-Grade Mineral Fuels and the Status of Powdered Coal.—F. PARKMAN COFFIN.—In this first installment of the series the distribution of the coal deposits in North America is described, and attention is called to the fact that certain sections of the continent at a distance from the coal mines have large undeveloped deposits of low-grade fuel. Reference is made to the other low grades of coal which are produced as by-products of mining. The solid mineral fuels are treated in the following order: peat, lignite, bituminous coal and anthracite. The methods of burning each of these fuels are reviewed—viz., burning on grates, in gas producers and in pulverized form. The relative advantages of each method are discussed in detail.—*General Elec. Review*, August, 1917.

Miscellaneous

Refractory Materials.—Report of the refractory materials committee of the (British) Institution of Gas Engineers, presented June 5, 1917. The committee reports that the necessary plant for the investigation of the question of refractoriness of material under load and of the differences in size of bricks when cold and when at high temperature has been completed for some time and research in these respects has commenced. The apparatus for investigating the influence of the fine flue dust carried into the setting on the refractoriness and life of the materials employed is now also practically complete. A large quantity of clay, amounting to about 20 tons (18.1 t.), has been obtained from six sources, representative of the different varieties of material found in the United Kingdom. The hot to cold measurements of the bricks collected as typical of those on the market are completed, and the results obtained are given in detail in the report of Dr. Mellor. The results obtained are such as to cast some doubt on previous measurements of the coefficient of thermal expansion of firebricks and related materials at high temperatures, as the true thermal expansion is obscured by effects due to the after-expansion or after-contraction of the firebricks which is taking place while the bricks are being measured. The work carried out by Dr. Mellor in this respect demonstrates the importance of taking into account the continued alteration in the character of bricks under prolonged or repeated heating. A number of measurements of the after-contraction or after-expansion of firebricks have been made to test the conditions laid down in this respect in the standard specification, and the results obtained are given in Dr. Mellor's report. The general conclusion derived from this series of tests is that the tendency is for ordinary silica bricks to give a less expansion and firebricks of fireclay to give a greater contraction in the reducing than in the oxidizing atmosphere.—*London Engineering*, June 15, 1917.

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

APPLICATION OF MISSOURI UTILITY ASSOCIATION DENIED

Commission Holds that Utilities Must Apply Individually for Increases in Rates Before Relief Can Be Granted

On Tuesday, Aug. 7, the Public Service Commission of the State of Missouri, sitting in Jefferson City, denied the application of the Missouri Association of Public Utilities for a blanket order whereby that association would have been empowered to increase the rates of each one of its 303 member companies. In handing down its decision the commission held that a specific case should be presented by each one of the 303 utilities involved. The commission contends that it has not the right to authorize an indiscriminate increase in rates of each of a number of individual companies on the motion of an association of which these utilities are members and asserts that it has never attempted to establish a rate without first knowing the valuation of the property involved. It therefore follows that each of the 303 member companies must make individual application unless the association can show the commission that conditions in a number of cities are identical and that a uniform rate exists in these cities.

The petition of the association included tabulated data showing that the price of coal increased from 50 cents a ton at the mines in April, 1913, to \$2 per ton in May, 1917. The petition also set forth the fact that the maximum prices for Illinois coal fixed by the government are \$2.75 for mine-run and \$3.50 for domestic.

As regards the prices of general supplies and labor, the petition set forth averages obtained from seventy-six answers to a circular letter sent to utility companies in Missouri. A tabulation of these reports showed the following advances in prices during the last five years: Steam coal, 49 per cent; gas coal, 50.8 per cent; coke, 66.6 per cent; wood, 13.8 per cent; fuel oil, 72.3 per cent; gas oil, 97.6 per cent; lubricating oil, 24.4 per cent; gasoline, 71.9 per cent; office help, 32.3 per cent; plant labor, 25.4 per cent, and freight, 16.2 per cent. This makes an average increase in the cost of these items of 47.4 per cent. Coal purchased in the open market because of expiring contracts or failure to obtain supply on existing contracts resulted in an advance of 119.1 per cent. Cases of this character are not taken into account, however, in the above tabulation.

Data collected from the discount sheets of supply houses show advances in prices during the last three years as follows: Class A, malleable fittings, 78.5 per cent; cast-iron fittings, 155.5 per cent; brass valves (regrinding), 78.3 per cent; straight-way valves, cast iron, 83.8 per cent; 4-in. (10.16-cm.) boiler tubes, 226.4 per cent; 2-in. (5.08-cm.) wrought-iron black pipe, 125.7 per cent; 6-in. (15.24-cm.) well casing, 75 per cent; 6-in. to 12-in. (15.24-cm. to 30.48-cm.) cast-iron water main, class B, 218.1 per cent; 4-in. (10.16-cm.)

cast-iron water main, class B, 236.3 per cent; 4-in. (10.16-cm.) hydrants (standard), 32.2 per cent; pig lead, 188.8 per cent; weatherproof copper wire, 131.4 per cent; pole-line hardware, 110 to 144.4 per cent. The average advance in this class of items amounted to 136.4 per cent.

The petition asked the commission to issue a general order permitting utilities to attach riders to bills rendered on present schedules to cover these unavoidable increases in operating expenses during the present crisis. The amount of relief desired by the several water, gas and electric utilities composing the association was presented to the commission at the time of the hearing on the application by a representative of each utility.

PRAISE FOR COMMITTEE ON GAS AND ELECTRIC SERVICE

Quartermaster's Department Gives Recognition to Its Work in Getting Electric Service Promptly for the Cantonments

The National Committee on Gas and Electric Service has been actively co-operating with the Advisory Commission of the Council of National Defense and with a number of the departments of the government that are actively engaged in various measures for the prosecution of the war. The committee has been able through its close touch with the gas and electric utility companies to be of special service to the Quartermaster General's Department in connection with the troop cantonments, and it has received the attached letter from Col. I. W. Littell, expressing appreciation of its services:

WAR DEPARTMENT

Office of the Quartermaster General of the Army
WASHINGTON, July 31, 1917.

From: Officer in charge of cantonment construction.
To: National Committee on Gas and Electric Service, Munsey Building, Washington, D. C.
Subject: Service rendered by your committee in connection with cantonments.

1. This office wishes to express its appreciation of the very valuable service rendered by your committee in connection with solving the problem of obtaining electric power and gas supply where required for the cantonments for the National Army. Due to the information furnished by your committee, a large amount of investment in temporary power plants has been saved to the government.

2. Time did not permit using your services in connection with the National Guard camps in the same manner as they were used in connection with the National Army cantonments, but even under these circumstances your services have proved very valuable in connection with the National Guard work.

3. This office also wishes to express its appreciation of the uniform courtesy and efficiency of your local representatives.

By authority of the Secretary of War:

I. W. LITTELL,
Colonel, Quartermaster Corps, in Charge of Cantonment Construction.

TO INCORPORATE AMERICAN ACADEMY OF ENGINEERS

Senate Committee on Judiciary Presents Bill with
This Object to Congress, and Favorable Action
Is Taken Upon It

On Aug. 3 the Senate, in committee of the whole, considered the bill incorporating the American Academy of Engineers.

The incorporation of the American Academy of Engineers was earnestly recommended by Gen. George W. Goethals, Dr. S. W. Stratton, director of the Bureau of Standards, and many other expert engineers and scientists. The measure provides for the establishment of a body of representative engineers upon whom the government may call for advice in time of need. The members named in the bill as the incorporators are well known as leaders in their respective professions. It was generally recognized that the body would be of great service to the government at all times in an advisory capacity as regards its engineering work both in the military and the civic departments. There are at least 200,000 engineers in the United States who are interested in securing a plan for united action in the most positive and effective way, and the incorporation of the American Academy of Engineers paves the way for such action.

OBJECTS OF THE ACADEMY

The objects of the proposed organization are first to render loyal and effective service to the government of the United States as far as lies in its power, and second to advance in every legitimate manner the interests and welfare of the engineering profession in all its numerous branches. The establishment of such an academy has been under consideration for eight years.

The bill provides that the incorporators and first members of the American Academy of Engineers, as given below, and their associates and successors duly chosen be and they are hereby constituted and declared to be a body corporate of the District of Columbia by the name of the American Academy of Engineers. It continues:

Sec. 2. That the purposes of this corporation are and shall be the furtherance of the interests of engineering, industrial technology and applied science.

Sec. 3. That the American Academy of Engineers shall consist of not more than 200 regular members, and the said corporation hereby constituted shall have power to adopt a constitution and to make all by-laws, rules and regulations not inconsistent with law that may be necessary or expedient in order to accomplish the purposes of its creation; to fill all vacancies created by death, resignation or otherwise; to provide for the election of foreign and domestic members and the division of such members into classes; to adopt a seal, and to do all other matters needful or usual in such institutions.

Sec. 4. That the American Academy of Engineers shall hold an annual meeting at such place in the United States as may be designated and shall make an annual report to the Congress, to be filed with the librarian of Congress.

Sec. 5. That the American Academy of Engineers shall, whenever called upon by any department or establishment of the government, investigate, examine, experiment and report upon any subject of engineering science or art, the actual expenses of such investigations, examinations, experiments and reports to be paid from appropriations which may be made for the purpose; but neither the academy as a body nor any of its committees shall receive any compensation whatever for any service to the government of the United States.

Sec. 6. That the American Academy of Engineers be and the same is hereby authorized and empowered to receive by devise, bequest, donation or otherwise, either real or personal property, to an amount not exceeding \$1,000,000 in the aggregate, and to hold the same absolutely or in trust, and to invest, reinvest, manage and apply the said property and the income arising therefrom in furtherance of the objects of its creation.

Sec. 7. That the right to alter, amend or repeal this act is hereby expressly reserved.

The incorporators and first members are as follows:

John W. Alvord, Chicago, consulting civil engineer.

Dr. Edward G. Acheson, Niagara Falls, past-president American Electrochemical Society.

Thomas E. Brown, New York, consulting engineer Otis Elevator Company.

Dr. Louis Bell, Boston, past-president Illuminating Engineering Society.

Dr. L. H. Baekeland, New York, past-president American Electrochemical Society, past-president American Institute of Chemical Engineers.

Dr. C. F. Chandler, New York, past-president American Chemical Society.

John F. Coleman, New Orleans, consulting civil engineer.

Howard E. Coffin, Detroit, vice-president and chief engineer Hudson Motor Car Company, member Naval Consulting Board.

Dr. John J. Carty, New York, chief engineer American Telephone & Telegraph Company, past-president American Institute of Electrical Engineers.

Dr. Mortimer E. Cooley, Ann Arbor, professor at University of Michigan.

Prof. William F. Durand, Stanford University, California, naval architect and marine engineer.

Col. Gustave J. Fieberger, West Point, professor of engineering at West Point.

Gen. George W. Goethals, New York, consulting engineer.

Dr. W. F. M. Goss, Urbana, Ill., past-president American Society of Mechanical Engineers.

Carl E. Grunsky, San Francisco, consulting civil engineer.

Admiral Robert S. Griffin, Washington, D. C., engineer-in-chief, U. S. N.

Dr. Carl Hering, Philadelphia, past-president American Electrochemical Society, past-president American Institute of Electrical Engineers.

Clemens Herschel, New York, past-president American Society of Civil Engineers.

Gen. H. F. Hodges, Washington, D. C., brigadier general U. S. A.

Dr. Henry M. Howe, New York, past-president American Institute of Mining Engineers, past-president American Society for Testing Materials, past-president International Association for Testing Materials.

Dr. John Hays Hammond, New York, past-president American Institute Mining Engineers.

Herbert C. Hoover, New York, honorary member American Institute of Mining Engineers, chairman Commission for Relief in Belgium.

Dr. Alexander C. Humphreys, New York, president Stevens Institute of Technology, past-president American Society of Mechanical Engineers.

Hennen Jennings, Washington, D. C., consulting mining engineer.

Dr. Julian Kennedy, Pittsburgh, Pa., designer of iron and steel works.

Hunter McDonald, Nashville, Tenn., past-president American Society of Civil Engineers.

Dr. C. O. Mailloux, New York, past-president American Institute of Electrical Engineers.

Charles T. Main, Boston, consulting mechanical engineer.

Bruno V. Nordberg, Milwaukee, president and chief engineer Nordberg Manufacturing Company.

Dr. William H. Nichols, New York, president General Chemical Company, past-president American Chemical Society.

Dr. William Barclay Parsons, New York, consulting civil engineer.

Corydon T. Purdy, New York, consulting engineer, expert in steel building construction.

Dr. M. I. Pupin, New York, member National Academy of Science, professor at Columbia University.

Charles F. Rand, New York, past-president American Institute of Mining Engineers.

Dr. Rossiter W. Raymond, New York, founder American Institute of Mining Engineers.

E. W. Rice, Jr., Schenectady, president General Electric Company, president-elect American Institute of Electrical Engineers.

Dr. S. W. Stratton, Washington, D. C., director of the Bureau of Standards.

Dr. George F. Swain, Cambridge, Mass., consulting civil engineer, professor at Harvard, past-president American Society of Civil Engineers.

E. Gybbon Spilsbury, New York, past-president American Institute of Mining Engineers.

Dr. Ambrose Swasey, Cleveland, Ohio, past-president American Society of Mechanical Engineers.

Frank J. Sprague, New York, past-president American Institute of Electrical Engineers.

Prof. A. N. Talbot, Urbana, Ill., past-president Society for Promotion of Engineering Education.

Stevenson Taylor, New York, president Society of Naval Architects and Marine Engineers.

Benjamin B. Thayer, New York, past-president American Institute of Mining Engineers.

Dr. Elihu Thomson, Lynn, Mass., member National Academy of Science, past-president American Institute of Electrical Engineers.

David W. Taylor, Washington, D. C., chief constructor U. S. N.

Prof. F. E. Turneure, Madison, Wis., professor at University of Wisconsin.

Dr. M. C. Whitaker, New York, consulting chemical engineer.

Dr. J. A. L. Waddell, Kansas City, consulting civil engineer.

Dr. John F. Wallace, New York, past-president American Society of Civil Engineers; past-president Western Society of Engineers.

REASONS FOR NATIONAL CHARTER

Among the more important supplications made to Congress for the speedy enactment of the law providing for the incorporation of the American Academy of Engineers as a war measure was the following letter from Dr. C. O. Mailloux:

I should like to urge the importance and desirability of the Senate and Congress of the United States giving a national charter to the American Academy of Engineers at the earliest date possible. Besides the reasons of professional, national and civic character which amply justify the formation of the American Academy of Engineers, and which will probably be urged in letters addressed to you by other engineers on this subject, there are other reasons which make the movement extremely opportune at the present time. While I was in France last fall with the American Industrial Commission to France, of which I was a member, I had occasion several times to speak of this matter to many men prominent in engineering, applied science and technology, including members of the French Académie des Sciences. Many compliments were paid to the American engineering profession for its foresight and its initiative in having inaugurated a movement for the creation of an academy of engineers. The fact was recognized and was stated by them, in so many words, that the time has come when academies of engineers are necessary for the further and fuller development and evolution of the engineering profession as a factor in human progress. I was informed that, notwithstanding the fact that France already has the greatest academy of sciences in the world, the need has been recognized for something more.

The French government has since the war began created a new academy called the Academy of Agriculture by a special decree of President Poincaré, issued under date of Feb. 23, 1915, and countersigned by the Minister of Agriculture. This academy succeeds, and is based upon, the National Agricultural Society of France, founded in 1761.

In the last two years efforts have been made to constitute in France a federation of engineers, architects and technologists with the idea of securing a better co-ordination of and co-operation between the different branches of applied science. Strange, but very important to note, a man like my friend Professor Blondel, the distinguished electrical engineer and scientist, who is himself a member of the Académie des Sciences, and consequently is a member of the Institut de France, was one of the very first to recognize the fact that there is still something lacking in France to enable the French nation and government to derive the fullest benefit and highest efficiency from the co-operation of technical men. He expressed to me the fervent hope that the American academy would soon be completely launched and established, because he fully believed that the example would be at once followed by the men interested in and connected with engineering and applied science in France. He expressed wonder that this happy idea, which he characterizes as an inspiration, had not been carried into execution long ago, especially in view of the fact that engineering and the work of engineers have assumed so much importance in modern life and in present-day activities, in warfare as well as in industry and commerce. A prominent French engineer told me that he wished that the idea of establishing a national academy of engineers had been thought of in France first instead of in America. However, under the circumstances, as France could not be the first, it would rather play second and come after America than after any other nation. He added laconically that there was one nation that might have been first, and which it would have been impossible for them to follow, as a matter of self-respect and dignity. In France the creation of an academy of engineers is regarded as a war measure of considerable importance, and seeing that the example is being set by America, France will be sure to follow it promptly and enthusiastically. A letter received from M. Blondel, under date of May 25, reiterates his great interest in the movement to establish the American Academy of Engineers, and congratulates American engineers on having organized that academy.

The preceding notes show that the men of the élite in engineering and applied science in France have the highest opinion of the American Academy of Engineers, and realize that its creation is fully justified. Their indorsement alone, in my opinion, constitutes a strong plea in favor of the prompt passage of the bills introduced in the Senate and the House of Representatives to incorporate that academy. I need not dwell upon the numerous other reasons related to the benefits which the profession of engineering in general and the nation as a whole can and will undoubtedly derive from the American Academy of Engineers. In France academies can be created by presidential decree on the recommendation of one of the ministers. I sincerely hope that the Senate and House of Representatives will not delay in taking the action desired by the charter members of the American Academy of Engineers, so that the said academy may not be deprived of the credit and satisfaction of having been the first academy of engineers to receive official sanction as a national academy of engineers.

DEFINITE RATE INCREASE BETTER THAN COAL CLAUSE

Illinois Commission in Rockford Case Disapproves Coal Clause Method, but Opens Way to Meet Higher Costs

A preliminary decision has been rendered by the Illinois Public Utilities Commission in the increased power rate case of the Rockford Electric Company, a subsidiary of the American Gas & Electric Company, which was reported in the ELECTRICAL WORLD for June 16, 1917, page 1151. The commission disapproves the coal-clause plan of raising rates, but indicates clearly that the higher cost of operation calls for an advance in power rates by other methods.

It was acknowledged by the commission that the tes-

timony showed decided increase in fuel cost. The statute provides that rates shall reimburse the company for cost. Increased cost should be reflected in increased rates. Discussing the question of what classes of consumers are most affected, the commission shows that coal cost is a larger proportion of total cost for power consumers than for other users. Power users would find the same conditions if they generated their own energy; lighting consumers could obtain other forms of energy for light.

The commission announced that it did not wish to subscribe *in toto* to the representations of the company, but the case demanded serious consideration. The principle involved was much broader than the particular issue raised. Copper might, for instance, furnish the basis for a similar case. Under the plan suggested of basing power rates on average coal cost, automatic increases would be made by the utility.

rate schedules should be made permanent schedules.

In effect, the conclusion of the commission was that if the company wished to submit a definite schedule and it was in accord with the general policy and requirements of the commission in other respects, an order would be issued.

WORKMEN'S HOUSES OF THE SHAWINIGAN POWER COMPANY

Attractive Homes Built for Employees at Shawinigan Falls—Groups of Two, Three and Five Dwellings

Attractive houses for workmen have been built by the Shawinigan Water & Power Company at Shawinigan Falls, Quebec.

Groups of three types are shown in the photographs



TYPES OF HOUSES PROVIDED FOR ITS EMPLOYEES BY SHAWINIGAN

The commission would have only bare statements as to coal cost.

The record indicated, the commission held, that the company was entitled to an increase in power rates, based on higher cost of operation. As the commission, however, does not believe rates should vary, the

WATER & POWER COMPANY AT SHAWINIGAN FALLS, QUEBEC

reproduced herewith. In one there are three distinct dwellings, the two end houses being of similar design and somewhat different from the center one. In another there are two dwellings of similar design. The third group of houses shown contains five individual dwellings.

HIGHER COAL COST AND RATES IN PITTSBURGH

President Callery of Duquesne Light Company Says
that Coal Cost Was 100 per Cent Higher
—Revised Schedule

In the annual report of the Duquesne Light Company, Pittsburgh, for the year ended March 31, 1917, President James D. Callery refers as follows to higher coal cost and revision of rate schedule:

During the year the company has had to contend with extraordinarily high prices for coal. This item alone increased \$748,605, which represents practically 100 per cent increase over last year, while the sale of energy increased about 30 per cent and the kilowatt output for the year increased 32 per cent over last year. The added cost of coal is partly due to the failure of the coal contractors to live up to their contracts owing to the miners' strike of two months in the early part of the season and the shortage of cars thereafter, which necessitated the company buying part of its requirements of fuel in the open market.

In the last three months of the year the production cost per kilowatt-hour on the system as a whole has increased 1.56 mills, caused chiefly by the extremely high price of coal.

During the latter part of the year a new schedule was filed with the Public Service Commission which provides for an increase in the price of energy to power consumers on the basis of an advance or a decline in the price of coal, and the company is now operating under the revised schedule.

THE NEW ENGLAND POWER SECURITY ISSUE APPROVED

Massachusetts Commission Recognizes the Need for
Enlarging and Improving the Company's System
and Assuring Sufficient Funds

A majority of the Massachusetts Gas and Electric Light Commission has approved the application of the New England Power Company for authority to issue additional securities of the par value of \$7,000,000 in stock and bonds to meet the cost of enlarging and improving the system as recently outlined in the ELECTRICAL WORLD. On this projected work \$96,000 had been expended prior to June 30, 1917, chiefly upon line extensions and new substation construction. In view of the small amount expended Commissioner Lewenberg voted against granting the petition. He maintained that the company's credit should be sufficient to enable it to raise the necessary funds, at least in large part, and stated that as the construction company owned by the petitioner is likely to do the work the chances of low competitive bids by outside contractors appear uncertain.

The company contended in the proceedings before the board that the approval of the latter is an important factor in financing the improvements contemplated at the present time. The majority, in approving the petition, points out that whereas the cost of the work rests so far mainly upon estimates made with regard for the existing abnormal prices of labor and materials, the work will cover a considerable period and it may be that actual costs will differ from the estimates. "The company claims with considerable force," says the majority opinion, "that the expenditure upon the further development of the water power of the Deerfield River is so large that it cannot finance this project without the assurance in advance that the means for

its completion are available. The undertaking is so important to the welfare of the State that the board has no hesitation in giving this assurance so far as its action is necessary to this end, and is of the opinion that upon the terms expressed in the order the public interests will be safeguarded." These terms included postponing for one year the sale of 10,000 shares of common stock. The commission approves the issue of 20,000 preferred and 20,000 common shares at \$100 par value and \$3,000,000 in bonds. The improvements to be made include the construction of a 22,000-kw. hydroelectric plant at Readsboro, Vt., with a large storage reservoir, substation development, and raising the pressure on certain lines from 66,000 volts to 110,000 volts.

SHIPPING BOARD SEEKS TO BUY 3000 ELECTRIC FANS

That Number of Direct-Current Desk and Wall Fans
Needed Next Year for the Cargo-Handling
Ships Now Being Built

Quotations are requested by the United States Shipping Board on all or any portion of 3000 commercial-type, non-oscillating 12-in. (30-cm.) electric fans, complete and suitable in every respect for marine service on board the cargo-handling ships now being constructed for the Emergency Fleet Corporation, with the option of increasing the quantity awarded by 50 per cent within thirty days of award.

The fan is to operate on a direct-current circuit at 116 volts, is to have three speeds with control at base, and may be either of the four-blade or the six-blade, wire-guarded type. The fan must run silently without undue humming, buzzing or rattling. The fan is to be mounted on a neat-appearing, wide-flaring base, with felt bottom, and is to be provided with swivel and hinge (or equivalent) joint, to permit directing the breeze at any angle, either horizontally or vertically. The motor is to be entirely inclosed and is to have properly designed bearings with wick oil cups which require no attention. Armature and field coils are to be moisture-proof and oil-proof and are to have insulation resistance and dielectric strength in accordance with the Standardization Rules of the American Institute of Electrical Engineers. Brushes and windings are to be easily accessible. The fan must be so arranged that it can be used as either a desk or a wall fan by a simple adjustment, and it must be provided with suitable holes in the base for fastening to a desk or wall by means of screws. The necessary number of base-fastening screws must be furnished with each fan.

The fan is to be furnished complete with all accessories, but without connecting cord and disconnecting plug or socket. The finish is to be standard black enamel (baked) with polished brass blades and guards, but alternatives will be considered for finish in all-white enamel or in all-one-color enamel of tint to be prescribed later by the corporation.

In submitting proposals bidders are requested to state the horsepower (or wattage rating) of the fan, the energy consumption at the various speeds at 116 volts, the three speeds of operation, the weight (both net and shipping), the number of fan blades, the quantity of air displaced per minute against free air (de-

rived from actual tests, the nature of which are to be described, together with the manner of conducting tests and by whom conducted), and the distance at which the breeze may be appreciably felt in a large inclosed room. Bidders are also asked to submit drawings, cuts, specifications and other data showing fully the detailed design of the fan and the construction of the armature, field, bearings and joint. A list of recommended spare parts, together with the net prices thereof, is also requested. Deliveries must begin Jan. 1, 1918, and be completed Oct. 1, 1918. Shipments will be made in lots of ten fans in one package. No bidding bond is required.

INCREASING EXPENSES AFFECT OPERATING RESULTS LARGELY

In First Six Months of 1917 Net Earnings of American Light & Traction Company Decrease \$476,000

A report of the American Light & Traction Company shows that extra costs affected operating results materially. The report says in part:

For the last six months of 1916 net earnings showed an increase of \$183,056, while for the first six months of 1917 net earnings showed a decrease of \$476,505, making a decrease for the year ended June 30, 1917, of \$293,449.

This decrease was due to conditions beyond the control of the management of your company or its subsidiaries, and was caused in part by extraordinary increases in expenses, due to increased cost of material, labor and taxes, during the six months ended June 30, 1917, as follows:

Coal, oil and coke.....	\$350,846
Labor	146,408
Taxes, subsidiary companies, local	\$77,928
Taxes, subsidiary companies, federal	162,600
Taxes, American Light & Traction, federal.....	124,000
Total	\$861,782

The subsidiary companies show substantial increases in gross business for the six months ended June 30, 1917, as follows:

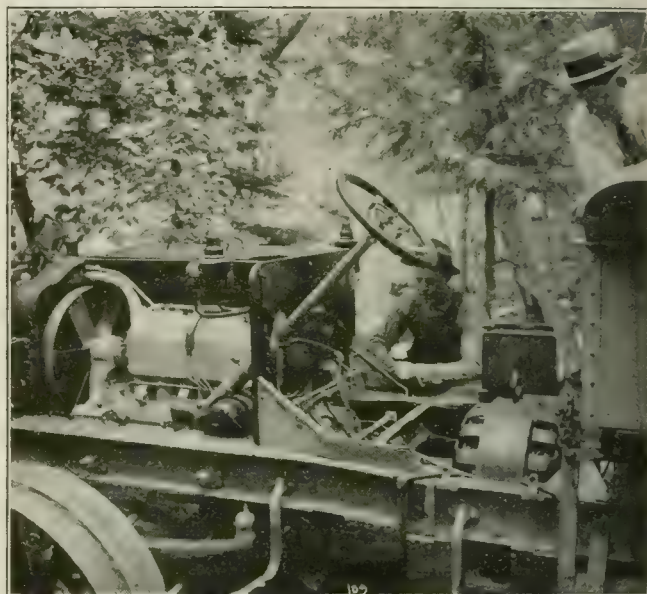
		Per Cent
Gas sales, cu. ft.....	1,014,316,000	12.78
Gas income	\$805,312	13.84
Electric sales, kw.-hr.....	4,017,443	15.08
Electric income	\$107,470	9.66
Street railway, passengers.....	2,200,882	21.65
Street railway income	\$104,932	21.50

EMERGENCY GENERATING OUTFIT IN THE YOSEMITE

It Being Impossible to Complete the Hydroelectric Station in Time, an Automobile Outfit Was Pressed into Service with Good Effect

Guy L. Bayley, formerly chief electrical and mechanical engineer for the Panama-Pacific International Exposition, sends us the following account of an emergency lighting outfit pressed into service in the Yosemite National Park. Mr. Bayley is building a 2500-kw. electric plant at Yosemite for the Department of the Interior to care for the growing needs of the valley. Inasmuch, however, as the station could not be finished in time to handle this season's load, something had to be done to augment the output of the existing equipment. The latter comprised two 75-kw., 2300-volt, two-phase generators, belt-driven by Pelton wheels. The size of the penstock is such that only 120 kw. can be obtained. About 30 kw. of additional power was needed to care for the peak this season, and the accompanying illustration shows how this amount of power was secured.

A White good roads truck having a six-cylinder engine rated at 60 hp. was pressed into service. The transmission gear box was removed, and in place of it a 30-hp., 1200-r.p.m., 220-volt induction motor which had been used on the construction work at the new dam was installed. The motor was connected directly to the engine through a flexible coupling and operated as



EMERGENCY LIGHTING PLANT AT YOSEMITE

an induction generator. Owing to the frequency of the plant being above normal, it was necessary to operate the engine at 1350 r.p.m. at full load. The auxiliary plant has operated every night over the peak for two months without giving any trouble. On test, it delivered 25 kw. for four hours, and this output has been exceeded for short periods. There is no governor on the engine, and the outfit is started up through regular motor compensator. As soon as the engine starts to fire, the throttle is opened to the point corresponding to full load, the waterwheel units taking care of the load variations.

The truck was installed just outside of the old power house and is cared for by the station operator, a boy being employed to watch the supply of water to the radiator and to replenish the gasoline and oil. The successful installation and operation of the plant was due to the co-operation of the local plant of the White Company and J. W. Emmert, chief electrician for the government.

COAL CLAUSE IN RATES OF A MISSOURI COMPANY

Missouri Gas & Electric Company, Operating at Richmond, Introduces Change in Schedules Based on Fuel Expense

T. M. Bradbury, secretary Missouri Public Service Commission, replying to an inquiry of the ELECTRICAL WORLD, writes that the commission has not as yet granted authority to increase electric rates on account of higher coal costs. One application was pending when Mr. Bradbury wrote, and he said that it would no doubt be granted unless a specific protest was received within a few days.

The increase asked for applies to the electric com-

pany at Richmond, Mo., owned by the Missouri Gas & Electric Service Company, Chicago. The proposed increase is set out in the following "rider":

Coal Clause.—It is agreed and understood that the aforesaid secondary charges hereof shall be subject each month to an addition of 0.06 cent per kilowatt-hour for each 10 cents of increase in the cost of coal during such month to the Missouri Gas & Electric Service Company above \$2.60 per ton delivered at the company's generating plant. The secondary charges shall likewise be subject each month to a deduction of 0.06 cent per kilowatt-hour for each 10 cents decrease in the monthly cost of coal to the company below \$2.10 delivered as aforesaid. The cost of coal herein mentioned is based upon coal of a standard quality of approximately 11,500 B.t.u.

This is to apply only to the wholesale rate for alternating current, which rate is as follows:

Primary Charge.—\$2.25 per month per kilowatt for the first 50 kw. of maximum demand in the month; \$2 per month per kilowatt for the excess of the maximum demand over 50 kw.

Secondary Charge.—4 cents per kilowatt-hour for the first 1000 kw.-hr. used per month; 2.5 cents for the next 4000 kw.-hr., and 1.25 cents for all in excess of 5000 kw.-hr.

**PRESENT WAR TO BE FOUGHT
OUT ON ENGINEERING LINES**

**Old Military Lines Have Practically Been Thrown
Aside for Special Industrial Organization
Whose Business Is War**

"This is a war of engineers." Just what does this oft-quoted phrase mean? Capt. Gustave P. Capart of the general staff of General Pétain, who is at present in this country as a member of the French scientific commission, indicates that the answer to this question involves a new understanding of what military operations are to-day.

When it is stated that this is a war of engineers, that statement means that the old military lines of organization have practically been thrown aside at the front, and in their place has been built up a specialized industrial organization whose business is war. We no longer have infantry, cavalry and artillery in the old sense of the words. We have a planned organization for offensive military operations, in which the plans are made on an engineering basis, in which the fighting is done in many branches of the service by engineering methods, and of which the operations are carried on by engineering work in roadmaking, in transportation, in industrial management and factory operations.

Captain Capart, in an interview with the ELECTRICAL WORLD, points out that this war is being fought with prime materials. Old warfare was a football game compared with the modern struggle, in which tons of material are hurled back and forth between opposing armies and carloads of foods, of machinery and supplies and of men are constantly transported to the line of action on both sides.

The modern battle, Captain Capart states, is a problem of roads and a problem of transport. In the maintenance of railways and roads, as well as in the construction of new extensions, a large and highly trained personnel is required for the laying of tracks, for repair shops, drivers and conductors, for the handling of construction material, etc.

Cableways and telpherage systems have given extraordinarily valuable service at the front. In one in-

stallation 600 mules were turned to other service by the installation of a telpherage system. The automobile, with its camions and its tractors, is another link in the service.

The electrical engineer is playing a wonderful part in this war. Great distribution systems for electric light and power have been necessary for the use of armies. The headquarters of the armies, the cantonments, artillery, repair shops, hospitals, air service, etc., all use electric power. Machinery and skilled men are necessary for air compressing, rock drilling, trenching machines, etc.

The government of the United States has comprehended fully the importance of organization of engineers in these many lines, and the engineer regiments which have already responded to the military needs indicate the ability of this country to furnish the class of men needed for the military industrial work.

In this country we must understand that to prosecute the war successfully we must think not only of materials and of human energy in tremendous totals, but we must think of using materials and literally of using human energy with the highest efficiency. Men must be selected for their places in this great industrial war, not on the basis of their physical characteristics alone, not on their ability to carry a gun, but on the basis of special knowledge to fit them for positions of responsibility and of specialized training which this war of engineers demands.

UNITED STATES CAN PROFIT BY ALLIES' EXPERIENCE

Captain Capart believes that in the United States we have the opportunity to combine the knowledge and the experience of what has been done in three years of war, and that our armies should go to France organized in such a way as to fit them for the industrial task which lies ahead of them. Captain Capart points out that our engineers who go to France as military men in their specialized branches will also be pioneers of American industry in times of peace and will prepare the ground for the economic war which is expected to follow when the military battles are over.

Military operations may be thought of as being conducted to-day in four zones—first, the firing line; second, the military zones immediately surrounding the firing line; third, the avenues and channels of communication between the military zone and what may be called the world-wide zones of supplies to that military zone, and, fourth, the zones of supplies themselves, which include the countries at war and the countries which are supplying food, machinery and materials for the countries at war.

Captain Capart points out that specialized engineering training is necessary in all these war zones. On the firing line—troops in contact with the enemy—engineers are involved in the strictly military operations, mining engineers are planning the executing of trench work, earth work, concrete work and so on. On this same battle line are engineers who maintain what the French so interestingly explain as a "liaison"—the nerves of communication between the various sectors of the armies, the telephone, the telegraph, the semiphore, the wig-wag system, wireless, heliograph; in short, the co-ordination of communication by every means known to science.

In the military zone, which is entirely in the control

of the military and potentially and actually threatened by the enemy, engineers are busy building and maintaining roads, constructing, maintaining and operating railroads, building, rebuilding and operating automobiles, constructing narrow-gage railroads, cableways, telpherage systems, etc. In this military zone electrical engineers are at work building and operating lighting and power plants, erecting and maintaining distributing lines, handling the network of telephone and wireless centers of communication. Waterworks and water-supply engineers, sanitary engineers, engineering construction gangs erecting shelters and raising camps and cantonments and repair shops for aeroplanes, automobiles, artillery, small arms—all are necessary, and more are required in the military zone.

In the same way, Captain Capart has indicated that engineers with their specialized knowledge are needed especially in the great problems that touch upon the transportation of the necessary materials between the military zone and the sources of supply which constitute what we have called the fourth great zone.

In this country we have already started the organization of this work, and the organization of the engineers and scientific men for the military army which is necessary to stay at home and maintain and develop the men, machinery and supplies needed at the front.

In all this organized army of specialized men every man is as essential as every other to carry forward the military plan. As Captain Capart puts it, "the soldier in the obscure post who works as a lineman is equally to be admired and honored with the soldier who sights the gun across the trenches."

U. S. ARMY IS TO ENLIST CORPS OF TELEPHONE MEN

Members, Who Must Be Practical Linemen, Will Do Construction, Maintenance and Cable Work for the Coast Guard

The recruiting officers of the United States Coast Guard have been authorized to undertake immediately the enlistment of a special force of linemen for duty in connection with the Coast Guard telephone system.

Applicants for enlistment as linemen must pass the required physical examination of the Coast Guard, and if found qualified must enlist for a period of one year. Men who receive honorable discharges or ordinary discharges with recommendation for re-enlistment may re-enlist for succeeding periods of one year each. All linemen will be required to be practical telephone men, and when enlisted will be known as electricians. They must be experienced in all branches of telephone work, including construction, maintenance and cable work, and possess sufficient ability to prepare estimates for utensils and labor.

All applicants when first enlisted will be rated as acting electricians at a salary of \$72 a month, with an allowance of 45 cents a day for rations, and in addition they will receive an allowance for clothing of \$45 at the expiration of their first year's enlistment, provided they receive an honorable discharge, and an allowance of \$20 a year for every year thereafter, subject to the same condition. They will have the benefit of Coast Guard provisions for medical treatment and retirement.

TREASURY DEPARTMENT NEEDS MORE ELECTRICAL ENGINEERS

Supervising Architect's Office Plans to Train Applicants to Design Entire Mechanical Equipment of Buildings

There are at present a few vacancies in the engineering force of the mechanical and electrical engineering division of the office of Supervising Architect of the Treasury Department. In order to obtain an eligible list from which permanent appointments to these positions may be made, a non-assembled examination will be held by the Civil Service Commission on Sept. 4. Any one desiring to take the examination should request a copy of Form 2118 from the Civil Service Commission immediately. Particular attention is called to the statement in the circular that an applicant will not be required to report for examination at any place.

Pending the establishment of an eligible list temporary appointments will be made. Such appointees, if they take the non-assembled examination above referred to and pass with a sufficiently high average, are eligible for permanent positions. Any engineers who would like such an appointment are requested to send in their names and ages, a brief history of their engineering training, lowest salary they will be willing to start at, and the earliest time they could report for duty after receipt of notification of appointment.

A majority of the engineers appointed are versed in heating and ventilating work, or in electrical work, only, but it is the aim of the Supervising Architects' office so to train them that they shall be able to design the entire mechanical equipment of a large building.

HOSTILITIES SUSPENDED ON THE CLEVELAND FRONT

Illuminating Company Will Provide Energy While Head of Competing Company Is "Somewhere in the Service"

The *Cleveland News* published the following in a recent issue:

While Colonel Dudley J. Hard, Second Ohio Artillery, is fighting in France, his little light company back in Cleveland will be safe. It was 1894 that the late C. V. Hard and his son, now Colonel Hard, started the Cleveland Light & Power Company. While the company never grew into a large concern, it persistently held its "place in the sun" against the larger illuminating company. At present Hard's company has 200 customers, mostly downtown.

Since Colonel Hard must go to war, and can't be here to nurse along the midget company, he was compelled to throw himself upon the mercy of the Illuminating company. Colonel Hard asked the Illuminating company to sell him juice at wholesale rates, to be redistributed to his customers while he is in France. This was Hard's only way of saving his company.

"I'd like to have something to come back to after the war—if I come back at all," said Colonel Hard.

By denying Hard wholesale energy, the Illuminating company would have put the little concern out of business. Two hundred desirable customers would have been gained by the "big monopoly." But the Illuminating company is sportsmanlike, also patriotic.

"While Colonel Hard is in France, his company will get all the energy it wants," said Mathias Turner, assistant general manager of the Illuminating company. "Colonel Hard may lead his men to battle feeling sure that while he is away the Illuminating company will not try to steal any of his customers."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Abandonment of Line Authorized.—The California Railroad Commission has authorized the Oakland, Antioch & Eastern Railway Company to discontinue operation of the line of the Sacramento Valley Electric Railroad extending from Dixon Junction to Dixon, 11.8 miles. The company has been operating this as a branch line since Jan. 1, 1915, under a verbal agreement which the operating company is permitted to terminate at its option. During the year ended Dec. 31, 1915, the branch line was operated at a net loss of \$9,423; for the year ended Dec. 31, 1916, at a net loss of \$9,358, while the loss for the five months ended May 31, 1917, is reported at \$3,839. The commission says: "It is evident that the operation of the line is conducted at a considerable financial loss, the deficit shown above including no taxes or depreciation. An analysis of the operating expense accounts does not indicate that any excessive charges have been made against the operation of the line; in fact, a less expense per car mile has accrued on the Dixon branch than on the main line of the Oakland, Antioch & Eastern Railway. An investigation by the service department of the commission indicates that the traffic handled and the possibility of increased traffic does not warrant the recommendation that the line be continued in operation."

Accounting in New York.—The Appellate Division of the New York State Supreme Court has upheld a ruling of the Public Service Commission, First District, that the system of accounting prescribed by the commission must be followed by companies under its jurisdiction. The decision was rendered in a certiorari proceeding brought by the Kings County Lighting Company to review a ruling of the commission. Authority had been given to the company to issue \$134,545 bonds, the condition being that the proceeds should be used only to make good the indisputable depreciation of the property of the company. The court held that the law authorized the commission to prescribe uniform accounting systems. In reference to accounting for depreciation the court said: "In no event could the commission, without taking an independent proceeding against the relator, in which the relator would have notice and an opportunity to defend itself, make an order requiring it to change its whole system of accounting and put its depreciation charge upon some other basis than that adopted by the company under the law and the earlier order of the commission." Discussing the use for exten-

sions of part of a depreciation reserve fund, the court said that such a proceeding "would be tantamount to permitting the relator to borrow money for the purpose of providing for a depreciation fund, a practice unsound in principle, and one which would ultimately lead a company into a serious financial condition. The commission therefore was naturally willing only to permit the treasury to be reimbursed by an issue of bonds on condition that such part of the proceeds as were equivalent to the sum spent out of depreciation reserve should be restored, and it coupled its permission with such a condition." The court also decided that the company was entitled to fix such a rule or rate for depreciation as it saw fit, and that this rule was to govern until the commission fixed a different rule or rate, as the commission had the power to do at any time when it might see fit.

Abnormal Conditions Make High Money Rates.—The California Railroad Commission has authorized the Southern California Edison Company to issue \$10,000,000 bonds, the proceeds to be spent as far as available for the following purposes: \$3,000,000 to add to the Big Creek hydroelectric plant and transmission line to Los Angeles; \$983,287 to pay obligations for purchase of Mount Whitney Power & Electric Corporation stock; \$4,000,000 to pay obligations for purchase of \$5,000,000 Pacific Light & Power Corporation first and refunding bonds; \$5,554,891 to pay Edison company and Pacific Corporation outstanding notes. The Edison company is authorized to execute a deed of trust of its properties as security for an issue of \$136,000,000 general and refunding mortgage bonds, of which the \$10,000,000 specified may be sold immediately. The bonds are to be issued in series, each series to mature at a date and bear interest at a rate to be determined by the company's directors. The 1917 series, though, matures July 1, 1919, with interest at 6 per cent. The company states that a syndicate will underwrite the \$10,000,000 issue so as to net the company 95.62 and to return the syndicate and its managers 3 per cent. "This results," says the commission, "considering the two-year term of these bonds, the discount at which they are sold and the interest rate, in a cost of this money to the Edison company of 8.4 per cent." The Edison company insists that this is an abnormally high price to pay for money, and that it does not set the standard for the credit of the company. The company's representatives say that the financial market at present makes it difficult to sell high-class securities of any kind and impossible to sell such securities unless they are attractive as to price and safety. The commission, in rendering its decision, calls attention to the high price of oil. If the market cost of oil is considered, says the commission, the company will save by increasing its power plant as specified \$700,000 a year, and under its contract price for oil, \$350,000.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Empire State Gas and Electric Association.—A meeting of the Electric Production Committee of the Empire State Gas and Electric Association was held on July 13 at Buffalo, N. Y. The meeting opened with a general discussion of the action taken by the different companies regarding the loss of employees called to war or subject to call. There was also a discussion of wages paid different classes of station labor and the hours worked by different shifts. I. E. Powell gave an outline of the bonus system employed in one of the steam power plants in Rochester.

National Association of Purchasing Agents.—The annual congress of purchasing agents, under the auspices of the national association, will be held at Pittsburgh, Oct. 9, 10 and 11. The program includes business sessions for the mornings and visitation and inspection of industrial works during the afternoons. Special features will be a tour of Pittsburgh's principal business districts by automobile and a cabaret dinner at one of the country clubs. The banquet will be held at the convention hotel on the evening of Oct. 10, with speakers of national prominence in attendance. James H. Robison is chairman of the publicity committee.

The Pacific Electrical Supply Jobbers' Association.—The regular quarterly meeting of the Pacific Electrical Supply Jobbers' Association was held at Del Monte, Cal., July 27-30, with representatives of all Pacific Coast centers from Seattle to Los Angeles in attendance. At the open meeting Saturday morning a paper on "Loyalty" was read by Garnet Young, Benjamin Electric Company, San Francisco, which provoked much discussion. In the comment on this subject, representatives of central stations, jobbers and manufacturers participated and exchanged views. There was general approval of a creed touching on this subject read by T. E. Bibbins, Pacific States Electric Company, San Francisco, which was as follows: "(1) That at all times I must be loyal to myself, my company and its policies; (2) that I should consistently support the manufacturer whose lines I have agreed to sell; (3) that every manufacturer who plays the game, whether I buy from him much or little, should have from me all reasonable encouragement and always a fair deal; (4) that I recognize the right of my competitor to live and prosper and no policy should be employed by me which is destructive to his rights; (5) that my first and last thought should be for the betterment of the electrical industry and for service to all my customers."

Muskogee Company to Offer Stock to Consumers.—The Muskogee (Okla.) Gas & Electric Company, a Byllesby property, will offer preferred stock to customers.

Change in Control of Mount Carmel (Pa.) Company.—Chandler & Company, Philadelphia, have bought control of the Edison Electric Illuminating Company, Mount Carmel, Pa.

Bureau to Better Working Conditions.—At a recent meeting of the Chicago chapter of the American Association of Engineers it was decided to form an information bureau in the hope of bettering the working conditions of engineers in the chapter's jurisdiction. This bureau, controlled and selected by the executive committee of the Chicago chapter, will assume the duties of the service clearing house of the national organization in its district. In addition to listing open positions in the community, this bureau will conduct a secret investigation of the working conditions of the various concerns. Thus, when a prospective employee wishes to start to work, he will have an insight into conditions in the office in which he is to work, including a knowledge of the hours of employment, the man who will have authority over him and the chances for advancement.

Federal Aid for Vocational Teaching.—The Carnegie Foundation for the Advancement of Teaching has issued as its tenth bulletin a study of federal aid for vocational education by Dr. I. L. Kandel of the Foundation staff. The bulletin traces in Part I the legislative history of federal aid for education and presents a detailed analysis of the debates in Congress on the numerous bills introduced at various times between 1857 and 1890 by Senator Justin S. Morrill for the establishment of land-grant colleges, as well as the bills for agricultural experiment station appropriations and increased grants for land-grant colleges and experiment stations. Such an analysis brings out prominently the fact that the educational aspect of the problem received but the scantiest attention. The chief interest of Congressmen was in the constitutional questions involved. Part II of the bulletin is devoted to a study of many of the questions to which the preceding analysis gave rise—the constitutional and educational precedents of the movement for federal aid for education. Part III gives an account of the subsequent developments of the Morrill act and discusses the influence of this precedent on the recent movement for the extension of the principle of federal grants to the whole field of vocational education. The conclusion is reached that the recently passed Smith-Hughes act is reproducing the history of the Morrill act in involving the federal government in great expenditures of money before a sound educational policy and system of supervision and control have been formulated. Copies of the bulletin may be had by addressing the Carnegie Foundation, 576 Fifth Avenue, New York City.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Electrical Voting Machine for Argentine Deputies.—The Argentine Embassy at Washington announces that bids are invited by the Argentine government for the designing, manufacture and installation of an electrical voting machine for the Chamber of Deputies of Argentina. American manufacturers who desire to submit bids may obtain particulars from Lieut. Eng. O. D. Michetti, 620 Woodward Building, Washington, D. C.

Electrical Trade Opportunities in Guatemala.—United States Consul Samuel C. Reat, writing from Guatemala City regarding Guatemala trade, says: "In manufactures of iron, copper, tin and lead and their compounds the United States supplied during 1916 over 93 per cent of the import trade, the increase in electrical goods more than equaling Germany's loss; but after the war American manufacturers may have to meet vigorous competition in these lines, especially as Germans control the largest electrical installation in Guatemala and their concession is practically a monopoly. The further development of electric lighting and power in small units on the larger coffee, cane and other plantations offers an opportunity that can be safely sought."

Bonus for Houston Employees.—At the annual outing of employees of the Houston (Tex.) Lighting & Power Company recently, Edwin B. Parker, the president, announced that all employees other than officers would be paid a monthly bonus of 5 per cent of their salaries. Mr. Parker said in part: "We have much important work ahead of us. Aside from its steady, substantial growth, the exigencies of war are bringing to Houston mobilization camps, shipyards and other activities which require service at the hands of this company, and which in turn require large expenditures by this company at a time when new capital is hard to procure. But this company must do its full part—and will find a way to do its full part—in the upbuilding of this city, and to that end I bespeak the hearty co-operation of each and all of you. From your own experience you know that the cost of living has greatly increased during the past year, and in order to assist you in bridging the gap caused by such increase the company has recently arranged to pay each of you other than officers a 5 per cent monthly bonus. But you must not lose sight of the fact that the high cost of living applies to the company as well as to individuals, and with the increased cost of copper

and all other materials, of fuel oil, of taxes, city, state and federal, the cost of operating this company has greatly increased and is still increasing, calling in turn for the most rigid economy. Each and all of us are expected cheerfully and wholeheartedly to put forth our best efforts to give to this company and to the people of Houston and its environs prompt, courteous, efficient service at a minimum of cost. May I not confidently rely on each and all of you to join with me in fulfilling this expectation?"

Change in Control of Berkshire Company.—C. D. Parker & Company, Inc., of Boston have bought control of the Stockbridge (Mass.) Lighting Company. The same interests bought control previously of the Lenox Electric Company and the Great Barrington Electric Light Company. It is reported that the companies will be operated together or consolidated.

Power Load Grows Rapidly in St. Louis, Mo.—On account of the fact that high coal prices are making owners of isolated plants scrutinize generation costs more closely, the power sales business of the Union Electric Light & Power Company, St. Louis, is growing by leaps and bounds. Within a short period the power sales department has signed contracts with the following companies for large blocks of power: The *Post-Dispatch*, 1000 kw.; Hotel Statler, 350 kw.; Lindell Department Store, 150 kw.; Mercantile Trust Company, 100 kw.; Hamilton-Brown Shoe Company, 500 kw.; Brown Shoe Company, 250 kw.; Leschen Rope Company, 200 kw., and Missouri Fire Brick Company, 150 kw. In each case the data on kilowatts indicate the demand of the installation, and not the connected load.

Profit-Sharing for Cities Service Employees.—The profit-sharing system for employees that will be in operation in the Cities Service Company after Aug. 1 has for its cornerstone the installment payment plan. Any member of the Doherty organization may subscribe for stock, and the amount of his subscription depends upon the length of employment and the amount of his yearly salary. Those who have been employed less than five years are permitted to invest only an amount representing a certain proportion of their salary. For example, a man employed less than a year may subscribe for stock equal in amount to 50 per cent of his yearly income. A person employed three years and less than four may invest 80 per cent, and so on. Furthermore, certain limitations are placed upon the amount. A further restriction is that whatever money the employee invests in the stock will be used to purchase twice as much preferred stock as common. When an employee desires to enter the profit-sharing scheme he agrees to pay for his stock in installments. Every one in the plan pays sixty equal monthly installments, so that at the end of five years he will have paid up all the stock.

W. F. Bellinger has been made chief load dispatcher of the system of the Georgia Railway & Power Company, Atlanta, Ga.

J. F. Stokes, local manager for the Hydro-Electric Power Commission of Ontario, Canada, at Tweed, has resigned to enlist for overseas service.

A. T. Hicks, local manager for the Hydro-Electric Power Commission of Ontario, Canada, at Trenton, has been transferred to Oshawa to succeed C. U. Peeling, who resigned.

Frank W. Casler, formerly general superintendent of plant of the Public Service Electric Company of New Jersey, is now general superintendent of production for the same company.

C. U. Peeling, local manager for the Hydro-Electric Power Commission of Ontario, Canada, at Oshawa, has resigned to accept the position of manager of the electric, gas and railway properties at Cornwall, Ont.

R. M. Boykin, engineer of the North Coast Power Company of Portland, Ore., has been elected vice-president and appointed general manager of the company, following the resignation of H. L. Harries, who is at the military training camp at Presidio.

W. B. Miser, formerly general superintendent for the Illinois Traction System at Jacksonville, Ill., has been appointed manager of the Drumright (Okla.) Light & Power Company, one of the new properties recently acquired by H. M. Bylesby & Company and which will be part of the enlarged Oklahoma Gas & Electric Company.

H. R. Gore has resigned his position as auditor of the Eastern Pennsylvania Railways Company, Pottsville, Pa., to accept a position with Haskins & Sells, public accountants, New York. Prior to being assigned to that company he served as auditor of the Kentucky Public Service Company, Bowling Green, Ky., both of these utilities being under the management of the J. G. White Management Corporation, New York.

J. B. Shickel has been appointed superintendent and electrical engineer for the Menominee & Marinette Light & Traction Company, Menominee, Mich., to succeed J. C. Strong. Mr. Shickel was graduated from the Rose Polytechnic Institute of Terre Haute, Ind., in 1907. Since that time he has been with the General Electric Company at Schenectady, N. Y., first in the testing department and later in the special engineering and sales departments.

George A. Sawin has been appointed to the new position of service engineer of the Public Service Electric Company of New Jersey, reporting directly to the vice-president and general manager. Mr. Sawin will decide for the operating department on all applications for power and follow through matters between the engineering, production, distribution and commercial departments occasioned by such applications. The position of illuminating engineer in the operating department will be discontinued.

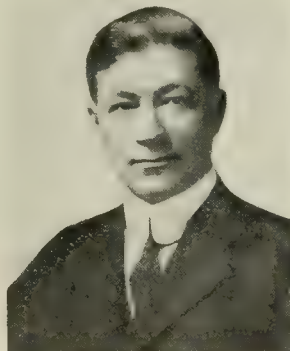
Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

L. Barr is now connected with the Buick Motor Company of Flint, Mich.

Montague Ferry, who was formerly Commissioner of Public Service for the city of Chicago, and who more recently was in the employ of the B. F. Goodrich Company, Akron, Ohio, designing radio systems for dirigible balloons, has accepted a position as production manager for the Curtiss Aeroplane Company at Buffalo, N. Y.

Lawrence N. Siler, a mechanical and electrical engineer of the J. G. White Management Corporation, New York, N. Y., has been assigned to the engineering staff of the Manila Electric Railroad & Light Company, Manila, P. I., which is being operated by the management corporation. Mr. Siler is a graduate of Cornell University.



J. F. CUMMINGS

V. G. Corkins has been appointed superintendent of the North Coast Power Company at Chehalis, Wash. He was formerly connected with the Nevada Valley Power Company, Lovelock, Nev., being employed prior to that by the Northwestern Electric Company, Portland, Ore. He is acting as manager of the company in the absence of W. A. Schoel, who is at the Presidio in the training camp.

W. C. Austin has been transferred from the staff of traveling auditors of the J. G. White Management Corporation, New York, to the position of auditor of the Eastern Pennsylvania Railways Company. This utility furnishes railway and electric service in Pottsville, Pa., and vicinity, and is operated by the management corporation. For a number of years Mr. Austin was treasurer and auditor of the Otsego & Herkimer Railroad Company (now the Southern New York Power & Railway Corporation), Cooperstown, N. Y.

Obituary

James Fulton Cummings, widely known as a pioneer distribution engineer both in the United States and Europe, died from a stroke of apoplexy at Long Beach, Long Island, N. Y., on July 26. Mr. Cummings was born at London, Ont., on May 6, 1869, his father being Alfred A. Cummings, author of "The Maple Leaf Forever," Canada's anthem. His earlier education was obtained in the schools of his native city, to which was added a university course at Toronto. In the days when those in the electrical industry developed young he connected himself for a brief period with the Michigan Telephone Company, and in 1889 accepted a position in the engineering department of the parent Edison interests. Although an exceedingly versatile and resourceful engineer, he at once specialized on making model installations of Mr. Edison's then marvelous underground system, contributing to the improvement of its feeder system and junction boxes. Some of the important installations of this character with which he was connected were in Philadelphia, Cincinnati, St. Paul and Milwaukee, the latter at the time at which it was made (1891 to 1893) being generally considered as the best of all such installations. Shortly after the parent Edison corporations had been merged in the present General Electric Company Mr. Cummings severed his connection therewith and produced the once well-known Cummings underground conduit system, of which several important installations were made in this country, the most notable perhaps being at Detroit and Pittsburgh. While this work was in progress he also invented one of the very earliest systems of interior conduit, if not the first, and with a partner established a factory at Pittsburgh for the production of material required therefor. During the 90's, as appears from the records of the United States Patent Office, many important patents of the character just indicated were granted to him. In 1897, having sold his American patents and business interests, he removed to London, where he opened a large contracting office in the interest of prominent American manufacturers of conduit material. Specific business accomplishments of Mr. Cummings abroad were many important underground installations in the United Kingdom and still others in Italy, the most notable of the latter being at Milan and Turin. Perhaps his greatest business accomplishment, however, was in Russia, where he installed a similar system in Petrograd, covering the entire city, which attracted wide attention in the technical press and electrical circles of both Europe and America. As an incident of his early work in the expansion of the electrical industry, he played an important rôle in the organization of the first electrical show in this country, which was held during the 90's at Madison Square Garden, New York City. This pioneer exhibition paved the way for annual events of the same kind in many cities.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

THE EXTENT OF FRENCH FOREIGN ELECTRICAL TRADE

Recently Published Figures Show Imports to the Value of \$12,221,300 in 1916, and Exports to the Value of \$9,272,800

Official figures showing the foreign trade of France during the years 1916, 1915 and 1914 in electrical materials, as published in the *Revue Générale de l'Electricité*, are contained in the accompanying table. The imports, which it will be noticed are much greater than the exports for 1916, amounted to \$12,221,300, in comparison with \$4,849,000 in 1915 and \$4,779,800 in 1914. The exports for 1916 were \$9,272,800, as compared with \$5,262,000 in 1915 and \$6,301,000 in 1914.

France, it will be remembered, since the beginning of the war has realized the vast economic possibilities of her water powers and is fast developing them. Plans for the period following the war include a tremendous development in hydroelectric plants. For that reason it is safe to assume that the French market for electrical goods will undoubtedly increase considerably.

IMPORTS

	1916	1915	1914
Dynamos	\$3,020,000	\$1,256,800	\$1,051,800
Electrical appliances	3,066,600	1,239,600	2,637,600
Dynamo frames and parts	3,500	11,200	600
Incandescent lamps:			
Carbon-filament	29,400	1,400	6,200
Metal-filament	608,200	58,400	214,000
Unassembled	600	...	3,600
Arc lamps and parts	1,600	800	7,400
Lighting carbons	865,800	654,400	56,400
Insulated wire and cable	2,813,200	741,400	67,400
Induction machinery and parts	1,490,000	597,200	416,800
Magnets and their electromagnets	3,600	800	25,800
Storage batteries and parts	65,000	97,800	19,800
Dry batteries	124,800	92,600	26,600
Porcelain, glass and similar insulators	128,500	96,600	245,800
	\$12,221,300	\$4,849,000	\$4,779,800

EXPORTS

Dynamos and transformers	\$203,000	\$201,800	\$577,200
Electrical appliances	2,431,600	1,364,800	1,814,400
Generator and motor parts	200	200	...
Incandescent lamps	291,800	357,600	34,200
Arc lamps and parts	10,800	23,000	30,200
Carbon for electrical and other industrial purposes	5,151,800	2,417,600	1,265,000
Insulated wire and cable	242,000	199,600	853,800
Induction machinery	694,200	462,200	402,400
Magnets other than electro	2,200	2,600	1,200
Storage batteries and parts	134,400	145,200	132,000
Dry batteries .....	...	...	...
Porcelain, glass and similar insulators	110,800	87,400	190,600
	\$9,272,800	\$5,262,000	\$6,301,000

QUICK DELIVERY WORK ON GOVERNMENT TRANSFORMERS

Arrangements for Rapid Shipment of Raw Materials to Successful Bidders, Who Guarantee to Make Shipment in Certain Time

Many transformers, including a wide range of capacities and voltages, have been purchased recently by the government, presumably for use in connection with the army encampments and other installations. When the government first started placing the orders considerable difficulty was experienced in getting reasonable deliveries, owing to the inability of the manufacturers to obtain the raw materials promptly. It is understood that the practice is now for the government, when it submits specifications, to ask the

manufacturers to quote a price and to specify how soon they can ship after they receive the raw material. Then, when the order is placed with the successful bidder, the government immediately requests from the bidder specifications for the raw material that will enter into the construction of the equipment. The government then arranges with the raw-material producer to make a shipment of raw material promptly. For example, if transformer sheet steel is required, it is understood that the government arranges with some manufacturer of this product to assign a mill to its manufacture until the requisite amount of steel has been rolled. By following this procedure the government is now able to obtain a splendid delivery on equipment that would under the old system require a prohibitively long time for its production. The ELECTRICAL WORLD is advised that a large number of transformers are being purchased on this basis.

THE WEEK IN TRADE

MARKET conditions remained quiet during the past week. The excessive heat which prevailed over the major portion of the country put a damper on trading. Office and factory hours were shortened, decreasing sales and also production to a slight extent. Stocks throughout the entire country are being replenished for the heavy buying expected in the fall. The government continues to demand supplies for cantonments and shipbuilding, and deliveries for this work are on the whole good.

The demand for fans was great and in many sections exceeded the supply.

The metal market was quiet and prices remained about the same. Prices of electrical supplies changed very little.

NEW YORK

The excessive heat of the last few days has made not only the members of the trade but business itself very languid, and to the uncertainty of the price-fixing program in Washington are now added the almost unprecedented weather conditions. Many factories have had to close down or run on short time, and two hours a day has been cut off from usual office hours. While business has been very dull in metals, no weakness has developed, sellers being quite as indifferent about doing business as buyers.

The demands on local stocks have, on the whole, been below normal, undoubtedly because of weather conditions. The largest demand that has ever been made for fans in New York City arose during the past week, and practically all stocks were depleted.

The buying by jobbers is falling off and stocks are fast filling up to the limit. Local building still continues to fall off, with no change in sight during the month. Collections continue to increase.

TURBINES.—A loan of \$5,000,000 has been issued by the Consolidated Power Company, a new organization, for the benefit of the Consolidated Gas, Electric Light & Power Company of Baltimore, Md. The proceeds of these notes are to be used in adding very largely to the production of electricity for the Consolidated Gas, Electric Light & Power Company. This company has ordered two 22,000-kva. turbo-generators and two condensers, to be furnished by the Westinghouse Electric & Manufacturing Company of

East Pittsburgh, Pa. To furnish additional power to industrial plants in the vicinity of Westport, Md., the same company has purchased four 12,000-kva. and one 1750-kva. Westinghouse transformer, all rated 13,200 volts to 2640 volts, three-phase, 25 cycles.

HOUSEHOLD DEVICES.—Washing machines are in steady demand, probably because of the servant problem in the New York territory. Vacuum cleaner sales fell off a bit during the past week. The demand for dishwashers is reported to be picking up considerably.

HEATING APPLIANCES.—The demand for heating appliances is normal, no marked changes occurring during the past week. Ranges are moving along nicely, it is reported.

LAMPS.—Local stocks are in good shape. On Aug. 1 the Mazda C-2 lamp, a further step in Mazda lamp development, was announced. It is said that this lamp embodies all the characteristics of the regular Mazda C construction, with the additional advantage that its light is an exact match in color quality with average daylight. The bulb of this lamp is blue. It is made in six sizes, ranging from 75 watts to 500 watts. This lamp should prove in great demand in office buildings, museums, surgeries, stores of every size and character, factories, etc.

WIRE AND CABLE.—The demand for wire and cable during the past week was quiet. Deliveries are slow, but local stocks appear to be in fair condition. Weatherproof wire, however, is in great demand by the government.

FANS.—Owing to the unusually hot spell during the past week, the fan manufacturers were pressed to the limit and in many cases were unable to supply the demand. Local stocks were practically cleaned out by Thursday. Many jobbers ran out the first day of the hot spell and were unable to replenish their stock. Jobbers who wisely got in a good stock early in the season were able to hold out exceedingly well through the hot spell. This past week should serve as a lesson to the jobber who puts in a small stock early in the season and expects to get immediate delivery upon placing his order in the middle of the season. Prices jumped considerably during the week owing to the heavy demand—reported to be heavier than ever—experienced in the New York territory. Heavy shipments are reported to be on the way, and dealers expect to stock up to be ready for future warm days.

COLLECTIONS AND CREDITS.—Collections for July were excellent and the prospects for August loom up well. Credits are still tightening up with certain classes of trade.

STANDARD PORCELAIN.—Deliveries continue better, and owing to the slack in the demand for the past week stocks should pick up.

FIXTURES.—Because of the inactivity of the building of apartment houses, hotels, etc., fixtures have been in little demand and there appears to be no change.

MOTORS.—It is reported that one of the large manufacturers is spending considerable money in making numerous extensions to present plants in order to take care of present unfilled orders and expected near future demand. These improvements will help deliveries.

TRANSFORMERS.—Distributing transformers are hard to get. Some of the large companies, it is reported, have sold their distributing transformer outputs for twelve months ahead.

CHICAGO

There has been very little change in the general business situation in the Chicago territory in the past week. Indications are that top-notch prices have not yet been reached on some lines of goods, but the price level is more steady now than it was some weeks ago. Advance buying is not so much a factor in the market as it has been, and there is not the same strife for merchandise as was seen before the United States joined the belligerents.

The following observation of the National City Bank of Chicago in its Aug. 1 bulletin is particularly applicable to the electrical industry in the Chicago territory at the present moment: "Manufacturers and merchants are shaping their affairs with reference to providing for the vicissitudes of a 'war market' and the possibility of a peace declara-

tion before many months have elapsed. There are many uncertainties to deal with in such a situation, but the thing to remember is that the crop outlook has improved and most of the great industries have more working capital than they ever had before, and that the country as a whole is protected by the largest gold reserve that any nation ever had at this or any other season. It is evident, therefore, that, war or no war, the United States is about the last nation for any sane man to 'go short of' at this stage of the game."

FANS.—Some jobbers are entirely cleaned out of fans; others have broken lines, but are out of certain types. It is a notable fact that the fan season this year in the Chicago territory was about as late as it ever has been.

FARM-LIGHTING PLANTS.—The fact that the crop outlook is so favorable leads manufacturers and distributors of farm-lighting plants to expect a fine fall business.

POLE-LINE MATERIAL.—Cross-arms, lag screws and other units of pole-line construction increased about 10 per cent in price.

INSULATORS.—No large orders for porcelain insulators are being placed. Production at the factories is the main problem at present.

STORAGE BATTERY TRACTORS.—The volume of business in storage battery tractors continues brisk, some government orders having been secured both for machines to be used in this country and abroad.

WIRE.—The wire factories are experiencing an unusual situation. The demand for large conductors is very good, while the demand for such wire as is used in ordinary residence work and in fixture wiring is slackening off. This is attributed to the fact that industrial plant work is going ahead but that other builders are being deterred by the high prices of construction material. Deliveries on the smaller sizes of wire are becoming very prompt.

GENERAL BUILDING.—Statistics covering the first half of 1917 show that some ninety large cities reported in that period reduced expenditures for building operations as compared with the year before. This movement is not considered unusual in view of the high cost of steel and the difficulty of securing quick deliveries at any price.

CLAY CONDUITS.—The Clay Products Company of Indianapolis has increased its plant capacity 66 per cent. The company is finding it necessary constantly to quote higher prices to all except its larger contract customers.

CANTONMENT EQUIPMENT.—The Ross Power Equipment Company, Indianapolis, reports success in selling motors, pumps and transformers, both new and second-hand, to the government for additional facilities at Fort Benjamin Harrison.

LIGHTING STANDARDS.—A contract for 450 ornamental "white way" lighting standards with copper Cleveland lanterns has just been closed by the Union Metal Manufacturing Company for installation in Cleveland, Ohio.

BOSTON

Little evidence of midsummer dullness appears in the electrical trade this week in New England. The volume of business holds up well, although a recession in new business is reported from Rhode Island jobbing circles. Large jobbers at Boston are busy and one of the principal houses reports excellent credit conditions. The favorable decision of the Massachusetts Gas and Electric Light Commission last week in the New England Power Company's seven-million-dollar security case spells more business along highly desirable lines of manufacture and distribution. Deliveries are about the same, perhaps a trifle better than a week ago, and few price changes have come to hand. Pole-line hardware is up about 15 per cent compared with two weeks ago. Fan movement was heavy and in some quarters made up for a slight decrease in general trade. Rapid progress is being made in the wiring of the cantonment at Ayer, which is expected to be ready for the drafted troops Sept. 1. As yet no great alarm is apparent with regard to labor shortage, but current well-informed opinion holds that many readjustments will have to be made. Here and there labor is

showing unrest, but in general conditions are reasonably good. A linemen's strike has been settled on the Berkshire Street Railway within the week.

SMALL MOTORS.—A tendency toward contraction in sales may be noted upon looking back several weeks. It is difficult to determine whether the cause is temporary saturation of the market or prevailing long deliveries. There is no question that the latter are a retarding influence with regard to a part of the volume of trade, and it is difficult to believe that the limit has been reached in regard to the absorption of labor-saving equipment. Any general stock accumulation appears problematical at present. It is still by no means assured that the price maximum has been reached.

FANS.—The abnormal heat wave of last week has virtually drained jobbers' stocks; in some cases fans have been sold off the desks of the jobbers' clerical staff to meet the demand. The seasonable weather relieved an eleventh-hour surplus in some quarters.

SEWING-MACHINE MOTORS.—A brisk campaign is reported as successful, one central station selling seventy-five in a single week.

WASHING MACHINES.—These are moving well and plans are under way for a vigorous fall campaign.

ELECTRIC RANGES.—These are moving well, and a strengthening of suburban demand was noted in the past week.

APPLIANCES.—Missionary work by advertisers and demonstrators, assisted by special campaigns, is producing a gratifying number of "trail-hitters," despite a curtailment of installment privileges on the part of some central stations. Vacuum cleaners are becoming more popular, and the outlook is good for industrial heating appliances this fall.

ELECTRIC SIGNS.—Business is rather quiet, and at present there is little evidence of a heavy fall trade. Coal shortages doubtless affect the exploitation of signs adversely at this time. Labor conditions are good in the sign field.

POLE-LINE HARDWARE.—Prices tend to advance steadily, current quotations being about 15 per cent above those of a fortnight back. Heavy demands are noted for industrial service.

WIRE AND CABLE.—Prices remain even on rubber-covered and weatherproof wire, despite a heavy demand.

CONDUIT.—Stocks are becoming low; deliveries are very poor and the situation is trying.

CONDENSING AND COOLING APPARATUS.—Demand is steady and substantial, with increasing foreign inquiries. Reported easing of pig iron is expected to hold back further price advances, at least for the immediate future.

ELECTRIC RANGES.—An order for fifteen hotel-type ranges was recently received and delivered by the Simplex Electric Heating Company, Cambridge, Mass., for the Naval Training Station, Newport, R. I.

ATLANTA

The Southeastern lighting and power utilities have been under considerable pressure for the last six months due to the heavy demand for service from industrial sources. A number of companies have reached the point where large investments will have to be made in order to take care of future requirements. There is a hesitancy in certain sections in regard to starting construction work at this time when material and labor are scarce and prices high. On the other hand, some of the larger companies are taking a more optimistic view of the situation and are planning big developments. A case in point is the Georgia Railway & Power Company, Atlanta, which has petitioned the state commission for authority to issue short-term notes covering the installation of the sixth 12,000-kw. unit at its Tallulah Falls plant, a new storage basin above the Mathis dam, and a complete 50,000-kw. development on the Tugaloo river 2 miles below the present Tallulah Falls development.

The new building situation looks good, and a number of

large structures are being planned on which permits will be issued shortly.

Financial circles report a slight tendency toward retrenchment along certain lines and a stiffening of interest rates. Collections remain excellent, showing an improvement over the last week in July. The jobbers are doing a good business and contractors report a healthy condition.

ARMORED FLEXIBLE-STEEL CONDUCTOR.—The inability of the trade to secure prompt shipments on rigid conduit has quickened the demand for the armored product. Prices are steady and stocks are in fair condition.

CONDUIT PRODUCTS.—Shipment promises have been advanced to six to eight weeks. Manufacturers prefer smaller orders which are well distributed rather than the larger ones.

VENTILATING EQUIPMENT.—Up to this week the movement of this line has been slow and considerably below normal, but the quick change in temperatures from cool to hot has tended to break this condition. Long deliveries on motors have also affected this year's sales.

FANS.—The strong movement of 8-in. and 12-in. fans during the past week is the reflection of the return of seasonable weather. Stocks are still quite complete.

GENERAL SUPPLIES.—Deliveries in all lines of supplies will probably be slow for some time owing to manufacturers giving preference to government orders.

APPARATUS.—The industrial motor demand is lessening, probably owing to the vacation period and uncertainty as to the fuel market. Deliveries, however, show no improvement. There is a strong buying movement in transformers of all capacities, and stocks are badly depleted in the smaller sizes. Shipment promises on the larger capacities are lengthening.

ST. LOUIS

Probably the thing that impresses most forcibly an individual who is making an analysis of conditions in the St. Louis territory is the almost universal complaint of "slow deliveries." The manufacturers assert that they cannot obtain raw materials, the jobbers state that they cannot get the manufactured product from the factories, and the ultimate consumer complains that he cannot in many cases obtain what he desires from his jobber. However, as the representative of one important concern explained, the statement that deliveries are in general poor should be taken in a relative sense. "While it is true that many things are hard to get, it is also true that purchasers are in many instances getting greater quantities of these things than ever before in their histories." For example, one motor manufacturer is now shipping a greater number of motors than ever before, but the concern could sell a great many additional machines if it could obtain the raw material wherewith to manufacture them. On the whole, deliveries do not appear to be improving. The congestion in shops and on the railroads is such that it is not easy to predict whether or not the delivery situation will be more satisfactory in the immediate future.

In so far as general conditions are concerned, there is little change from last week. If there has been any change in volume of sales, it is probably an increase because a few interests have reported that their sales were notably better last week than during the preceding. None has reported a decrease. Collections appear to be better. Some of the manufacturers are tightening up on the credits to the jobbers because of the greatly increased investments which are now required for merchandising. Labor, both skilled and unskilled, is very scarce in the larger cities in this territory. One organization is advertising that it will pay \$9 a day for carpenters.

WIRING SUPPLIES.—New building operations seem to be decreasing materially. An accurate index to this situation is the fact that the applications for the electrical inspection of wiring installations are in volume one-half of those being handled this time last year. Consequently the demand for wiring supplies, except possibly those of the types which are used in industrial plants, is considerably below normal.

WROUGHT-IRON CONDUIT.—Considerable conduit was received in St. Louis last week, so that, temporarily at least, the situation regarding this product is more satisfactory. The jobbers are still obtaining card prices for immediate delivery.

WIRE.—There has been no change in prices, but a number of concerns received last week consignments which had been on order for a long time, so that the general situation in regard to deliveries is somewhat better. The stocks are, however, not up to normal.

FANS.—In spite of the fact that there was a hot wave through a portion of this territory last week, fan-motor sales have not in general been what might be expected. It is reported that several local jobbers have canceled orders for fan motors which were to have been delivered last spring but which the manufacturers have only now completed. It appears not unlikely, therefore, that some of the smaller manufacturers will carry over fan-motor stocks for next year, although other manufacturers report that they have been sold out.

POLE-LINE HARDWARE.—One jobber reports that the deliveries to his concern are improving appreciably and that the business in this particular line is better than in many years. It is doubtful, however, whether the above statement would hold for the territory as a whole.

AUTOMOBILE STARTING AND LIGHTING EQUIPMENTS.—Manufacturers report a decided improvement in the demand for these devices. The motor-car manufacturers are issuing releases to ship equipments which have been on order for some time and certain concerns have put on additional men to produce these outfits.

SEATTLE

Business in the Northwest is still in an unsettled condition, owing specifically to the fact that mills and logging camps are tied up with strikes. Nearly every mill and camp in the Grays Harbor and Puget Sound district is idle, with no likelihood of immediate resumption. Lumber production is reported 53 per cent normal. Four shipyards in the Grays Harbor district and two in Olympia have been closed by strikers. Apparently the threatened shipyard strike in Seattle has been averted. The workers have been assured by union officials that negotiations for a new agreement embodying an upward revision of the wage scale are progressing favorably. As the electrical jobbers derive the major portion of their business from the above industries, the outlook is depressing. With the settlement of the street car strike in Tacoma and Seattle a slight increase in sales, particularly of miscellaneous appliances, was noted in those cities. Practically no new construction work is reported. The freight situation is fairly satisfactory when conditions are considered. The usual fall ordering has been light. Jobbers do not expect to load up, conditions being too uncertain. Credits and collections are satisfactory. The transformer demand is keeping up because of new power development. Quotations on copper are unchanged from last week. Seattle jobbers report very light sales. While material contracts for the American Lake cantonment were secured by Eastern firms, Seattle jobbers, owing to large stocks on hand, thus far have been able to take care of pick-up requirements.

CONDUIT.—Stock is low and deliveries are poor, but demand is fairly heavy. Prices remain unchanged.

CABLE.—Power cables show fair demand, but delivery is slow.

LAMPS.—There is a fairly large stock of lamps on hand despite normal demand. No change in prices in past week.

HEATING APPLIANCES.—The recent advance in heating appliances caused a curtailment in sales; however, the demand is fair, but delivery very slow.

WIRING DEVICES.—Adequate stocks on hand; falling off in demand owing to small amount of building.

POLE-LINE MATERIAL.—Practically no demand except in isolated cases. Power companies are making few extensions to stocks.

FANS.—Portland and eastern Washington cities report heavy sales of fans due to recent warm weather.

SAN FRANCISCO

Very little construction such as hotels, apartments and office buildings is under way. There are few specifications in the hands of the architects and there is no prospect of immediate change in this line. In addition to the uncertainty of wartimes, this is partly due to the difficulty of getting labor, both skilled and unskilled. Such labor as there is available has been uncertain. Strikes and I. W. W. troubles have been frequent, so that both owners and contractors are disinclined to take risks. The shortage of maids and household help generally has greatly helped the electrical trade. Domestic are attracted to factories by high wages, and with decreased immigration the household problem has become more and more acute. Within six weeks one of the largest jobbing houses has increased its sale of washing machines four times. Practically all household labor-saving devices are likewise unusually active. Even electric range sales are keeping up remarkably well under the advanced price. Temporary relief from quiet building conditions continues to come in the shape of industrial and government orders, particularly with firms that are equipped to handle the latter. The government business has more than offset the falling off in the other line. Collections have been slowing up slightly, this being noticeable chiefly in the larger accounts. Contractors and dealers are still meeting obligations remarkably well. The first few days in August indicate a better financial situation than last month. Conduit stocks are being reduced, and some apprehension is felt for the future in this line because of expected slow deliveries. Wire is scarce because of large cantonment orders and slow deliveries, but the decrease in building activity has cut down the normal demand. Stocks of practically all other roughing-in materials are good because of the decrease of the usual outlet in building work.

METAL MARKETS CONDITIONS

Copper Stagnant and Unchanged—Few Changes in Prices for Past Week

The flurry in the market in the last ten days was apparently due to speculative sentiment based upon decreasing production and the possibility of a falling off in imports as well as in domestic output. These factors were made use of to bring about a further advance in nearby deliveries early last week, but there was a lack of support in actual transactions and at the close of the week the tendency of prices was again downward. Electrolytic copper is nominally held at 28 cents for spot and August shipment, 27.50 cents for September, and 26.50 cents to 27 cents for shipment over the last quarter of the year.

The lead market is in a firm but quiet condition. Old metals remain about the same.

NEW YORK METAL MARKET PRICES

	July 30			Aug. 6		
	£	s	d	£	s	d
Copper:						
London, standard spot	125	0	0	125	0	0
Prime Lake	29.50	to	30.00*	29.50	to	30.00*
Electrolytic	28.00	to	28.50*	28.00	to	28.50*
Casting	26.50	to	27.00*	28.00	to	28.50*
Wire base	33.00	to	33.50*	33.00	to	33.50*
Lead, trust price	11	00		10.92½		
Nickel, ingot	50	00		50.00		
Sheet zinc, f.o.b. smelter	19	00		19.00		
Spelter, spot	8.55	to	8 67½	8 67½	to	8 80
Tin, Straits	63	60		63 75		
Aluminum, 98 to 99 per cent.	46.00	to	48.00*	46.00	to	48.00*

OLD METALS

Heavy copper and wire	24.00	to	24.50	24.00	to	24.50
Brass, heavy	15.00	to	15.50	15.50	to	16.25
Brass, light	12.50	to	13.00	13.50	to	14.00
Lead, heavy	8 75	to	9 00	8 75	to	9 00
Zinc, old scrap	6 25	to	6 50	6 25	to	6 50

*Nominal.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor		List, per 1000 Ft.
B. & S. Size		
No. 14 solid		\$61.00
No. 12 solid		71.00
No. 10 solid		90.00
No. 8 solid		106.00
No. 6 solid		145.00
No. 10 stranded		95.00
No. 8 stranded		115.00
No. 6 stranded		160.00
No. 4 stranded		205.00
No. 2 stranded		266.00
No. 1 stranded		315.00

Twin-Conductor		List, per 1000 Ft.
No. 14 solid		104.00
No. 12 solid		135.00
No. 10 solid		185.00
No. 8 stranded		235.00
No. 6 stranded		370.00
No. 4 stranded		575.00

NET PRICE PER 1000 FT.—NEW YORK

Single-Conductor		Less than coil	Coil to 1000 ft.
No. 14 solid:		\$54.90 to \$61.00	
Coil to 1000 ft.		48.80 to 59.17	
No. 12 solid:		63.90 to 71.00	
Coil to 1000 ft.		56.80 to 68.87	

Twin-Conductor		Less than coil	Coil to 1000 ft.
No. 14 solid:		\$78.00 to \$104.00	
Coil to 1000 ft.		75.00 to 80.00	
No. 12 solid:		121.50 to 135.00	
Coil to 1000 ft.		108.00 to 130.95	

DISCOUNT—CHICAGO

Single-Conductor		Less than coil	Coil to 1000 ft.
		+10%	10%

Twin-Conductor

Less than coil	+10%
Coil to 1000 ft.	10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	—10% to 12%
1 5 to std. pkg.	10% to 20%
Std. pkg.	34% to 44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	—20% to 12%
1 5 to std. pkg.	Net to 20%
Std. pkg.	30% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28	.29

BATTERIES, DRY—Continued CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 30	.35	.35
50 to barrel	.31 to .31 1/2	.32 to .32 3/4
Barrel lots	.28	.28 3/4

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5 16	250	\$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25-50	35.00
2	25-50	45.00
2 1/2	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less than Coil	Coil to 1000 Ft.
3/8-in. single strip	\$67.50 to \$75.00 \$60.00 to \$69.75
3/8-in. double strip	71.75 to 75.00 63.75 to 72.00
1/2-in. single strip	90.00 to 100.00 80.00 to 93.00
1/2-in. double strip	95.00 to 100.00 85.00 to 96.00

NET PER 1000 FT.—CHICAGO

Less than Coil	Coil to 1000 Ft.
3/8-in. single strip	\$71.25 to \$75.00 \$60.00 to \$63.75
3/8-in. double strip	75.00 to 78.75 67.50 to 71.25
1/2-in. single strip	95.00 to 100.00 80.00 to 85.00
1/2-in. double strip	100.00 to 105.00 85.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List, per Foot	Size, In.	List, per Foot
7/32	\$0.05 1/2	1	\$0.25
1/4	.06	1 1/4	.33
3/8	.09	1 1/2	.40
1/2	.12	1 3/4	.47
5/8	.15	2	.55
3/4	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$55.00 \$24.50-\$25.50	\$21.50-\$24.75
1/4-in.—	\$40.00-\$60.00	\$27.00-\$30.00 \$23.50-\$27.00

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$55.00 \$25.50-\$27.50	\$23.10-\$24.75
1/4-in.—	\$60.00	\$30.00 \$25.20-\$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Size, In.	Conduit, List per Foot
1/4	\$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37
2 1/2	.58 1/2
3	.76 1/2

Couplings, List	Elbows, List
1/4	\$0.05 \$0.19
3/8	.06 .19
1/2	.07 .19
3/4	.10 .25
1	.13 .37
1 1/4	.17 .45
1 1/2	.21 .60
2	.28 1.10
2 1/2	.40 1.80
3	.60 4.80

DISCOUNT—NEW YORK

Less than 2500 lb.	6% to 8%	3/4 In. to 1/2 In.	8% to 10%
2500 to 5000 lb.	9% to 11%	1/2 In. to 3/4 In.	11% to 13%
(For galvanized deduct six points from above discounts.)			

DISCOUNT—CHICAGO

Less than 2500 lb.	3 1/2% to 5 1/2%	3/4 In. to 1/2 In.	5 1/2% to 7 1/2%
2500 to 5000 lb.	6 1/2% to 8 1/2%	1/2 In. to 3/4 In.	8 1/2% to 10 1/2%
(For galvanized deduct six points from above discounts.)			

FLATIRONS

NEW YORK

Net	\$3.50
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CHICAGO

Net	\$3.15 to \$4.20
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FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	\$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	\$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38% to 39%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38% to 39%

FUSE PLUGS		
3-Amp. to 30-Amp.		
NEW YORK		
	Per 100 Net	
Less than 1/5 std. pkg.	\$5.75 to \$6.30	
1/5 to std. pkg.	4.50 to 5.25	
Standard package, 500.	List, each, \$0.07.	

CHICAGO		
	Per 100 Net	
Less than 1/5 std. pkg.	\$6.25	
1/5 to std. pkg.	5.25	
Standard package, 500.	List, each, \$0.07.	

LAMPS, MAZDA		
105 to 125 Volts		
	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt-B	100	\$0.27
60-watt-B	100	.36
100-watt-B	24	.65
75-watt-C	50	.65
100-watt-C	24	1.00
200-watt-C	24	2.00
300-watt-C	24	3.00
Round bulbs, 3 1/4 in., frosted:		
15-watt-G 25	50	.50
25-watt-G 25	50	.50
40-watt-G 25	50	.50
Round bulbs, 3 3/4 in., frosted:		
60-watt-G 30	24	.72
Round bulbs, 4 in., frosted:		
100-watt-G 35	24	1.05

DISCOUNT—NEW YORK		
Less than std. pkg.		Net 10%
Std. pkg.		

DISCOUNT—CHICAGO		
Less than std. pg.		Net 10%
Std. pkg.		

LAMP CORD		
Cotton-Covered, Type C, No. 18		

NEW YORK		
	Per 1000 Ft. Net	
Less than coil (250 ft.)	\$30.00 to \$34.88	
Coil to 1000 ft.	21.00 to 26.52	

CHICAGO		
	Per 1000 Ft. Net	
Less than coil (250 ft.)	\$37.20 to \$38.16	
Coil to 1000 ft.	27.90 to 28.62	

LAMP GUARDS, WIRE		
Standard packages from 50 to 150.		

NEW YORK		
Net per 100	\$18.00 to \$29.00	

CHICAGO		
Net per 100	\$13.33 to \$25.50	

OUTLET BOXES		
Nos.	List, per 100	
101—A.A. 1 1/2, 4 S.C., 6200, 320	\$30.00	
102—B.A., 6200 S.E., 300, A.X. 1 1/2, 4 S.	30.00	
103—C.A., 9, 4 R, B 1 1/2	25.00	
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00	

DISCOUNT—NEW YORK		
	Black	Galvanized
Less than \$10.00 list	List to 33%	List to 27%
\$10.00 to \$50.00 list	List to 42%	37%

DISCOUNT—CHICAGO		
	Black	Galvanized
Less than \$10.00 list	40%	35%
\$10.00 to \$50.00 list	50%	45%

PIPE FITTINGS		
DISCOUNT—NEW YORK		
Less than 1/5 std. pkg.		10%
1/5 to std. pkg.		20%
Std. pkg.		30%

DISCOUNT—CHICAGO		
Less than 1/5 std. pkg.		10%
1/5 to std. pkg.		20%
Std. pkg.		30%

PORCELAIN CLEATS—UNGLAZED		
2 and 3 Wire		
NEW YORK		
	Per 1000 Net	
Less than 1/5 std. pkg.	\$14.00 to \$20.00	
1/5 to std. pkg.	13.00 to 15.00	
Standard package, 2200.	List per 1000, \$20.	

CHICAGO		
	Per 1000 Net	
Less than 1/5 std. pkg.	\$16.80 to \$20.54	
1/5 to std. pkg.	13.00 to 19.24	
Standard package, 2200.	List per 1000, \$20.	

PORCELAIN KNOBS		
NEW YORK		
5 1/2 N.C.—Solid Nail-it—N.C.		
	Std. Pkg. 3500	Std. Pkg. 4000
Per 1000 Net		
Less than 1/5 std. pkg.	\$10.50 to \$24.30	\$28.00
1/5 to std. pkg.	9.75 to 12.15	21.50
CHICAGO		
5 1/2 N.C.—Solid Nail-it—N.C.		
	Std. Pkg. 3500	Std. Pkg. 4000
Per 1000 Net		
Less than 1/5 std. pkg.	\$11.85 to \$18.00	\$20.75 to \$33.60
1/5 to std. pkg.	9.00 to 11.70	16.30 to 25.80

SOCKETS AND RECEPTACLES		
	Std. Pk.	List
1/8-in. cap key and push sockets	500	\$0.33
1/4-in. cap keyless socket	500	.30
1/8-in. cap pull socket	250	.60

DISCOUNT—NEW YORK		
Less than 1/5 std. pkg.		Net 15% to 20%
1/5 to std. pkg.		

DISCOUNT—CHICAGO		
Less than 1/5 std. pkg.		Net 15%
1/5 to std. pkg.		

SWITCHES, KNIFE		
250-Volt, Front Connections, No Fuse		
	List	
High Grade:		
30-amp. S. P. S. T.	\$0.80	
60-amp. S. P. S. T.	1.20	
100-amp. S. P. S. T.	2.25	
200-amp. S. P. S. T.	3.48	
300-amp. S. P. S. T.	5.34	
30-amp. D. P. S. T.	1.20	
60-amp. D. P. S. T.	1.78	
100-amp. D. P. S. T.	3.38	
200-amp. D. P. S. T.	5.20	
300-amp. D. P. S. T.	8.00	
30-amp. 3 P. S. T.	1.80	
60-amp. 3 P. S. T.	2.68	
100-amp. 3 P. S. T.	5.08	
200-amp. 3 P. S. T.	7.80	
300-amp. 3 P. S. T.	12.00	
Low Grade:		
30-amp. S. P. S. T.	0.42	
60-amp. S. P. S. T.	0.74	
100-amp. S. P. S. T.	1.50	
200-amp. S. P. S. T.	2.70	
30-amp. D. P. S. T.	0.68	
60-amp. D. P. S. T.	1.22	
100-amp. D. P. S. T.	2.50	
200-amp. D. P. S. T.	4.50	
30-amp. 3 P. S. T.	1.02	
60-amp. 3 P. S. T.	1.84	
100-amp. 3 P. S. T.	3.76	
200-amp. 3 P. S. T.	6.76	

DISCOUNT—NEW YORK		
High Grade:		
Less than \$10 list	List to —5%	
\$10 to \$25 list	11% to 16%	
\$25 to \$50 list	14% to 24%	
Low Grade:		
Less than \$10.00 list	5% to —5%	
\$10.00 to \$25.00 list	11% to 16%	
\$25.00 to \$50.00 list	14% to 24%	

DISCOUNT—CHICAGO		
High Grade:		
Less than \$10 list	+5%	
\$10 to \$25 list	11%	
\$25 to \$50 list	14%	
Low Grade:		
Less than \$10.00 list	5%	
\$10.00 to \$25.00 list	16%	
\$25.00 to \$50.00	24%	

SWITCHES, SNAP AND FLUSH		
5-Amp. and 10-Amp., 125-Volt Snap Switches		
	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp., three-point	100	.76
10-amp., three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd		
10-Amp. 250-Volt Push-Button Switches		
	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK		
Less than 1/5 std. pkg.		Net 15%
1/5 to std. pkg.		28%
Std. pkg.		

DISCOUNT—CHICAGO		
Less than 1/5 std. pkg.		—20% to Net
1/5 to std. pkg.		15% to Net
Std. pkg.		30%

SWITCH BOXES, SECTIONAL CONDUIT		
	List, Each	
Union and Similar		
No. 155	\$0.34	
No. 160	.60	

DISCOUNT—NEW YORK		
	Black	Galvanized
Less than \$2.00 list	List to 23%	18%
\$2.00 to \$10.00 list	20% to 23%	18%
\$10.00 to \$50.00 list	23 1/4 to 30%	18%

DISCOUNT—CHICAGO		
	Black	Galvanized
Less than \$2.00 list	25% to 50%	15% to 40%
\$2.00 to \$10.00 list	25% to 50%	15% to 40%
\$10.00 to \$50.00 list	35% to 64%	25% to 52%

TOASTERS, UPRIGHT		
NEW YORK		
Net price	\$3.10 to \$3.50	

CHICAGO		
Net price	\$2.80 to \$3.50	

WIRE, ANNUNCIATOR		
NET PRICE—NEW YORK		
No. 18, less than full spools	\$0.52	
No. 18, full spools	0.48	

CHICAGO		
	Per Lb. Net	
No. 18, less than full spools	\$0.65 to \$0.6885	
No. 18, full spools	0.5285 to 0.56	

WIRE, RUBBER-COVERED, N. C.			
<i>Solid-Conductor, Single-Braid</i>			
NEW YORK			
	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	\$15.00-18.00	\$12.00-14.50	\$11.50-12.50
12	21.06-28.35	18.96-24.30	18.01-20.25
10	29.60-39.83	26.64-34.14	25.31-28.45
8	42.40-56.49	38.16-48.42	36.25-40.35
6	72.19-89.39	64.98-76.62	61.73-63.85

CHICAGO			
	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	\$18.00	\$16.00	\$14.00
12	25.99-29.89	21.96-25.62	20.13-23.48
10	36.49-42.28	30.84-36.24	28.27-33.22
8	51.54-60.13	43.80-51.50	40.15-47.25
6	74.80-82.20	68.00-75.35	56.54-61.20

WIRE, WEATHER-PROOF		
Solid-Conductor, Triple-Braid, Sizes 4/0 to 8 Inc.		

NEW YORK		
	Per 100 Lb. Net	
Less than 25 lb.	\$40.25 to \$45.00	
25 to 50 lb.	39.25 to 42.00	
50 to 100 lb.	38.00 to 38.25	

CHICAGO		
	Per 100 Lb. Net	
Less than 25 lb.	\$38.35 to \$45.35	
25 to 50 lb.	37.35 to 44.35	
50 to 100 lb.	36.35 to 43.35	

NEW APPARATUS AND APPLIANCES

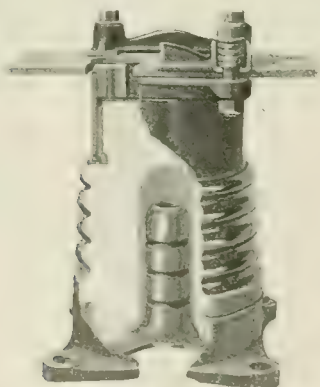
A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Calculator for Determining Metered Loads Directly

A calculating device has recently been perfected by C. M. Hoag and C. F. Backstrand of Riverside, Cal., that is constructed on the principle of the circular slide rule with scales arranged for determining metered loads directly, without the use of a meter formula. The calculator may be used by a person not familiar with meter formulas. The following results may be read directly with a setting on the calculator: Horsepower and kilowatt load, power cost in dollars per hour and necessary ampere rating for meters at any voltage or load. It is adapted for use with Westinghouse, General Electric or Fort Wayne meters, and the device may also be used as a slide rule for other calculations.

Post-Type Insulators

The Electrical Development & Machine Company of Philadelphia has developed a method of fastening metal parts to its post-type insulators. By means of the method adopted it is possible to produce an insulator having extremely high cantilever and tensile strength, it is claimed. The insulator base and top are made with wide, shallow grooves for holding the threaded collar, which is a metal composition molded around the insulator. This operation is done by a special device, which drives the metal under high pressure around the porcelain. The operation is practically instantaneous and when complete forms intimate contact with the surface of the porcelain.



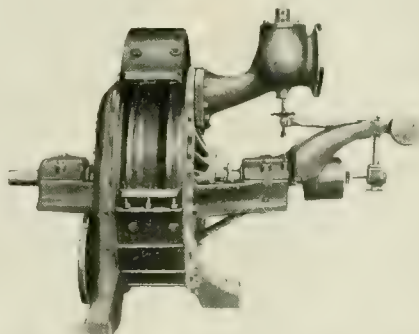
METHOD OF FASTENING METAL PARTS TO INSULATOR

The outer surface of the collar is threaded, and the covering is screwed over this and is jammed in on a cushioning washer. All screws, clamping bolts and nuts are avoided in this construction. There is, therefore, no possi-

bility of any clamping parts loosening and no danger from over-tightening where clamping rings, etc., are employed, it is said. The Philadelphia Electric Supply Company, 132 South Eleventh Street, Philadelphia, is the selling agent for this device.

Curtis Steam Turbine for Fans and Pumps

The General Electric Company, Schenectady, N. Y., has developed a Curtis steam turbine in a wide variety of capacities to drive fans, blowers and pumps for boiler feeding and circulating systems. It is called the type L and is of the impulse type. The number of stages and rows of buckets varies with the capacity. A split wheel casing is used to permit ready inspection of the buckets, which are of bronze securely



CURTIS STEAM TURBINE WITH SPLIT CASING

dovetailed into the rim of the wheel. The exhaust steam is free from oil and is well suited for heating feed water. Speed regulation is close and reliable, it is claimed, and the speed may be changed by hand-wheel adjustment while the turbine is in operation. A constant running speed is maintained by a speed governor mounted directly on the shaft and controlling a double-balance piston valve-type throttle.

The main shaft carrying the turbine and governor runs on babbitted bearings with renewable linings.

Detachable Wheel Pulley for Automobiles

A pulley designed to fasten to the wheel of an automobile for light power requirements, and which should prove useful to contractors marketing farm-lighting sets, is being manufactured by Max Barash, Maquon, Ill. The pulley can be attached or taken off the wheel in less than four minutes. It is 10.5 in. (26.7 cm.) in diameter and 5 in. (12.7 cm.) on the crown face.

Panelboard Switches

The General Electric Company's panelboard switches are made in both push-button and rotary snap types, with round and square bases for panelboards having either vertical or



ROTARY-TYPE SWITCHES

horizontal mains. They are rated at 10 amp., 250 volts, double-pole. With this new type of panelboard switch the metal parts are entirely inclosed, practically eliminating all danger to the operator. The outside inclosing case is of black composition, smooth and of high finish. They are made in snap and push-button types, as desired. If required, these panelboard switches can be furnished in locking type, operated by a key instead of a push-button.

The rotary type of panelboard switch with the round base is a standard metal-covered snap switch with base slotted for busbars. This can be made to lock by substituting the locking attachment for rotary switches in place of the snap button.

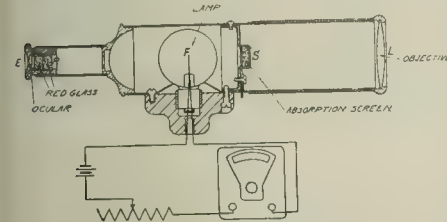
Optical Pyrometer

Portable optical pyrometers, which are based upon the fact that luminous radiation from hot bodies varies in a definite manner as the temperature, have been developed by the Leeds & Northrup Company of Philadelphia, Pa. The instrument is suitable for measuring temperatures from that of a body heated to a dull red color (about 1100 deg. Fahr.—611 deg. C.) up to the highest known temperature, the manufacturer claims.

The manner in which the luminous radiation from a hot body is compared with that from a standardized source will be understood by reference to the accompanying illustration. *L* is a lens by which rays from the hot body at *C* are brought to a focus in the plane *F*, where there is located a tungsten lamp filament. By means of the eyepiece *E* the observer views the incandescent filament, which appears to lie upon the image. By means of rheostat in a case (the case also containing a storage battery and a milliammeter), the current through the lamp is adjusted until the

brightness of the filament is just equal to the brightness of the image produced by the lens, that is, so that the filament blends with, or becomes indistinguishable upon, the background formed by the hot object. The observer then notes the reading of the milliammeter, which may either be provided with a special scale to read in degrees of temperature, or the temperature corresponding to the current may be read from a calibration curve supplied with the instrument.

The adjustment may be made with



DETAILS AND WIRING OF PYROMETER

accuracy and certainty, as the effect of radiation upon the eye varies about twenty times faster than does the temperature at 1300 deg. Fahr. (722 deg. C.), and some fourteen times faster at 3400 deg. Fahr. (1888 deg. C.). Furthermore, the eye is very keen in distinguishing differences in brightness between superposed objects. At high temperatures the light emitted by both the hot body and the filament would become dazzling, and comparison would be difficult. For this reason a red glass is placed in the eyepiece at R, which has the further advantage that light of only one color then reaches the eye. The brightness of the image of the hot body produced by the lens L is almost absolutely constant, irrespective of the distance from the hot body, although the size of the image varies with the distance.

Placed between the lens and the image is a screen which reduces the light from the hot body, but not that from the filament. With this screen it is possible to make direct observations of the most brilliant light sources, such as the electric arc or the surface of the sun.

The instrument can be calibrated by sighting it upon bodies whose temperatures are known. The instrument is so designed that one lamp can quickly be replaced by another. By keeping two lamps, their correctness can always be insured by checking one against the other. The instrument is handy and portable, weighing only a few ounces, and can be sighted as easily as an opera glass.

Threading Three Sizes of Conduit with One Stock

A pipe-threading die stock that carries three different sizes of dies, each adjusted and ready for use, is one of the new products of the Greenfield Tap & Die Corporation, Greenfield, Mass. The tools are made in sets containing three sizes from $\frac{1}{8}$ in. to 1 in. (0.3 cm. to 2.54 cm.). Lost motion, lost parts or lost time, the manufacturer states, are unknown in handling this die stock.

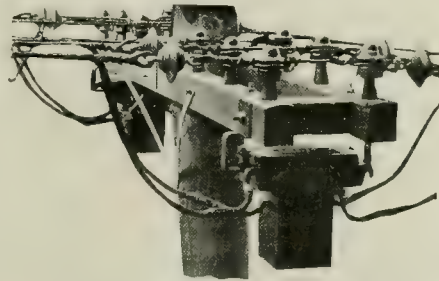
Making Electric Cooking Economical

A small electric range for the use of small families, for apartments, bungalows and summer cottages, has been developed by Landers, Frary & Clark of New Britain, Conn. The device has two heaters. One is a hot plate with two zones of heat, including a small center 3 in. (7.6 cm.) in diameter, for use with small pans, and an outside ring, the complete unit being 8 in. (20.3 cm.) in diameter and consuming 900 watts. The other unit is a 600-watt radiant-grill type, similar to that used in the "Universal" line of grills.

A small portable oven equipped with a heat indicator and capable of holding a 5-lb. (2.26-kg.) roast of meat is supplied, together with two deep steel nickel-plated pans and a reflector plate.

Line-Sectionalizing Breaker

Pole mounting, non-automatic oil circuit breakers have been supplied by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., based upon an idea suggested by the Edison Electric Illuminating Company of Brooklyn, N. Y. Galvanized iron straps are bent and drilled so as to be



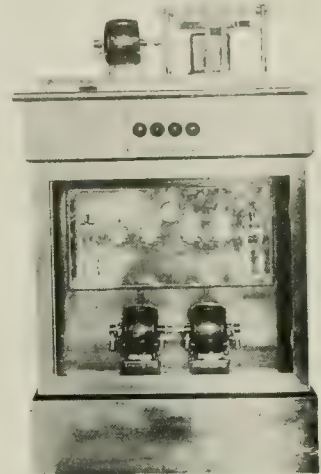
METHOD OF MOUNTING BREAKER

attached by one bolt to the cross-arm and by a cover-clamping bolt to the type D non-automatic oil circuit breaker. Longer bolts than standard are used in this latter case. The illustration shows two of these breakers installed on Brooklyn Edison lines, the 4500-volt, two-phase wires being dead-ended on strain insulators tied together and supported by pin insulators.

Automatic Elevator Dispatcher

A device for automatically starting elevators from either top or bottom of elevator shaft at predetermined time intervals, each car or bank of cars being confined to its own particular schedule and all cars being controlled from one centralized device, has been brought out by the Building Equipment Company of Chicago, Ill. The results claimed are even distribution of passenger load, reduced cost of operation as result of reduced peak load, better accommodation to passengers because of more room in cars, and more trips made per car. The device consists of a circular plate which is driven by a small motor through reduction gearing

at constant speed. Upon this circular plate rest rubber-tired disks. These disks are fastened to shafts upon the end of which are cams having contact brushes. At each revolution of the



DISPATCHER THAT KEEPS ELEVATORS MOVING

cam contact is made and a bell is rung or lamp is illumined as a signal to the elevator driver to start.

Lamp Standards

The lamp standard shown in the accompanying illustration is a product of the Union Metal Manufacturing Company of Canton, Ohio. Six hundred and fifty standards of this design have just been installed in Cleveland. The standards are given a shop coat of green metallastic paint, both inside and outside, before leaving factory, and should have a finishing coat after erection. It is pointed out that all de-



CLEVELAND LAMP STANDARD

signs can be furnished with copper-jacketed shafts at an extra charge. When required, bases are arranged for cut-outs, transformers, etc. Many different designs may be created by interchanging bases, shafts and capitals.

New Incorporations

THE ALVIN (TEX.) LIGHT & ICE COMPANY has been incorporated with a capital stock of \$15,000 by C. A. Levens, C. W. Marlin and W. M. Galey.

THE BOWERS (PA.) ELECTRIC COMPANY has been chartered with a capital stock of \$5,000 to operate an electric system in Bowers. W. J. Upton is treasurer.

THE GEORGIA PUBLIC SERVICE COMPANY of Tifton, Ga., has been incorporated with a capital stock of \$250,000 by C. I. Day, F. G. Whitney and H. R. Roseboro.

THE HONAKER (VA.) LIGHT COMPANY has been incorporated with a capital stock of \$5,000. The officers are: C. W. Hurt, president, and G. B. Johnson, secretary.

THE PAUL M. EVANS COMPANY of Philadelphia, Pa., has been incorporated with a capital stock of \$25,000 to manufacture and deal in storage batteries by Sarah H. Evans and others.

THE HENRYETTA (OKLA.) PUBLIC SERVICE COMPANY has been chartered with a capital stock of \$200,000 by J. R. Watson, A. W. Anderson and Harlan Reed, all of Okmulgee, Okla.

THE EUREKA (MONT.) HYDRO-ELECTRIC COMPANY has been chartered with a capital stock of \$200,000 by J. J. Tetrault of Eureka; C. B. Manwright and Louis H. Brainwant, both of Whitefish.

THE DEARBORN ELECTRIC CONSTRUCTION COMPANY of Chicago, Ill., has been chartered with a capital stock of \$10,000 by Charles S. Knudson, Fred H. Bowen and Leon J. Edelman.

THE NUNN ELECTRIC SIGN SYSTEM, INC., of Oklahoma City, Okla., has been chartered with a capital stock of \$5,000 by J. E. Nunn of Amarillo, Tex.; D. W. Mays and W. L. Carliss of Oklahoma City, Okla.

THE SHERIDAN (ILL.) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital stock of \$3,000 by C. H. Weston, Elmer J. Clark, E. D. R. Robison, A. Christensen and E. S. Erickson.

THE GRAND RIVER ELECTRIC COMPANY of Quapaw, Okla., has been chartered with a capital stock of \$3,000 by G. C. Knight of Quapaw, D. F. Butler of Joplin, Mo., and Carl L. Rogers of Oklahoma City, Okla.

THE ANDERSON ELECTRIC CAR COMPANY OF CALIFORNIA of Los Angeles, Cal., has been incorporated with a capital stock of \$5,000. The directors are: W. C. Anderson, Fred S. Rogers and T. K. Lemmon.

THE LIGHTING SPECIALTIES COMPANY of Pittsburgh, Pa., has been incorporated with a capital stock of \$10,000 by Harold Kirschberg and others. The company proposes to manufacture electric-lighting specialties.

THE GREEN BRIER POWER COMPANY of Ronceverte, W. Va., has been incorporated by J. W. Johnson, of Alderson, W. Va.; W. G. Matthews and A. C. Ford of Clifton Forge, Va. The company is capitalized at \$5,000.

THE SANITARY ELECTRIC NOVELTY COMPANY of New York, N. Y., has been chartered with a capital stock of \$1,000 to manufacture and deal in electrical devices. The incorporators are: John L. Lytle, Richard O. Smith and Grace L. Perocheau.

THE STAR ELECTRIC INVESTMENT COMPANY of Newark, N. J., has been incorporated with a capital stock of \$100,000 by C. M. Peterson, E. E. Hollander and H. P. Peterson, all of Newark, N. J. The company proposes to deal in electric devices.

THE PULASKI (TENN.) ELECTRIC & WATER COMPANY has been incorporated by C. O. Lindsay, George B. Adams and S. W. Alley, all of Chattanooga, Tenn. The company is capitalized at \$50,000 and proposes to operate electric and other local utilities.

THE CAPITAL ELECTRIC LIGHT COMPANY of New York, N. Y., has been incorporated by S. and M. Siegel and S. Eisenberg, 356 Miller Avenue, Brooklyn, N. Y. The company is capitalized at \$15,000 and proposes to manufacture gas and electric lamps.

THE NORTHPORT (WASH.) POWER & LIGHT COMPANY has been chartered with a capital stock of \$200,000 by Lorne A. Campbell of Rossland, B. C., and others. The company proposes to supply electricity and gas in the State of Washington near Northport.

THE RALPH R. LEWIS COMPANY of Philadelphia, Pa., has been chartered with

a capital stock of \$25,000 to do a general electrical engineering business. The incorporators are: F. R. Hansell of Philadelphia, Pa.; J. Vernon Pimm and S. C. Seymour of Camden, N. J.

THE CLYMER (N. Y.) POWER CORPORATION has been incorporated by G. H. Tenpas, L. Tenpas and G. W. Tenpas. The company is capitalized at \$25,000 and proposes to generate and distribute electricity for transportation, manufacturing, heating and lighting purposes.

THE NUTRY & COOK INTERNATIONAL TRANSMITTER COMPANY of New York, N. Y., has been incorporated by John Nutry, A. S. and W. A. Cook, 15 Jerome Street, Brooklyn, N. Y. The company is capitalized at \$5,000 and proposes to manufacture transmitting and telegraphic instruments.

THE SILENT VALVE MOTOR CORPORATION has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$3,500,000 to manufacture motors, engines and mechanical and electrical devices. The incorporators are: W. E. Pearson, E. F. Oates and E. L. Russell, all of New York, N. Y.

THE ELECTRIC AUTO LITE CORPORATION has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$13,000,000 to manufacture, sell and deal in engines, electrical and mechanical devices of all kinds. C. L. Rimlinger, H. L. Mullin, C. M. Egner, local (Wilmington, Del.), incorporators.

THE UNIT VENTILATION COMPANY of Queens, N. Y., has been incorporated to manufacture ventilating devices and to do a general electrical and mechanical engineering business. The incorporators are: A. Bautz of College Point; W. F. Brown, 911 Whitlock Avenue, the Bronx, and J. F. Maguire, 375 Fulton Street, Brooklyn, N. Y.

Trade Notes

B. J. SULLIVAN, who has been associated with the sales department of the Commercial Electrical Supply Company of St. Louis in charge of its service department, has joined the First Missouri Artillery, Battery A, which is to be mustered into federal service shortly.

THE NEVADA CONSOLIDATED COPPER COMPANY has placed an order for electric hoisting equipment for its mine at Ruth, Nev., which calls for a 400-hp. Westinghouse type CW wound-rotor induction motor and complete control equipment, comprising a Westinghouse liquid controller with necessary electromagnetic switches.

H. H. CUDMORE has left the Mazda lamp department of the General Electric Company to engage in the business of distributing the Oscar Sheck Universal Projector Lamp Appliances, distributed by the Argus Lamp & Appliance Company of Cleveland. Mr. Cudmore has been identified with the Mazda lamp industry for over ten years, and prior to that time was engaged in the electrical jobbing business in Cleveland.

THE CHELTON ELECTRIC COMPANY, 314 Armat Street, Philadelphia, Pa., announces that it has recently made arrangements to have Hight & Stout, 143 Liberty Street, New York City, handle its New York account. This firm will furnish samples as well as distribute literature and can quote low prices on the full line of the Chelton company. Mr. Hight was formerly New York representative of the Weber Electric Company, and Mr. Stout was formerly with the Bryant Electric Company.

D. M. BIGGAR, for several years the manager of the foreign exchange department of the American Express Company in Chicago, will sail late in August for Shanghai, where he will establish another office of this company's Far Eastern organization, which had its beginning with the opening of offices in Manila and Hongkong in 1916. He will be followed by R. E. Bergeron, formerly special traffic agent of the Russian division in New York, who will sail on Sept. 15 for Yokohama to open there the fourth Far Eastern office. Mr. Bergeron has only recently returned from making a first-hand investigation of conditions in the Orient and Russia. Each of these new offices will be fully equipped to serve in connection with commercial financing and transportation of merchandise or personal shipments, large or small, via freight or express service. They will investigate opportunities for trade, provide tickets or accommodations for tourists or commercial travelers and extend the field of the American Express travelers' cheque.

THE ATLAS CRUCIBLE STEEL COMPANY has ordered for its Dunkirk (N. Y.) plant a standard rolling-mill drive consisting of a 450-hp. wound-rotor induction motor, a rotary converter and a 130-hp. direct-current motor. This apparatus is so interconnected that at heavy loads the rotor currents supply power through the rotary converter for the direct-current motor, which in turn helps drive the mill. The manufacturer of this outfit, the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has also received from the Brier Hill Steel Company of Niles, Ohio, an order for a 132-in. plate-mill equipment consisting of a 5000-hp. induction motor with primary control panel and step regulator, a 24-in. reversing roughing mill with a 7600-hp. direct-current motor and a 2250-kw., 1500-hp. motor-generator set with 60,000-lb. flywheel, besides an 84-in. plate-mill equipment with a 2500-hp. induction motor, primary control panel and slip regulator. Additional electrical equipment ordered for this plant includes two 750-kw. synchronous motor-generator sets and four 3500-kva. radiator-type transformers.

Trade Publications

FIRE EQUIPMENT.—The New York Brass Foundry Company of 104 Centre Street, New York City, has prepared a booklet on the Monitor detector system.

INSULATION.—The Mitchell-Rand Manufacturing Company, 99 John Street, New York City, is sending out a mailing card containing a few plain tape samples.

ELEVATOR DISPATCHER.—The Buildings Equipment Manufacturing Company, 327 South La Salle Street, Chicago, has prepared a folder descriptive of its line of automatic elevator dispatchers.

LOCOMOTIVES.—Edison storage batteries for use in storage-battery locomotives are described and illustrated in bulletin 608, published by the Edison Storage Battery Company of Orange, N. J.

LUNG MOTOR.—The Life Savings Devices Company, 564 West Monroe Street, Chicago, is mailing out a "hurrygram," announcing a booklet on "Life for the Men in the Trenches."

OIL SWITCH.—The Crocker-Wheeler Company of Ampere, N. J., has prepared bulletin No. 179 descriptive of its alternating-current oil switch for reversing service for two-phase or three-phase work.

ADJUSTABLE LIGHT FIXTURES.—Anderson adjustable light holders and unit systems of lighting are illustrated and described in a bulletin distributed by the Franklin Specialty Manufacturing Company of New York City.

ELECTRICAL SUPPLIES.—M. B. Austin & Company of Chicago are distributing catalog "G," descriptive of "The Austin Line." This catalog includes data on electrical wires and cables, interior conduits, conduit fittings and electrical specialties.

CHAIN DRIVE.—"Some Facts About Chain Roller Chain Drives" is the title of book No. 361, issued by the Link-Belt Company of Chicago, Ill. This company has also prepared book No. 326, descriptive of "T T" class roller chains for tractors and trucks.

CONSTRUCTION WORK.—Ford, Bacon & Davis, engineers, of New York, San Francisco and New Orleans, are distributing a folder descriptive of recent construction work. This bulletin includes information on a double-deck wharf house, pier 41, Galveston Wharf Company, Galveston, Tex.

LOCOMOTIVE PERFORMANCE COSTS.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has prepared a bulletin entitled "Westinghouse Electrification Data." This book outlines the proper basis for comparing locomotive performance costs. Type "E" oil circuit-breakers for capacities up to 2000 amp. for voltages up to 23,000 are illustrated and described in catalog No. 3001 issued by this company. It has also prepared a catalog on oil-circuit-breaker accessories.

STORAGE BATTERIES.—Bulletin No. 168 is descriptive of the "Exide" battery for marine wireless service and is being distributed by the Electric Storage Battery Company of Philadelphia. This bulletin supersedes bulletin No. 149. This company is also distributing bulletin No. 165, descriptive of twenty-four-hour service for small central stations by means of the "Chloride" accumulator. It is also distributing bulletin No. 166, which relates to storage battery installations for stand-by service in large central lighting and power plants.

New England States

PORTLAND, ME.—The Board of Aldermen has granted the petition of the Cumberland Light & Power Company asking for conduit rights, manholes, etc., on various streets of the city.

WATERBURY, VT.—The installation of a municipal electric-light plant is under consideration.

ATHOL, MASS.—The Athol Gas & Electric Company has secured contracts to supply electricity to operate the mills of the L. S. Starrett Company and the Union Twist Drill Company. Both companies have private electric generating plants, which have been discarded owing to the high price of coal.

BONDSDVILLE, MASS.—Work is progressing rapidly on the new power house being erected for the Boston Duck Company.

BROCKTON, MASS.—Application has been made by the W. W. Cross Company for a permit to erect a power house and stack on Montauk Road, to cost about \$20,000. Contract has been awarded to George Howard & Sons Company.

NORTH ADAMS, MASS.—The Boston & Maine Railroad Company, through its receiver, James H. Hustis, has filed a petition with the Federal Court for permission to contract with the North Adams (Mass.) Gas Light Company for energy to light the Hoosac tunnel. If the petition is granted this will separate the lighting equipment from that which furnishes power for the electric operation of trains through the tunnel, releasing more power to operate the trains through the tunnel and insuring adequate lighting facilities.

PITTSFIELD, MASS.—The contract for the erection of a power house 60 ft. by 70 ft. at the James & E. H. Wilson plant has been awarded to F. T. Ley & Company of Springfield.

SPRINGFIELD, MASS.—The Standard Electric Time Company is planning to erect an addition to its factory in Logan Street, at a cost of about \$25,000. H. V. Paterson is architect.

SPRINGFIELD, MASS.—The Turners Falls (Mass.) Power & Electric Company has petitioned the Massachusetts Waterways Board for permission to cross the Connecticut River at Springfield to supply energy to the Springfield Street Railway Company.

SPRINGFIELD, MASS.—An urgent deficiency appropriation of \$445,000 for improvements at the United States Armory and the water-shop plant has been asked by Secretary Baker of the War Department. Of the proceeds, \$300,000 would be used for replacing obsolete and worn-out machinery, \$90,000 for installing an electric generating plant at the watersheds, \$25,000 for a new lighting system and \$30,000 for a physical and chemical laboratory, including buildings at the Armory.

TURNER'S FALLS, MASS.—The Franklin Electric Light Company has been granted permission to erect electric transmission lines on O and High Streets. The company has also asked for authority to build a transmission line on the Montague road at Montague City in the near future.

WORCESTER, MASS.—The Worcester Electric Light Company is erecting another substation, 53 ft. by 73 ft., on Grafton Street. Energy from the Webster Street generating plant will be transformed at this station. The E. J. Cross Company has contract for construction of building.

WORCESTER, MASS.—The Gas and Electric Light Commissioners have authorized the New England Power Company to issue securities to the amount of \$7,000,000, the proceeds to be used for the construction of a dam, power house and reservoir at Readsboro. The proposed dam will be about 200 ft. high and the reservoir is to have a storage capacity of 3,600,000,000 cu. ft. A tunnel will be built 14,000 ft. long from the dam to the power house. The plans provide for a development of about 36,000 hp.

HARTFORD, CONN.—The Hartford Electric Steel Company has secured a contract from the New Britain (Conn.) Machine Company for 1,200,000 lb. of steel castings, to be used in building anti-aircraft gun mounts. The New Britain company will advance the money to double the capacity of the Connecticut company's plant, the advance to be paid out of future profits.

NEW HAVEN, CONN.—A permit has been granted to Yale University for a one-story heating and power plant to be erected at the corner of Ashmun and York Streets. The proposed plant will supply electricity for lighting and heating all of the university buildings. The recently constructed tunnels connecting the college buildings will be used for the wire and pipe lines extending from this station. The cost of

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

the plant complete is estimated at about \$160,070.

NEW LONDON, CONN.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 20 for construction of a reinforced concrete general storehouse, 64 ft. by 224 ft., including electrical work, etc., at the submarine base, New London, Conn. Drawings and specifications (No. 2462) may be obtained on application to the above bureau or to the commanding officer at the submarine base named.

Middle Atlantic States

BALDWINVILLE, N. Y.—The Seneca River Power Company has petitioned the Public Service Commission for permission to erect a new electric transmission line at Van Buren.

ROCHESTER, N. Y.—The Public Service Commission has granted the Rochester Railway & Light Company permission to increase its capital stock from \$9,500,000 to \$10,250,000.

GARWOOD, N. J.—Plans have been prepared for an extension, 40 ft. by 100 ft., one story high, to the plant of the Hall Switch & Signal Company on Centre Street. H. W. Wolf is general superintendent.

PHILLIPSBURG, N. J.—The Phillipsburg Transit Company has applied to the Public Service Commission of the State of Pennsylvania for permission to operate in Easton and vicinity.

PRINCETON, N. J.—The Public Service Electric Company is installing a new underground conduit on Stockton Street, prior to paving the thoroughfare.

CHESTER, PA.—A machine shop, 40 ft. by 70 ft., is being erected at the new electric power station of the Beacon Light Company in Chester, now under construction at a cost of over \$2,000,000.

ENOLA, PA.—Work has begun on the construction of the new addition of the power plant in the local yards of the Pennsylvania Railroad. A battery of six out-of-date railroad engines has been equipped to be used while the boilers of the power plant are being overhauled. The output of the plant will be doubled.

HARWOOD, PA.—The Harwood Coal Company is installing a new electrically operated shovel at its local culm banks. Energy will be supplied from the plant of the Harwood Electric Company.

LANSDALE, PA.—Plans are being considered by the North Penn & Buckingham Valley Railways Company for the construction of a new interurban railway connecting Upper North Penn and Buckingham Valley districts, including Quakertown, Dublin, Glen, Almont and Blooming Glen with Doylestown and vicinity, about 24 miles long.

MARCUS HOOK, PA.—The Benzol Products Company is contemplating the erection of a new transformer and switching station, to cost about \$10,000, at its local plant.

PHILADELPHIA, PA.—Revised plans are now being prepared for the construction of a one-story power plant at the new institution to be constructed by the St. Vincent's Home on Lansdowne Avenue.

PITTSBURGH, PA.—Permits have been granted the National Biscuit Company for the erection of a seven-story brick and concrete baking factory, a two-story power house and a garage, at Penn Avenue and Lambert Street. The cost of the buildings is estimated at \$560,000.

POTTSVILLE, PA.—The Public Service Commission has given its approval of the new system of lighting for Pottsville and also of the new contract for street lighting between the city of Pottsville and the Eastern Pennsylvania Light, Heat & Power Company for a period of ten years. The new system will be installed as soon as possible.

SHARON, PA.—The Borough Council has awarded a contract to the Shenango Valley Electric Light Company for the installation of an ornamental street-lighting system, consisting of 84 ornamental standards, at a cost of about \$3,913.

WAYNESBORO, PA.—Negotiations are under way between the Chambersburg, Greencastle & Waynesboro Street Railway

Company and the Hagerstown & Frederick Railway Company whereby the electric railway from Pen Mar to Chambersburg (30 miles long) and the electric-light and power plant in Waynesboro may be purchased by the latter.

WILKES-BARRE, PA.—The Lehigh Valley Railroad Company, it is reported, is preparing plans for equipping its line from Penn Haven to Wilkes-Barre, Hazleton and vicinity for electrical operation.

BALTIMORE, MD.—Plans have been prepared by the Baltimore Dry Dock & Shipbuilding Company for the erection of additional buildings, including a power house, 70 ft. by 90 ft., one story high.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company, it is reported, is planning to increase its electrical department and proposes to organize a company to be known as the Consolidated Power Company and issue \$5,000,000 in notes. The plans of the company provide for doubling the electric generating capacity and include the installation of a 50,000-hp. generating plant within the next 18 months.

MARLINTON, W. VA.—The City Council is considering the purchase of the local electric-light plant and water-works system to be owned and operated by the municipality.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 27 for the construction of six two-story steel-frame buildings, including electric elevators, electric lighting, heating and plumbing, etc., at the following naval depots: Two at Hingham, Mass.; two at Lake Denmark, N. J.; one at Fort Mifflin, Pa., and one at St. Julien's Creek, Va. Drawings and specifications (No. 2427) may be obtained upon application to the bureau or to the commandants of the navy yards, Boston, Mass., New York, N. Y., Philadelphia, Pa., and Norfolk, Va.

North Central States

LAKEVIEW, MICH.—Work has begun on the erection of the electric transmission line from Amble to Lakeview, which will furnish energy here from the new power plant at Morley. Poles have been erected for the line between Lakeview and Edmore.

BELLEVIEW, OHIO.—Right-of-way has been secured by the Ohio Light & Power Company of Mount Vernon for the erection of an electric transmission line from Fredericktown to Belleview. The company will install a lighting system in Belleview.

CANTON, OHIO.—A 7500-kw. synchronous condenser at the Sunnyside plant of the Central Power Company was damaged recently by fire.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company has awarded the general contract for the reinforced concrete work in connection with its new power house, 122 ft. by 300 ft., to the Turner Construction Company.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, Ohio, until Aug. 21, for furnishing transformers for the Division of Light and Heat. Specifications may be obtained at the office of the Division of Light and Heat, Room 204, City Hall.

DEFIANCE, OHIO.—The Defiance Gas & Electric Company has secured contracts to supply electricity for lighting the towns of Waterville and Haskins from its hydroelectric plant above Defiance.

SPRINGFIELD, OHIO.—The contract for construction of the addition to the plant of the Springfield Light, Heat & Power Company has been awarded to L. Schreiber & Sons Company of Cincinnati.

YOUNGSTOWN, OHIO.—Arrangements are being made to equip the plant of the Hercules Powder Company, just outside of the city, for electrical operation throughout. The Hercules company has contracted with the Mahoning & Shenango Railway & Light Company to supply 300 hp., which heretofore has been supplied by its own steam generating plant.

SOMERSET, KY.—The Southern Machine Exchange of Somerset is reported to be in the market for a 50-hp., 220-volt, alternating-current motor and a 50-hp. oil engine.

GOSHEN, IND.—The City Council has instructed V. A. Harding, superintendent of the municipal electric-light plant and water-works system, to prepare plans and estimates of cost of the installation of a central heating station. A preliminary estimate places the cost at about \$16,797.

CHICAGO, ILL.—The National Electric Lamp Association is reported to have purchased a site on Flourney Street upon which it proposes to erect a factory.

CHICAGO, ILL.—The Belden Manufacturing Company, 2300 South Western Avenue, has awarded the general contract for a one-story factory building, 92 ft. by 127 ft., to be erected on West Van Buren Street. This is the initial building of a proposed plant, to cost about \$250,000. The company manufactures insulated wires.

CLINTON, ILL.—Plans have been prepared for the construction of a boiler and engine house, to cost \$20,000, and an addition to roundhouse and coal chute, to cost about \$38,000, at the yards of the Illinois Central Railroad Company at Clinton. A. S. Baldwin is chief engineer.

ASHLAND, WIS.—Plans are being considered by the Wisconsin Telephone Company for extensions to its local system.

BEAVER DAM, WIS.—The City Council is considering the purchase of the local electric-light plant to be owned and operated by the municipality. If taken over by the city improvements will be made to the system.

MANITOWOC, WIS.—The Wisconsin Public Service Company has been granted permission by the City Council to extend its transmission lines into the city.

MODGOVI, WIS.—Joseph Wulff, local machinist and blacksmith, is contemplating enlarging his shop and installing a new electric motor and a number of machine tools.

RACINE, WIS.—The Wisconsin Gas & Electric Company has increased its capital stock from \$2,750,000 to \$3,350,000; the proceeds to be used for extensions to its electric plant and transmission system at Racine and throughout southern Wisconsin. S. B. Way of Milwaukee, vice-president, is in charge.

CEDAR RAPIDS, IOWA.—The Iowa Electric Company of Cedar Rapids has been granted a franchise by the Board of Railroad Commissioners to erect and operate electric transmission lines upon certain roads and highways in Johnson and Washington Counties for a period of 25 years.

CENTERVILLE, IOWA.—The Board of Railroad Commissioners has granted the Iowa Southern Utilities Company of Centerville a franchise to erect and operate electric transmission lines over certain roads and highways in Wayne, Decatur and Ringgold Counties for a period of 25 years.

EDDYVILLE, IOWA.—The Albia Interurban Railway Company is reported to have secured contracts to supply energy to the mines of the Rex Fuel Company and the Maple Coal Company, which will be equipped with electrically operated machinery.

MAXWELL, IOWA.—The Mid-West Electric Company has been awarded contract to erect a high-tension transmission line from Maxwell to Collins and also a substation in Collins.

TRENTON, MO.—The Chicago, Rock Island & Pacific Railway Company is planning to erect a coaling station at Trenton and install mechanical loading apparatus. C. A. Morse of Chicago, Ill., chief engineer, is in charge of the work.

JAMESTOWN, N. D.—The local plant of the Western Electric Company is reported to have been destroyed by fire.

AVOCA, NEB.—Bonds to the amount of \$5,000 have been voted for the installation of an electric-lighting system in Avoa.

LINCOLN, NEB.—Plans are being prepared for the construction of a boiler house at the State Penitentiary, to cost about \$15,000. J. W. Salmon, Orpheum Building, Lincoln, is architect. Leo Matthews is secretary of state board of control.

YORK, NEB.—The Council has passed an ordinance providing for improvements to the electric-lighting system. The plans, it is understood, provide for 235 street lamps.

ABILENE, KAN.—The Riverside Light & Power Company is erecting a reinforced concrete oil tank of 25,000 barrels capacity. The oil will be used for fuel in its steam-driven electric plant.

CAPRON, KAN.—The installation of an electric-lighting plant in Capron is under consideration. An electric transmission line will be erected to connect with the Kiowa-Hardtner transmission line to secure energy to operate the system.

LURAY, KAN.—Bonds to the amount of \$20,000 have been voted for the installation of a municipal electric-light plant.

Southern States

BADIN, N. C.—Plans are being considered by the Aluminum Company of America, Oliver Building, Pittsburgh, Pa., for the construction of a second dam at the Yadkin Falls site, below its Narrows Dam plant. The power house will be equipped

with three 10,000-hp. units. The proposed new plant will be used as an auxiliary to the present plant during the low water periods. James W. Rickey of Pittsburgh, Pa., is hydraulic engineer.

MAXTON, N. C.—Bids will be received by the Town Commissioners for the construction of an electric-lighting system. C. B. Thompson is clerk and treasurer.

GREENVILLE, S. C.—The contract for the electrical system for Camp Sevier has been awarded to Huntington & Guerry of Greenville. More than 1,000,000 ft. of wire will be required.

PORT ROYAL, S. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 20 for construction of two officers' quarters, including electric lighting, plumbing, etc., at the Marine Recruiting Station at Port Royal, S. C. Drawings and specifications (No. 2499) can be obtained on application to the bureau or to the commandant of the naval station named.

SPARTANBURG, S. C.—Huntington & Guerry of Greenville have been awarded the contract for furnishing and installing electrical equipment at Camp Wadsworth for which more than 1,000,000 ft. of wire will be required.

ATLANTA, GA.—The Georgia Railway & Power Company has petitioned the State Railroad Commission for permission to issue \$2,500,000 in bonds, the proceeds to be used for the installation of the sixth unit in the Tallulah Falls power station, the construction of a new reservoir on the Tallulah River, above Rabun Lake, to be known as the Burton reservoir, and the construction of a new power station, 2 miles below the Tallulah Falls plant, near the junction of the Tallulah and Chattooga Rivers, at the point where they form the Tuglo River.

LEESBURG, FLA.—The City Council is considering calling an election to submit the proposal to issue \$40,000 for the installation of an electric-light plant and water-works system to the voters.

CLARKSVILLE, TENN.—Steps have been taken by the Young Men's Club to secure the installation of an ornamental street-lighting system in the downtown section of the city. The cost is estimated at \$5,000.

KNOXVILLE, TENN.—The New Imperial Realty Company has awarded contract to the E. W. Minter Company, 115 Broadway, New York, N. Y., to erect the Hotel Farragut. The main building will be 75 ft. by 123 ft., nine stories high, and will cost about \$350,000; heating system, \$47,000; electric lighting, \$15,000; elevators, \$15,000; and plumbing, \$56,000. The contract for electrical equipment and plumbing has been awarded to Engert Vance Company of Knoxville. W. L. Stoddard, 9 East Fortieth Street, New York, N. Y., is architect.

BATESVILLE, ARK.—Contract has been awarded by the City Commissioners for improvements to the water and light plant, including the installation of a new engine and generator, etc., to the P-K Engineers, 915 Olive Street, St. Louis, Mo. Bids will be opened on Aug. 14 for filter building, wells, etc. Frank L. Wilcox, Syndicate Trust Building, St. Louis, Mo., is engineer.

FORT SMITH, ARK.—The Fort Smith Light & Traction Company has erected a high-tension transmission line to Huntington to supply electricity to the Coal District Power Company. The Fort Smith company has also ordered material for an extension of its transmission lines to supply the Citizens' Electric Company with energy. The latter company supplies electrical service in Alma, Mulberry and Ozark. The contract with the Coal District company calls for 1000 hp. The Fort Smith company will increase the output of its power station to meet the additional demands for service.

JONESVILLE, LA.—The Jonesville Lumber & Veneer Company is considering the purchase of equipment for power plant, including boilers, two engines, etc. A. W. Stewart is president.

COMANCHE, OKLA.—The Consumers Light & Power Company has submitted a proposal to the City Council offering to purchase the municipal light plant and water-works system.

OKLAHOMA CITY, OKLA.—The Traders' Oil & Refining Company, Baltimore Building, is reported to be in the market for the purchase of equipment for an oil-refining plant, including boiler, steam still, tanks, pumps, etc.

STILLWATER, OKLA.—Bonds to the amount of \$6,000 have been voted, the proceeds to be used for the installation of a boiler in the municipal light and water plant.

CISCO, TEX.—Improvements are contemplated to the plant of the Cisco Gas & Electric Company, including the installation of a new boiler, lightning arresters, etc.

EL PASO, TEX.—It is announced by J. M. Lawson, manager of the Elephant Butte Reclamation project, that the United States government will make a thorough investigation as to the advisability of installing a hydroelectric plant at the dam which was completed across the Rio Grande at a point in New Mexico, above El Paso, several months ago. It is roughly estimated that the cost of the proposed plant would be about \$1,000,000. The government does not propose to provide this money, but the funds are to be furnished by the Water Users' Association, which owns the land embraced in the large irrigation enterprise. It is estimated that 40,000 hp. could be developed.

SAN ANGELO, TEX.—The power of the electric transmission line extending between San Angelo and Winters, a distance of 75 miles, it is reported, will be doubled. This will be done in time to supply electricity to operate the cotton gins this fall.

VICTORIA, TEX.—The City Council has adopted a resolution providing for engaging an electrical engineer to prepare plans for the installation of a municipal electric-light plant. This action was taken expressly for the purpose of laying a municipal service wire conduit underground and installing the equipment for an ornamental lighting system before the streets are paved. Bonds to the amount of \$40,000 were voted for the installation of a municipal plant more than two years ago. The delay in the sale of the bonds was due to a reduction in the street-lighting charges and other concessions made by the Texas Gas & Electric Company.

Pacific and Mountain States

BREMERTON, WASH.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 20 for construction of a torpedo storehouse, including overhead trolley track and electric hoists, at the naval torpedo station, Keyport, Puget Sound, Wash. Drawings and specifications (No. 2483) may be obtained on application to the bureau or to the commandant of the navy yard, Puget Sound.

CENTRALIA, WASH.—The Thomas Paper & Pulp Company, recently organized, has purchased 300 acres of coal land to furnish fuel for its power plant to be erected in Centralia. The company proposes to build a large paper mill in Aberdeen to manufacture paper from red fir by a new process.

EDMUNDS, WASH.—The City Council has accepted the proposal of the Washington Coast Utilities Company of Arlington to furnish electricity for lighting the city. On account of financial conditions the lighting system was discontinued two years ago. The street-lighting system will consist of 17 lamps of 60 cp. and 16 of 100 cp.

PORT ANGELES, WASH.—At an election held July 20 the proposal to issue \$30,000 for extensions and improvements to the municipal electric-lighting system was defeated.

SEATTLE, WASH.—Extensions to the municipal street railway lines, involving an expenditure of about \$500,000, have been authorized by the City Council.

SEATTLE, WASH.—The Seattle Construction & Drydock Company is planning to build a one-story addition, 16 ft. by 50 ft., to its power plant at 901 Railroad Avenue South.

SEATTLE, WASH.—A site covering an entire block of waterfront property has been secured by the Gray & Barash Company on which it will erect a plant for manufacturing electrical and nautical machinery.

SEATTLE, WASH.—Bids will be received by Reuben W. Jones, secretary of board of directors of the Seattle school district No. 1, until Aug. 17 for electric-lighting fixtures for the West Seattle High School in accordance with plans prepared by Edgar Blair, school architect.

SEATTLE, WASH.—The Kilbourne & Clark Manufacturing Company, manufacturers of wireless apparatus, has purchased a two-story, 180 ft. by 120 ft., concrete building on Railroad Avenue and Connecticut Street, and is remodeling same. Two extensions are being built at the main structure and a system of skylights installed. The plant will be operated throughout by electricity.

SEATTLE, WASH.—Contracts will soon be awarded for the construction of the first unit of the new manufacturing plant of Gray & Barash, manufacturers of electrical machinery, to be located on the Canal Waterway. The plans provide for the erection of one frame building, 75 ft. by 120 ft., and one of concrete, 40 ft. by 100 ft., to cost \$20,000 and \$25,000 respectively. The company now has a plant at 316 First Avenue South.

SEDRO-WOOLLEY, WASH.—Bids will be received by the State Board of Control, Olympia, Wash., until Aug. 13 for construction of power house and stack at the Northern State Hospital, near Sedro-Woolley. Bids will also be received at the same time for furnishing and installing one water-tube boiler, with necessary steam, water, smoke and other connection and two new stokers, one for the new boiler and the other for the boiler now in use. George W. Lawton, Alaska Building, Seattle, is architect.

TACOMA, WASH.—The Puget Sound Traction, Light & Power Company has petitioned the Commissioners of Pierce County for a franchise to construct and operate an electric transmission line over and along certain roads and highways in Pierce County for a period of 25 years.

TACOMA, WASH.—The City Council is considering a proposal to furnish the Chicago, Milwaukee & St. Paul Railway Company energy to the amount of 2000 kw. daily. This is the amount, it is estimated, that the railroad will require within the city limits when it has completed changing its railway through the State from steam to electrical operation.

VANCOUVER, WASH.—Plans are being considered by the National Home Building Company to double the output of its plant and install new machinery, equipped with individual motors. The company manufactures knockdown houses and boxes.

BAKER, ORE.—The Allis-Chalmers Company has secured the contract for furnishing machinery for an electrically driven sawmill for the Oregon Lumber Company at Baker. The power plant will be equipped with a 625-kva. Allis-Chalmers steam turbine unit.

BAKER, ORE.—The power plant of the Eastern Oregon Light & Power Company at Olive Lake, near Baker, was recently damaged by fire. At present Baker and a number of small cities in this section are without lighting service. Fire caused the headgates to open, flooding the plant.

GRANTS PASS, ORE.—The contract for furnishing electric-lighting fixtures for the Grants Pass court house has been awarded to M. J. Walsh of Portland, at \$4,678.

MYRTLE CREEK, ORE.—The proposed charter for the town of Myrtle Creek permitting the Council to issue bonds not exceeding \$30,000 for the installation of an electric power plant and improvements to the water-works system was adopted by the voters at a recent election.

PORTLAND, ORE.—The contract for electric wiring in the Woodstock School in Portland has been awarded to Miller & Halls, electrical contractors, of Portland.

PORTLAND, ORE.—Plans have been completed for the erection of bunkers and the installation of coal-handling machinery at the Port of Portland and also for the construction of a number of ocean-going barges with a capacity of 8000 tons each.

SALEM, ORE.—The contract for wiring the new Oregon Agricultural College Library has been awarded to the Salem Electric Company.

CHICO, CAL.—Steps have been taken by the Board of Trustees to secure an improved street-lighting system in Chico.

FRESNO, CAL.—Preparations are being made by the San Joaquin Light & Power Corporation to extend its electric transmission lines into new territory from Chowchilla for a distance of about 20 miles, which will take in the block of 42,000 acres of land recently purchased by the Chowchilla Lands Company of the United States Land Company, and the large ranch, 44,000 acres, owned by Bliss Brothers.

GRASS VALLEY, CAL.—Extensive improvements are contemplated for the Wisconsin gravel mine and new machinery has been ordered. An electric hoist will be installed, together with rotary blower and other equipment. The electric plant will be installed in the main tunnel.

HANFORD, CAL.—The installation of a new street-lighting system in Hanford is under consideration. It is proposed to substitute electroliers for the arc lamps now in use in the business district and erect new lamps throughout the residential section of the city.

LA GRANGE, CAL.—The Sierra & San Francisco Power Company of San Francisco and the Yosemite Power Company of La Grange have applied to the State Railroad Commission for permission for the latter to sell to the former all its property in its La Grange division for \$450,000.

LA HABRA, CAL.—The residents of La Habra have petitioned the Board of Supervisors for permission to establish an electric-lighting system here.

LIVINGSTON, CAL.—A petition is being circulated by the Livingston Board of Trade asking the Supervisors to call a special election to vote on the proposition of the forma-

tion of a lighting district, to take in all of the town sites.

LOS ANGELES, CAL.—The City Power Bureau is considering beginning work soon on the construction of a power plant on the Franklin canyon line of the Los Angeles aqueduct.

LOS ANGELES, CAL.—A petition for the establishment of a highway lighting district, to be known as the Stephenson Avenue and Laguna Lighting District, has been filed with the Board of Supervisors.

LOS ANGELES, CAL.—Preparations are being made to install an auxiliary power plant in the San Francisquito Canyon, to be ready for service in a few months. The Westinghouse Electric & Manufacturing Company has been awarded contract for generator, transformers and other equipment, at \$31,735.

LOS ANGELES, CAL.—The State Railroad Commission has granted the Southern California Edison Company permission to issue \$10,000,000 in two years bonds, of which the proceeds of \$3,000,000 will be used for the construction of its Big Creek hydroelectric plant and electric transmission line to Los Angeles. The remainder will be used to take up outstanding obligations.

LOS ANGELES, CAL.—Plans are being considered for supplying electricity from the municipal electric power plant to the Los Angeles Shipbuilding & Drydock Company's works at the harbor. The municipal power lines to the harbor are completed and as soon as the aqueduct breaks are repaired the power plant will be able to furnish 1000 hp. of electrical energy to the shipyard.

OROVILLE, CAL.—The Board of Trustees of the city of Oroville has filed a petition with the State Railroad Commission wherein it requests the commission to determine the compensation to be paid the Pacific Gas & Electric Company and the Oro Electric Corporation for their gas and electric plants and distributing systems located in Oroville and an addition known as Oro Vista. The city proposes to purchase the plants rather than to construct a competing system.

SAN DIEGO, CAL.—Application has been filed with the Board of Supervisors for the formation of a public highway lighting district in Normal Heights.

SAN FRANCISCO, CAL.—The State Railroad Commission has granted the Great Western Power Company authority to construct and operate electric transmission and distribution lines throughout Plumas County except in territory reserved for the Grizzly Electric Company, the Quincy Electric Light & Power Company and the Plumas Light & Power Company. The Great Western Power Company is erecting a 50-mile, 44,000-volt transmission line from its Las Plumas plant to Crescent mills at a cost of about \$154,000.

SANTA CRUZ, CAL.—The power plant of the Coast Counties Gas & Electric Company at Big Creek, it is reported, was recently destroyed by fire.

TURLOCK, CAL.—Application has been made to the State Railroad Commission for approval of the sale of the Yosemite Power Company, which operates in and around Turlock, to the Sierra & San Francisco Power Company, a subsidiary of the California Railway & Power Company of San Francisco. The Yosemite company has a right of 300 second-ft. of water from the Tuolumne River. The price is said to be \$450,000.

VALLEJO, CAL.—Plans are being prepared for the erection of a new plant for the Santa Rosa-Vallejo Tanning Company on the site of the factory that was burned down at North Vallejo. It is proposed to erect a large drying house, a large mill and a small brick or concrete building for power plant. All steam-driven machinery will be replaced with electric motors in the new tannery.

MACKAY, IDAHO.—Contract has been awarded by the Empire Copper Company for the construction of an aerial tramway, 16,300 ft., to cost about \$80,000, to the American Steel & Wire Company.

MURRAY, IDAHO.—The Washington Water Power Company of Spokane, Wash., is erecting an electric transmission line into the Murray district to supply energy for dredging operations on North Fork. The transmission line will cross the property of the Giant Ledge Mining Company and will supply electricity to operate the 150-ton mill now under construction on the Giant Ledge.

AJO, ARIZ.—Application has been made to the Board of Supervisors by the Ajo Improvement Club for a franchise to supply electricity, telephone, water, gas and sewer service for domestic and commercial use to the townsites of Ajo.

WILLIAMS, ARIZ.—The City Council is

considering issuing bonds for rebuilding the water and light plant, which was recently destroyed by fire.

YUMA, ARIZ.—The Arizona State Corporation Commission has refused to grant the application of Messrs. Sanguinetti & Uwing of Yuma for permission to install a duplicate electric-light and power system in this city. Electrical service is now furnished by the Yuma Light, Gas & Water Company, which secures energy from a California hydroelectric transmission system.

GREAT FALLS, MONT.—The City Council has awarded contracts for the installation of equipment for two ornamental lighting districts: One to the Great Falls Electric Supply Company, at \$6,730, and the other to the Electric Supply & Engineering Company of Great Falls, for \$7,125.

MALTA, MONT.—The Malta Light Company, recently incorporated, it is reported, contemplates installing an electric-lighting system in Malta. George W. Kemper is interested.

RONAN, MONT.—The City Council has granted Walter G. Griffin of Kalispell a franchise to install and operate an electric-light and power plant in Ronan.

BATTLE MOUNTAIN, NEV.—The Nevada Valleys Power Company of Lovelocks, which was recently granted a franchise to operate in Lander County, has acquired the local plant. The company proposes to enlarge the plant and transmit energy to Copper Canyon, Copper Basin and other points to operate mines and mills in these districts. The erection of a transmission line as far south as Austin is also under consideration.

HORN SILVER, NEV.—The construction of a modern cyanide plant at the Great Western Mine is under way. All machinery, including crusher, ball mill, tube mills, conveyors, pumps, etc., will be operated by electric motors. The power plant will be equipped with a generator driven by a 200-hp. semi-Diesel oil engine. M. R. Thurston consulting engineer, has charge of the work.

LOVELOCK, NEV.—The Nevada Valleys Power Company is planning to extend its electric transmission lines in Storey and Lyon counties to connect with the power plant under construction on the Truckee River at Ditho.

Canada

HARTNEY, MAN.—Tenders will be received until Aug. 13 for electric meters, transformers, wire, generators, switchboard and oil engine. Plans and specifications are on file at the office of the Public Utilities Commission, 300 Tribune Building, Winnipeg.

BRUSSELS, ONT.—The plant of the Brussels Electric Light Company, it is reported, will be sold at auction on Aug. 14.

MOOREFIELD, ONT.—The ratepayers have voted to make connection with the Hydro-Electric system at Palmerston.

ST. CATHARINES, ONT.—The Packard Electric Company of St. Catharines is reported to be in the market for a power squaring shear to cut No. 10 gage steel up to 24 in. wide.

TORONTO, ONT.—The John Inglis Company, 14 Strachan Avenue, is contemplating the construction of a power house, to cost about \$5,000.

TORONTO, ONT.—H. W. Petrie of Toronto is reported to be in the market for the purchase of motors, 60 cycles, three-phase, 550 volts, in sizes up to 75 hp.; also an electric generating unit consisting of a 50-hp. or 60-hp. high-speed engine, directly connected to a 110-volt generator.

WINDSOR, ONT.—The Maloney Electric Company is building an addition to its plant, at a cost of about \$12,000. William Kerr is manager.

COOKSHIRE, QUE.—The general contract for the construction of a concrete dam for the Westbury Electric Light & Power Company has been awarded to A. Bromwell.

GREENFIELD PARK, QUE.—The contract for the erection of a transformer station has been awarded by the Municipal Council to G. M. Gest, 83 Craig Street W., Montreal.

JOLIETTE, QUE.—The purchase of electrical equipment for the municipal electric-light plant is under consideration. Alfred L. Marsolais is secretary and treasurer.

SWIFT CURRENT, SASK.—The City Council has adopted the recommendation of Engineer Calder for the purchase of a 75-hp. auxiliary induction motor, at a cost of \$2,000, and also repair parts for pumps, etc.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Aug. 24 for wire lathe copper screening, brass tubing, electric cable, cable hangers, motor-driven wood-working machine, motor driven band saw, combination chemical en-

gine and hose cart, tackle blocks, etc. Blanks and further information relating to this circular (No. 1159) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

KUAHUA, HAWAII.—Bids will be re-

ceived at the Naval Station, Pearl Harbor, Hawaii, until Sept. 3, for construction of one mine storage building, including steel track and crane, electrical work, etc., at the naval ammunition depot, Kuahua, Hawaii. Drawings and specifications (No. 2489) can be obtained on application to the above bureau or to the commandant of the naval station, Pearl Harbor, Hawaii.

Record of Electrical Patents

Notes on United States Patents issued on July 24 and 31, 1917

1,234,149. ELECTRIC UNIT; Frederick M. Furber, Revere, Mass. App. filed March 27, 1917. Particularly for use in shoe machinery.

1,234,151. MOTOR CONTROLLER; Maurice M. Goldenstein, Milwaukee, Wis. App. filed May 17, 1915. Applicable to motor-driven printing presses.

1,234,196. HEATING-COIL DISK; Morton Murphy, Janesville, Wis. App. filed April 15, 1916. Means for supporting the heating coil within the bottom of the receptacle.

1,234,205. STRAIN INSULATOR; David H. Osborne, Victor, N. Y. App. filed April 15, 1916. Method of connecting the insulating or porcelain section with a strain member.

1,234,271. OUTLET BOX FOR ELECTRIC CONDUITS; William A. Bonnell, Brooklyn, N. Y. App. filed July 8, 1915. Means for holding so-called "knock-outs" in position in the conduit-receiving sockets or apertures in the boxes when the same are not in use.

1,234,280. ELECTRIC HEATING DEVICE; Francis C. E. Burnett and Ernest J. Brunning, Montreal, Quebec, Canada. App. filed Nov. 27, 1916. Improvements.

1,234,313. INSULATOR; Anthony F. Efrig, Perkassie, Pa. App. filed May 4, 1915. Without the use of binding wires, plates, etc.

1,234,412. PUSH-BUTTON SWITCH; Alexander K. Sutherland, New Britain, Conn. App. filed Aug. 3, 1916. Flush-type wall switch.

1,234,439. RECTIFIER; Donald M. Bliss, West Orange, N. J. App. filed Sept. 27, 1910. Sparking is minimized.

1,234,464. ELECTRICAL INSTRUMENT; Chester I. Hall, Fort Wayne, Ind. App. filed June 23, 1914. Demand indicator.

1,234,465. ELECTRIC MOTOR; Chester I. Hall, Fort Wayne, Ind. App. filed Dec. 5, 1914. Adapted to be used as timekeeping devices.

1,234,466. MOTOR DEVICE OF THE INDUCTION TYPE; Chester I. Hall, Fort Wayne, Ind. App. filed June 6, 1916. Operation is substantially independent of ordinary voltage fluctuations.

1,234,489. PROCESS TO INCREASE THE SENSIBILITY OF RELAYS FOR ALTERNATING CURRENTS; Eugen Reisz, Berlin-Treptow, Germany. App. filed April 9, 1913. Can only be employed when the relay has no mechanical inertia at all, as is the case, for instance, in gas-discharging relays.

1,234,500. REGULATOR; Allen M. Smith, Fort Snelling, Minn. App. filed July 23, 1915. For opening and closing the draft doors of stoves or furnaces.

1,234,534. ELECTRIC CIRCUIT CONTROLLING DEVICE; John Friis, Chicago, Ill. App. filed Nov. 2, 1914. Flashers.

1,234,542. FEED-THROUGH SWITCH; George H. Hart, West Hartford, Conn. App. filed June 17, 1916. Two base members inclosing a suitable quick-acting switch mechanism, with a simple and effective means for holding said base members together.

1,234,544. FUSE BLOCK; Duncan C. Hooker, Farmington, Conn. App. filed July 1, 1916. Improvement.

1,234,583. SUPPORTING LENGTHS OF WIRE; George V. Twiss, London, England. App. filed Oct. 24, 1916. Support is formed with a passage and segmental undercut recesses on opposite faces of the passage, the wire being retained by a clamp one element of which is provided with flanges adapted to engage in the segmental recesses.

1,234,584. SYNCHRONISM INDICATOR; Gerardus J. Van Swaay, Delft, and Henri I. Keus, Hengelo, Netherlands. App. filed March 16, 1915. Comprises a well-known movable element, such as a disk, subjected to the action of magnetic fields.

1,234,670. ELECTRIC HEATING ELEMENT; George B. Jones, Kokomo, Ind. App. filed Sept. 30, 1915. Supporting means for the exposed resistance coils.

1,234,673. ELECTRIC SPOT-WELDING APPARATUS; Laurence S. Lachman, New York, N. Y. App. filed Jan. 19, 1916. Improvements.

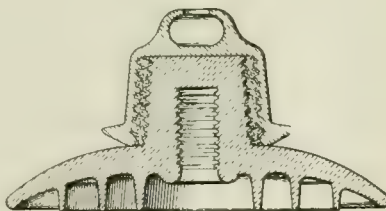
1,234,678. ELECTRIC SWITCH; James F. Lincoln, East Cleveland, Ohio. App. filed Sept. 4, 1915. For retarding the movement of a hand-operated electric switch.

1,234,749. PUSH-BUTTON SWITCH; Frederick P. Gates, Hartford, Conn. App. filed May 21, 1915. Quick-make and quick-break type.

1,234,799. CAPPED CARBON PENCIL; Johann G. Peterson, Jersey City, N. J. App. filed Oct. 25, 1916. Securing a better electrical connection between the cap and the pencil than is at the present time possible.

1,234,840. BINDING POST; Edward F. Weston, Elizabeth, N. J. App. filed Feb. 20, 1917. Head may be removed for inspection.

1,234,857. ELECTRICAL CONNECTION AND BOX; Carl H. Bissell and John J. Dossett, Syracuse, N. Y. App. filed July 27, 1914. Having terminals on its upper face and a closure for the open side of the box having holes aligned with the terminals of the connection.



1,233,296—High-Tension Insulator

1,234,865. ELECTRICAL REGULATOR; Harold W. Brown, Ithaca, N. Y. App. filed Jan. 7, 1914. Based upon the principle that there must necessarily be a time lag after the regulator acts before the machine or circuit is regulated.

1,234,914. DYNAMO-ELECTRIC MACHINE; Marius Latour, Paris, France. App. filed Nov. 25, 1916. High-frequency homopolar machine.

1,234,964. ELECTRICAL MEASURING INSTRUMENT; Harold B. Taylor, Wilkensburg, Pa. App. filed Aug. 11, 1913. Maximum-demand meters.

1,234,970. INDICATING CYCLE METER; Victor H. Todd, Orange, N. J. App. filed Oct. 6, 1914. Pair of magnets oscillate an armature that releases an escapement wheel which transmits its motion to the hand for indicating the number of cycles of an alternating current that have passed in a certain period.

1,234,973. ELECTRICAL HEATING APPARATUS AND PROCESS OF MAKING THE SAME; Samuel Trood, Wilkensburg, Pa. App. filed Jan. 7, 1914. Improvements.

1,234,976. ELECTRICAL MEASURING INSTRUMENT; Thomas W. Varley, Pittsburgh, Pa. App. filed Oct. 3, 1913. Watt-hour meters.

1,234,985. CASE FOR INCANDESCENT ELECTRIC LAMP SOCKETS; John Weber, Schenectady, N. Y. App. filed Sept. 3, 1912. Improvements.

1,234,991. ELECTRICALLY HEATED COOKING STOVE; Clifford W. Winterbotham, Brighton Beach, Victoria, Australia. App.

filed May 9, 1917. Heat leakage through the cooking chamber insulation is absorbed in a jacket and utilized for warming or heating water.

1,234,999. SWITCHING DEVICE; Walter M. Austin, Swissvale, Pa. App. filed May 28, 1913. Double-throw type.

1,235,028. FIRE-DETECTING WIRE; Charles A. Harsch, New York, N. Y. App. filed Dec. 27, 1916. Steel tape.

1,235,033. RELAY; Henry D. James, Wilkensburg, Pa. App. filed June 9, 1914. Field magnet relays employed to protect dynamo-electric machines.

1,235,063. ELECTRO-OSMOTIC PROCESS OF TREATING LIQUID MIXTURES; Botho Schwerin, Frankfurt-on-the-Main, Germany. App. filed Feb. 16, 1915. Permits a separation from each other of suspension colloids, the so-called true colloids, actually dissolved bodies and electrolytically dissociated ions.

1,235,069. MULTIPLE SERVICE CONNECTION; John T. Skinner, Lawrence, Kan. App. filed Sept. 21, 1914. Improvements.

1,235,081. REACTANCE COIL; Philip Torchio and Harry R. Woodrow, New York, N. Y. App. filed March 15, 1917. For high-tension voltage.

1,235,106. INSULATOR ATTACHMENT; Adelbert C. Burnett, Youngstown, Ohio. App. filed Jan. 24, 1917. Method of securing high-tension wires to the insulator in such manner that the wire may be detached from the insulator, for the purpose of renewing the insulator.

1,235,132. ELECTRICAL MOTIVE APPARATUS; Robert H. Gaylord, Pasadena, and Guy B. Capps, Los Angeles, Cal. App. filed July 23, 1914. For operation of elevators or hoists.

1,235,149. STAMP MILL; Charles M. Mullen and Ray E. Hall, Portland, Ore. App. filed Dec. 1, 1911. Electromagnet or solenoid with which to accomplish successive lifts, thereby greatly simplifying the mechanism necessary.

1,235,162. ENGINE-STARTING MOTOR; Samuel W. Rushmore, Plainfield, N. J. App. filed Sept. 27, 1912. For internal-combustion engines.

1,235,202. PROCESS FOR PURIFYING SALT BRINE; Bruce E. Hartsuch, East Lansing, Mich. App. filed April 26, 1916. Improvements.

1,235,203. ELECTRIC WATER HEATER; Alfred Herz and Charles Herbst, Chicago, Ill. App. filed Aug. 21, 1915. Improvements.

1,235,234. ELECTRIC BELL AND BUZZER; Henry G. Osborne, Brooklyn, N. Y. App. filed Sept. 18, 1916. Improvements.

1,235,271. MULTIPLE-ARC LAMP; Maurice J. Wohl, Brooklyn, N. Y. App. filed April 18, 1916. Improved construction.

1,235,272. ARC LAMP AND REFLECTOR; Maurice J. Wohl, Brooklyn, N. Y. App. filed April 18, 1916. Keeps the arc chamber at a distance from the operating mechanism and prevent injury to the latter by the excessive heat from the arc.

1,235,366. SPRING CONTROL FOR ELECTRICAL MEASURING INSTRUMENTS; Edward P. Noyes, Fort Monroe, Va. App. filed Oct. 18, 1915. Means of counterbalancing the moving parts.

1,235,373. PROTECTION OF ELECTRICAL APPARATUS; Frank W. Peek, Jr., Schenectady, N. Y. App. filed Nov. 30, 1914. Uses alternate layers of an energy-absorbing material and a good dielectric, preferably disposed between the various conducting portions thereof.

1,235,397. ELECTRIC FITTING; George B. Thomas, Bridgeport, Conn. App. filed Feb. 7, 1917. Combined switch and outlet device.

1,235,436. REGULATOR FOR PHASE BALANCERS; Robert M. Carothers, Schenectady, N. Y. May be automatically controlled so as to maintain equality of voltages or currents in the phases of the system.

1,235,524. ELECTRIC WELDING MACHINE; Robert C. Pierce, Cincinnati, Ohio. App. filed Jan. 8, 1917. Improved.

1,235,531. LAMP-SOCKET CASING OR THE LIKE; Charles J. Klein, Milwaukee, Wis. Interlocking means for the sections of such casings.

Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN

Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, AUGUST 18, 1917

No. 7

Issuing Securities in Advance of Expenditures

IN AUTHORIZING a seven-million-dollar security issue by the New England Power Company in a recent decision, the Gas and Electric Light Commission of Massachusetts took a constructive step of general interest from the standpoint of utility regulation. The company urged the commission to grant the issue before any considerable portion of the funds represented had been expended; in fact, less than 1 1/3 per cent of the proposed outlay for new plant facilities and system improvements imperatively needed could be shown to the board as paid out or borrowed under the usual note arrangement. The petitioner maintained that with the commission's advance approval the former would stand a much better chance of marketing its new securities, and in view of the present war conditions a majority of the board took this view.

New England is in danger of a serious coal shortage. Demands for power are increasing rapidly, and hydro-electric development is being actively pushed to help meet the situation. Although it is usual to require exhibits of expenditures constituting a pretty fair proportion of the security total before approving an issue, the board realized the importance of prompt and favorable action and performed a patriotic service in taking it. By holding back permission to issue about \$1,000,000 of the total for a year, the commission safeguarded the whole issue with respect to the total cost of the work and put the company in a position to take full advantage of any reductions in the cost of labor or material should such occur within the next twelve months as the result of an improved international situation or other cause at present not in evidence.

The American Academy of Engineers

WE REPORTED in our news columns last week the passage of the Senate bill incorporating the long-projected American Academy of Engineers, now brought into activity by the exigencies of the times. We trust that the bill will as promptly pass the House and bring the Academy into being as a fully organized national body. There are many technical organizations in the country. A constantly increasing list of bodies of specialists in one line or another gather for professional co-operation, but there has been for a long time and is now especially, in the national crisis, need for gathering the supreme engineering talent of the country in a single working brotherhood. Engineering today represents a very broad range of activities, the co-ordination of which, with the government service specially in view, is a highly important matter. Many

engineers are members of the several technical bodies with which their activities come most closely in touch, yet there is need, filled by the constitution of the present Academy, for bringing all branches of engineering together on a common meeting ground. The closeness of the contact between one group of engineers and another is constantly increasing, and it will become closer yet under the pressure of technical work brought on by the conditions of war. That the Academy as constituted can be of great and immediate service to the government goes quite without saying, and it is an especially appropriate thing that it should be incorporated now, at the present session of Congress, as part of the country's preparation for defense. Of course, the Naval Advisory Board and the Engineering Council are both doing excellent work in the present emergency, and there will be co-ordination of the activities of all such bodies. The first mentioned is, however, a more or less temporary body, while the American Academy of Engineers and the Engineering Council will be permanent organizations.

Control of the Coal Supply

ONE of the most important things in the food control bill from the standpoint of industry is the special authority delegated to the President for the administration of the coal resources of the country. Nothing touches more deeply the very roots of organized society than its supply of fuel. Many estimates have been made of the magnitude of the coal supply and the probable date of its exhaustion or depletion to an extent almost equivalent to exhaustion. These estimates have looked forward from one to several centuries, but the fact is that real fuel scarcity has been brought upon us prematurely by the conditions of war, a cause never contemplated by any prophet. The time is actually here when the fuel supply for all purposes, public and private, is temporarily reduced to a condition corresponding with a great and genuine scarcity of resources. Many an industry finds itself in hard straits for the coal necessary to operate its works or driven to purchase what scant supply can be obtained at almost impossible prices. Lack of adequate transportation, to say nothing of unmitigated profiteering, is at the bottom of the difficulty. The condition is not yet quite so bad as that which was brought upon England 250 years ago when the Dutch were sweeping the seas, but it arises from the same fundamental cause, the breaking down of communications under the stress of war.

The power now vested in the President gives him practical control of the situation. That he will use it

wisely and reasonably we believe, and that he will use it promptly and efficiently we earnestly pray. Before long the winter will be upon us, when difficulties of transportation are still further increased and quick measures of relief are doubly valuable. It is absolutely necessary that the manufacturers needful for the country's success, and the public servants necessary to hold the status quo of our civilization, should be assured of the fuel necessary to their needs; and it is no less important that the householder, who in the long run has to bear the brunt of financing the war, should not be doubly burdened by misfortune or extortion. We are not inclined to worry about the food supply, for its sources are widely distributed. Its amount bids fair to be adequate, and if the waste be stopped there should be no serious shortage. But the fuel supply is absolutely dependent upon organization of transportation and on the prevention of shortened production or hoarding at the hands of the profiteer. There is no feature of the bill just passed which deserves higher commendation than the conferring of full powers to deal with this vital fuel proposition.

Regulation with V-Connected Transformers

WHEN three-phase, 1100-volt distribution systems are tapped for the supply of alternating current to a consumer, it is customary to install but one transformer, when electric lighting only is demanded. This is an ordinary single-phase transformer, with its primary winding connected between one pair of the three distributing lines, so that only one phase of alternating current is supplied to the consumer's lamps. In order to prevent all the lighting load from falling on one and the same phase of the system, care is taken to distribute such single-phase transformers, with more or less uniformity, among the three phases of the system.

When, however, polyphase motors have to be supplied on the consumer's house mains, more than one phase must be tapped at the house service. In the case of a relatively large motor, it is desirable to tap all three phases. In Europe one step-down three-phase transformer is ordinarily used in such cases, with interlinked three-phase magnetic circuits and with three-phase primary and secondary windings. In America the custom is to employ three independent single-phase step-down transformers, one on each phase. Each of these methods of supply has its particular advantages and disadvantages. In the common case of but a small amount of polyphase power being required, only two single-phase transformers are installed, which, being connected in V, as it is called, provide three-phase voltages between the three secondary house mains. Assuming that no accident ever happens to either of the two V-connected transformers, this arrangement is entirely satisfactory at small loads. At or near rated load, the two V-connected transformers are not able to maintain their terminal voltages so well as a corresponding set of three delta-connected transformers. The voltage collapses on the side that has no transformer directly assigned to it. A pair of V-connected step-down transformers are

therefore not so well able to maintain a symmetrical three-phase system of secondary voltages under load as a trio of delta-connected step-down transformers, and their plant efficiency under load is also inferior. Nevertheless, the plan works surprisingly well in a large number of cases.

The article by Leslie F. Curtis which we print this week reports the voltage regulation under different conditions of load and power factor for a particular pair of V-connected 10-kva., 1100-volt transformers. The results show that, at unity power factor and 150 per cent of rated load current, there may be very appreciable unbalancing, except in the case, of course, where all the load is carried on the two sides of the system which have the transformers.

Cost of Factory Lighting

IN THE current issue of the ELECTRICAL WORLD Professor Clewell rounds out his recent discussions of factory lighting by an analysis of costs as dependent on the various items which go into the annual charges, paying especial attention to the effect of the size of the units upon expense. Within limits, a few units form a cheaper equipment than do many, this being subject to the varying conditions imposed by the necessities of distribution and the grade of illumination required. In making or analyzing any estimates of this kind the construction costs will, of course, vary enormously, depending on the class of building, the uses to which it is put, the costs at the moment of material and labor and a good many other factors, so that one may say at the start that it is difficult to find two cases exactly comparable. The best that can be done is to analyze each case so thoroughly that one can accurately deduce its relation to other cases. A great deal of this cost reckoning is a matter of bookkeeping, as in the example cited by Professor Clewell where the cost per outlet was carried clear back to the transformer and switchboard equipment. Such an all-inclusive scheme may be at times justifiable, but is likely to involve considerable errors and certainly is not a ready basis for the comparison of lighting installations as to initial cost.

What is much more important is the figure for a complete installation of wiring, lamps and accessories up to the switchboard. In some cases further segregation in the costs compared is necessary, as when the new system is operated from old mains. One cannot in the long run do much more than furnish general data for which rough estimates of cost can be made, just as the complete solution of the illumination problem in any given factory cannot wholly be trusted to general average but must involve factors based on local circumstances. The main fact brought to the fore in Professor Clewell's admirable series of papers is the necessity of good lighting in factories as a means of securing proper efficiency of operation under working conditions. That the average factory is not well lighted and that its output can be increased in quantity and quality by suitable illumination are facts which stand out pre-eminently. Certain general methods of illumination and approximate figures

as to requirements may be taken by the help of Professor Clewell's various tables as generalized data, just as a contractor can block out the cost of an office building of any particular type per cubic foot without harassing his soul with details. In each case these details have to be considered before final figures are secured and the whole scheme placed in construction. At the present moment it takes the wisdom of the serpent to figure even the approximate costs of material and labor with any likelihood that these costs will hold true when the work is actually undertaken. But the broad lines of construction and of cost estimation here given are sound and will be found most helpful in dealing with the concrete cases which come before the engineer or the manager. While the war is on there will be a keener necessity for high-grade illumination than ever before, on account of the greatly increased amount of night work, and the information here presented will be found most pertinent.

Government Nitrate Plants

THE passage of the food control bill, giving incidental plenary powers to the President with respect to securing an adequate stock of nitrate of soda for agricultural purposes, finds the situation as to ways and means of accomplishing the necessary result in a somewhat chaotic state. Several projects for the fixation of nitrogen have been elaborated, involving both the utilization of water powers in the possession of the government and the building of steam plants, or the combination of both as in one example recently brought to notice in these columns. Unfortunately, prior to the outbreak of the war the synthetic nitrate industry was in a particularly indeterminate condition. What information was available was hidden in a few hands, and accurate data as to output and costs have been painfully lacking. Under the present bill the government would seem to have an absolutely free hand, with \$10,000,000 available as a starter. With all the expert knowledge that can be summoned, decision on methods of plants is none too easy. That it will be made in accordance with the best judgment now available we must rest assured, whether time and experience back up that particular judgment or not. The need for nitrates may turn out to be less acute than has been feared, but the lesson driven home by the war is that it is the part of wisdom not to be de-

pendent on outside sources for materials so vital to the country's prosperity.

We are not inclined to worry about the present situation, since immense crops are in prospect for the season at hand. After all is said and done, the food proposition is probably less serious than some calamity howlers would have us believe. We have been feeding ourselves, and for the most part our allies, for the last two years without any particular struggle, to say nothing of furnishing Germany with large amounts of food and other necessary materials through neutral sources. If this latter leak is stopped, there seems little likelihood that we shall fail this year or the next to meet all requirements. The number of mouths to be fed remains fairly constant, while the acreage under cultivation and the yield are certainly not diminishing, so that the real problem consists in a somewhat extensive redistribution of available material. An army of a million and a half or two million men in the field makes no really serious draft on the man power of the nation. A bigger number of men than this is idle, on vacation or otherwise unproductive a large part of the time. It is the possibility of a prolongation of the war, of four or five million men under arms, and a consequent extraordinary scarcity of labor, that constitutes the serious phase of the matter.

If we begin now, there is time enough to get the nitrate industry under way. We have the resources and the talent necessary for the work, and we believe the government will utilize these promptly enough to meet the requirements. Personally we earnestly hope that if the work is undertaken via the electrochemical route it will be done by the utilization of some of the available water powers. In the present necessity for transportation, carrying a finished product is a much more sensible proposition than carrying the raw material, including fuel, particularly when the transportation of necessary energy can be economically made over wires instead of rails. The main thing now is to get the industry actually into efficient being, and on a considerable scale, so as to meet the requirements of intensive working if the time shall come when a really serious shortage of men will have to be faced. At all events, let the work go on steadily to such a finish that the country can never again find itself short of important material through dependence on an interrupted foreign supply.

OPINIONS of various central station companies on what subjects should be taken into consideration in locating electric service offices will be presented in the next issue of the ELECTRICAL WORLD. Among the most important factors named is the ease with which consumers can reach an office to pay bills, purchase appliances, enter orders for service, etc. The industrial-lighting series by Prof. C. E. Clewell ends with the present issue. Another branch of the lighting field, street illumination, will be treated in a series beginning with the Sept. 1 issue by J. R. Cravath. The first installment will deal with the general principles involved in lighting streets and the

The Coming Issues

effects desired. Lighting of an underground passageway and the experience of the St. Louis company in selling electric ranges are other articles which will be taken up in the next issue, in addition to the regular departments devoted to operating practice, commercial service and current news, including that of the trade. The "National Service Number," dated Sept. 1, will tell how the electrical industry is "doing its bit" in furnishing men, money and, what is of equal importance, the means of hastening the production of supplies—besides endeavoring in every way possible to increase output and keep down costs.

Initial and Operating Cost of Factory Lighting

Cost Values for Different Classes of Wiring—Discussion on Initial Costs of Larger and Smaller Lamps for Given Factory Areas, Supplemented by an Analysis of Annual Operating Charges

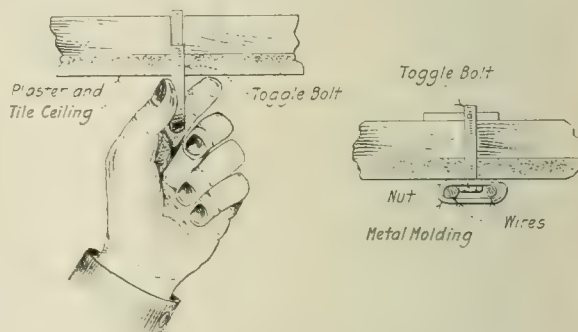
BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

SUMMARY.—In this article the author outlines the items included in the wiring for typical outlets in the factory system and discusses the elements of installation for various building constructions. Cost values for different classes of wiring are given so as to show the relative labor and material charges, and a large number of initial costs are included, based on actual installations and so arranged as to show the cost per outlet and the cost per unit of floor area. The latter furnish an interesting basis for comparing the initial costs of larger and smaller lamps for given factory areas. The discussion on initial costs is supplemented by an analysis of annual operating charges, first, in a general way applicable to all types of lamps, and, second, applied specifically to tungsten lamps of a given type and size. The unusual recent advances in the prices of wiring materials make it difficult, or even impossible, to estimate on new work at this time on a basis of actual costs of older installations, and while the use of the values in this article is subject to this limitation, they show how much the initial costs of lighting have amounted to under actual industrial conditions in the past, and hence furnish an interesting basis of comparison when estimates are prepared for new work to be installed under approximately the same conditions.

are most likely to be, entirely different from those prevailing at this time is limited in its application to estimates for new work, the unit costs given in the accompanying tables possess several fundamental points of interest as outlined below.

Thus the figures given herewith, because they all apply to approximately the same conditions of material prices and wiring wage rates, may be used to compare



FIGS. 2 AND 3—INSERTING TOGGLE BOLT IN PLASTER AND TILE CEILING; METAL MOLDING AND WIRES IN PLACE ON A TILE AND PLASTER CEILING

the expense of wiring for the various classes of ceiling and mill constructions, and they show, moreover, how the initial cost per outlet and the initial costs per 1000 sq. ft. (92.9 sq. m.) of floor area vary with the different sizes of lamps for a given intensity of the illumination, the quantity of illumination being closely comparable in all of the installations listed. It is to realize these latter advantages, rather than to suggest their use for estimates, that these costs are given.

TABLE I—TYPICAL ITEMS INCLUDED PER OUTLET

Common to each outlet:

- (1) Lamps of given type, size and voltage.
- (2) Reflectors suitable for the size of lamp, and the spacing and mounting height.
- (3) Shade holders of the type suitable for the reflectors.
- (4) Keyless sockets.
- (5) Fused ceiling rosettes.
- (6) Socket bushings.

Proportional per outlet:

- (7) Snap switches (one switch usually controls several lamps).
- (8) Fuse blocks, plugs and fuses.
- (9) Lamp cord (required mainly between rosettes and sockets).
- (10) Conduit and conduit boxes; or
- (11) Wood (or metal) molding (sometimes both conduit and molding are used in a given installation).
- (12) Screws, tape and solder.
- (13) Wire for the circuits.
- (14) Labor and overhead.

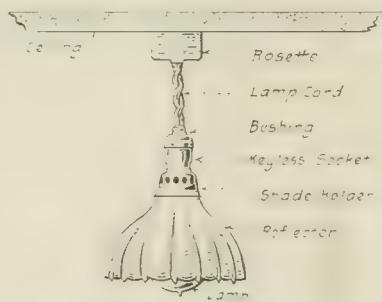


FIG. 1—TYPICAL OUTLET OF THE KIND REFERRED TO IN TABLES

as low as \$2.44, approximately one-tenth the above figure, a fact which makes obvious the necessity for clearly specifying just what is included for each outlet in the following discussion on initial costs. It is well to note that while a complete unit cost for installing a given lamp under price conditions which may be, and

In Fig. 1 the typical outlet referred to in the tables is shown, consisting of the lamp and reflector, shade holder, socket, bushing, a short length of lamp cord, and ceiling rosette. To these items are added the wiring materials for the circuits between the lamps and the service mains and for the switch loops, also the

labor and overhead charges. All of the initial costs given refer to wiring work performed by the electrical department in a part of a large manufacturing plant, where the work of relighting the buildings involved a cost of about \$100,000 for lamps and wiring only. Because of the large amount of this work, the electrical department became very proficient, and hence the labor item is probably considerably lower than the same work would be in a small plant. Furthermore, the materials were purchased in large quantities, this

TABLE II—ESTIMATED COSTS PER OUTLET FOR INSTALLING 60-WATT AND 100-WATT TUNGSTEN LAMPS

Lamp	Class of Wiring	Material	Labor
60-watt	Wood molding on wood ceiling.....	\$1.40	\$1.20
60-watt	Wood molding on stringer boards.....	1.78	1.41
60-watt	Metal molding on plaster ceiling.....	1.30	1.36
100-watt	Wood molding on wood ceiling.....	1.17	0.91
100-watt	Wood molding on stringer boards.....	2.05	1.36

TABLE III—ACTUAL COSTS FOR INSTALLING 60-WATT TUNGSTEN LAMPS ON WOOD CEILINGS WITH WOOD MOLDING*

Number of Installation	Nature of Space	Total Cost of Installation	Cost per Outlet	Cost per 1000 Sq. Ft. of Floor	Number of Lamps in Installation	Approximate Ceiling Height, in Ft.	Approximate Watts per Sq. Ft.	Approximate Floor Area, in Sq. Ft.	Average Spacing Between Lamps, Ft. In.
1	Factory office..	\$223.36	\$3.11	\$69.60	72	12	1.35	3205	6-8
2	Factory office..	72.37	3.01	75.36	24	12	1.50	960	7-9
3	Factory office..	163.03	3.39	116.00	48	13	2.05	1405	6-2
4	Factory office..	100.51	4.78	139.88	21	13	1.75	719	6-4
5	Manufacturing	478.99	2.66	51.17	180	10	1.15	9360	8-0
6	Packing space..	83.89	3.49	65.00	24	10	1.12	1290	7-6
7	Factory office..	84.05	3.50	90.03	24	12	1.60	900	6-6
8	Factory office..	47.31	3.94	143.50	12	12	2.18	330	5-6

Average cost per outlet, \$3.48. Average cost per 1000 sq. ft., \$93.82.
*A portion of the costs discussed in this article were made the basis for a brief report on the general subject of shop-lighting costs in the *American Machinist*, Vol. 46, No. 16, pp. 677-680.

likewise tending to reduce the total costs below the values which would be found in many other cases.



total cost by the number of lamps in the system, and the cost per 1000 sq. ft. (92.9 sq. m.) of floor area being found by multiplying the total cost by 1000 and then dividing by the total floor area served by the system.

CLASSES OF WIRING LISTED

The plaster and tile ceilings are treated as shown by Figs. 2 and 3. The ceiling is drilled to receive a toggle

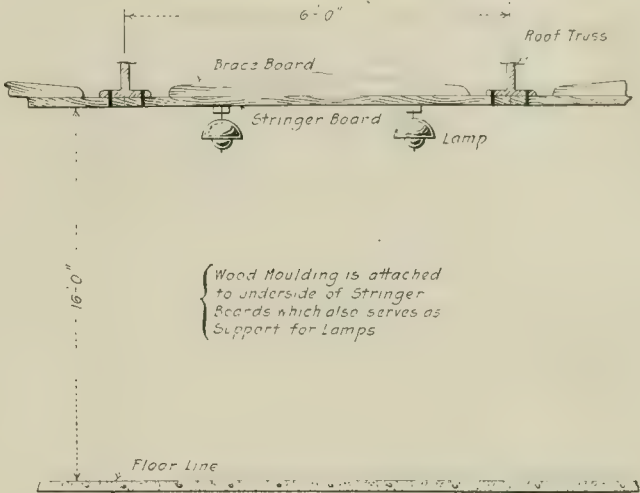
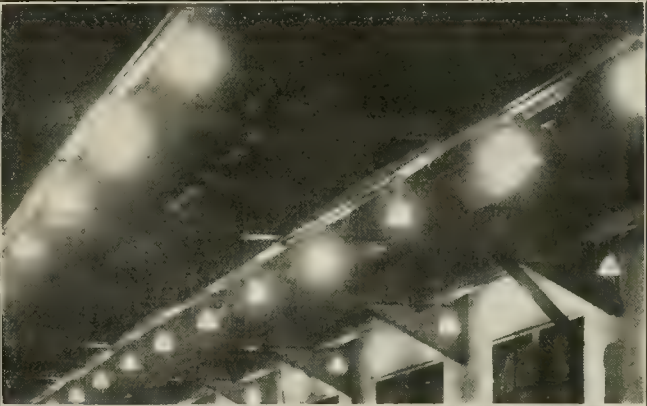


FIG. 5—METHOD OF SUPPORTING STRINGER BOARDS BETWEEN ADJACENT ROOF TRUSSES

bolt, to which the metal molding is attached as in Fig. 3. The general appearance of such a ceiling equipped with metal molding is shown in Fig. 4. The details of the use of wood molding on ordinary wood ceilings, a class of wiring referred to in some of the tables, are so familiar that they require no explanation.

For open-girder roof construction the use of moderate-sized lamps may bring many if not all of the lamps, for symmetry, at points between the trusses, and hence the use of stringer boards as shown in Fig. 5 has been found of advantage. These boards are braced for the rather long spans, and the wood molding and lamps are attached to the under sides of them. In Fig. 6 an idea is given of the appearance of these stringer boards in



FIGS. 4 AND 6—PLASTER AND TILE CEILING SHOWING INSTALLATION OF METAL MOLDING; OPEN-GIRDER ROOF CONSTRUCTION WITH STRINGER BOARDS IN PLACE AS SUPPORT FOR WOOD MOLDING AND LAMPS

A typical list of items constituting an outlet like that in Fig. 1 would be made up somewhat as shown in Table I. The total cost of a given installation is the sum of the individual items, in general as listed in the table, the cost per outlet being found by dividing the

an actual installation. The brick arched ceiling referred to in one of the tables has the general outlines shown by Fig. 7. Here baseboards, attached to the iron trusses, serve as a support for molding and lamps. It will be noted from the tables that while the cost per

outlet is usually higher for the larger lamps, the cost per 1000 sq. ft. (92.9 sq. m.) of floor area is usually lower for the larger lamps. The difference, however, is not enough to warrant the use of large lamps for low ceilings, because of the many advantages of small lamps for such spaces from the illumination standpoint.

The initial cost tables refer, in general, to a list of material similar to the foregoing table of typical items included per outlet, and do not include generating or

transforming equipment. To show the relative costs for material and labor per outlet, Table II has been prepared on a basis of estimated values of material and labor for various classes of wiring as listed. The material in this one case does not include the lamp or the reflector. In all of the remaining tables the lamp and reflector are included as a part of the cost per outlet.

In Tables III to VII actual costs to install various sizes of tungsten lamps under varying factory condi-

TABLE IV—ACTUAL COSTS FOR INSTALLING 60-WATT TUNGSTEN LAMPS ON TILE AND PLASTER CEILINGS WITH METAL MOLDING

Number of Installation	Nature of Space	Total Cost of Installation	Cost per Outlet	Cost per 1000 Sq. Ft. of Floor	Number of Lamps in Installation	Approximate Ceiling Height, in Ft.	Approximate Watts per Sq. Ft.	Approximate Floor Area, in Sq. Ft.	Average Spacing Between Lamps, Ft. In.
9	General office...	\$121.16	\$4.48	\$114.30	27	12	1.54	1053	7-0
10	General office...	169.85	4.59	122.00	37	12	1.59	1397	6-6
11	General office...	114.23	3.08	97.02	37	10	1.90	1144	5-9
12	General office...	235.60	3.99	93.90	59	12	1.65	2509	7-0
13	General office...	122.25	3.82	105.84	32	13	1.66	1155	6-8
14	Filing vault...	196.70	3.71	66.30	53	10	1.07	2966	8-7
15	General office...	31.96	3.99	96.85	8	10	1.45	330	7-0

Average cost per outlet, \$3.95. Average cost per 1000 sq. ft., \$99.46.

TABLE V—ACTUAL COSTS FOR INSTALLING THE LARGER TUNGSTEN LAMPS ON WOOD CEILINGS WITH WOOD MOLDING

Size of Units	Number of Installation	Nature of Space	Total Cost of Installation	Cost per Outlet	Cost per 1000 Sq. Ft. of Floor	Number of Lamps in Installation	Approximate Ceiling Height, in Ft.	Approximate Watts per Sq. Ft.	Approximate Floor Area, in Sq. Ft.	Average Spacing Between Lamps, Ft. In.
100-watt	16	Manufacturing...	\$564.65	\$2.44	\$41.41	243	13	1.78	13,633	8-0
	17	Machine shop...	204.88	4.65	53.86	60	12	1.56	3,840	9-0
250-watt	18	Manufacturing...	46.45	7.74	42.50	6	16	1.38	1,092	13-6
	19	Shop space...	102.63	5.13	34.21	20	20	1.67	3,000	10-6
	20	Shop space...	185.52	7.73	64.40	24	20	2.08	2,880	9-0
500-watt	21	Shop space...	160.08	13.34	67.50	12	20	2.08	2,375	14-0

Average costs per outlet: 100-watt units, \$3.54; 250-watt units, \$6.87. Average costs per 1000 sq. ft.: 100-watt units, \$47.64; 250-watt units, \$47.04.

TABLE VI—ACTUAL COSTS FOR INSTALLING TUNGSTEN LAMPS ON STRINGER BOARDS ATTACHED TO OPEN ROOF TRUSSES, WIRING PLACED IN WOOD MOLDING

Size of Units	Number of Installation	Nature of Space	Total Cost of Installation	Cost per Outlet	Cost per 1000 Sq. Ft. of Floor	Number of Lamps in Installation	Approximate Ceiling Height, in Ft.	Approximate Watts per Sq. Ft.	Approximate Floor Area, in Sq. Ft.	Average Spacing Between Lamps, Ft. In.
100-watt	22	Manufacturing...	\$182.46	\$5.35	\$82.03	34	16	1.63	2090	8-5
	23	Manufacturing...	724.64	4.83	77.39	150	9	1.60	9360	8-0
250-watt	24	Shop space...	76.79	7.68	47.80	10	18	1.56	1603	12-8
	25	Manufacturing...	189.81	10.54	62.76	18	16	1.48	3024	13-0
	26	Paint shop...	116.55	7.77	44.40	15	16	1.77	2121	13-9
	27	Shop space...	146.34	5.46	22.90	29	16	1.13	6400	14-6

Average costs per outlet: 100-watt units, \$5.09; 250-watt units, \$7.86. Average costs per 1000 sq. ft.: 100-watt units, \$82.35; 250-watt units, \$44.47.

TABLE VII—ACTUAL COSTS FOR INSTALLING TUNGSTEN LAMPS ON ARCHED BRICK-CEILING CONSTRUCTION HAVING IRON TRUSSES ON WHICH BASEBOARDS AND MOLDING WERE MOUNTED

Size of Unit	Number of Installation	Nature of Space	Total Cost of Installation	Cost per Outlet	Cost per 1000 Sq. Ft. of Floor	Number of Lamps in Installation	Approximate Ceiling Height, in Ft.	Approximate Watts per Sq. Ft.	Approximate Floor Area, in Sq. Ft.	Average Spacing Between Lamps, Ft. In.
100-watt	28	Tool room...	\$15.13	\$2.16	\$31.06	7	9	1.44	487	8-5
250-watt	29	Dynamo room...	407.22	10.18	78.58	40	20	1.93	5,183	14-0

NOTE.—It should be observed carefully that the watts-per-square-foot values as listed in each of these tables relate to installations where the older vacuum type of tungsten lamps was in use.

TABLE VIII—TYPICAL ITEMS INCLUDED UNDER ANNUAL OPERATING COSTS

(1) *Annual fixed charges:*

An interest charge on the total initial investment.
A depreciation charge on the non-renewal part of the equipment, that is, on everything included under the initial cost, except the lamp (or the tube for mercury-vapor lamps, or the carbons for arc lamps).
A charge for cleaning at regular intervals independently of the number of hours the lamps are used. If cleaning is done at the time of trimming for arc lamps, as an example, it may then be added as a part of the maintenance, since it then becomes a function of the number of hours the lamps are burned.

(2) *Maintenance charges:*

Repairs on equipment, that is on the units themselves where arc lamps and mercury-vapor lamps are used, also on sockets, switches, etc.
Renewals of tungsten lamps, or tubes of mercury-vapor lamps, or carbons for arc lamps.
Labor for the above items.

(3) *Energy charges:*

This charge must be based on the rate per kilowatt-hour applicable, and depends on the number of hours the lamps are used per annum.

TABLE IX—ANNUAL OPERATING COST (1000 HOURS' SERVICE) OF A 300-WATT MAZDA "C" LAMP†

Cost of lamp, list price.....	\$3.000
Cost of lamp, standard package, discount.....	2.700
Cost of reflector standard package, discount.....	3.371
Cost of unit standard package, discount.....	6.071
<i>Annual fixed charges:</i>	
Interest on investment at 6 per cent.....	\$0.364
Depreciation on reflector, 12½ per cent.....	0.421
Labor for monthly cleaning.....	0.360
Total	\$1.145
<i>Maintenance cost per 1000 hours of service:</i>	
Lamp renewal at standard-package prices.....	\$2.700
Lamp renewal at \$150 contract prices.....	2.490
Lamp renewal at \$1,200 contract prices.....	2.190
<i>Energy cost per 1000 hours of service:</i>	
At 1 per cent per kilowatt-hour.....	\$3.000

†In this case interest and depreciation are based on cost of lamp and reflector only, that is to say, no wiring expenses are included.

tions are given. The conditions governing the installation are indicated at the top of each table, and the meaning of each column of figures is explained by the

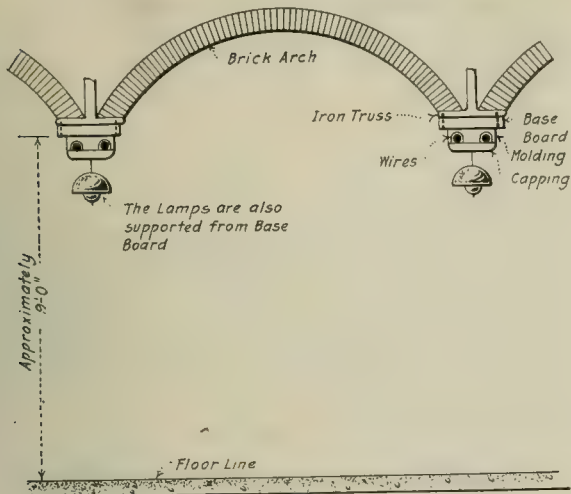


FIG. 7—METHOD OF SUPPORTING WOOD MOLDING AND LAMPS ON THE IRONWORK OF A BRICK CEILING

heading at the top of the column. It is particularly interesting to note that in some of the very large installations, indicated by the number of lamps, the costs per 1000 sq. ft. (92.9 sq. m.) are lower than for the

TABLE X—TOTAL ANNUAL OPERATING COSTS FOR A 300-WATT MAZDA "C" LAMP FOR VARIOUS LAMP PRICES, ANNUAL HOURS OF SERVICE AND RATES

	Energy Rate per Kw.-hr.	Total Annual Operating Cost
1000 hours' operation per year and lamps purchased on \$150 contract	1	\$6.64
	2	9.64
	3	12.64
	4	15.64
	5	18.64
	6	21.64
	8	27.64
	10	33.64
1000 hours' operation per year and lamps purchased on \$1,200 contract	1	6.34
	2	9.34
	3	12.34
	4	15.34
	5	18.34
	6	21.34
	8	27.34
	10	33.34
4000 hours' operation per year and lamps purchased on \$150 contract.	1.0	23.11
	1.5	29.11
	2.0	35.11
	3.0	47.11
	4.0	59.11
4000 hours' operation per year and lamps purchased on \$1,200 contract.	1.0	21.91
	1.5	27.91
	2.0	33.91
	3.0	45.91
	4.0	57.91

smaller systems. Averages will be found at the end of each table.

OPERATING COSTS

The annual costs of operating a lighting system may conveniently be divided under three heads, as indicated in Table VIII.

To illustrate the items in Table VIII on the basis of a given type of lamp, the individual charges there outlined are given for a 300-watt Mazda "C" lamp

in Table IX.¹ The total annual operating charge is then found by adding together the items under the three heads in this table, care being taken to select the item corresponding to the proper discount for lamps and to apply the proper energy charge. Obviously if the number of hours of service per annum differs from the value used in the table, a corresponding change will be made in the maintenance and energy items.

The total annual operating costs for a 300-watt Mazda "C" lamp for various energy and discount rates are given in Table X.

COMMUTATION DEVICE FOR DIRECT-CURRENT MACHINES

Separate Commutating Generator Is Placed Outside the Main Bearing, Avoiding the Use of Sliding Contacts

In order to avoid the use of magnetic distortion due to interpole, B. Ljunstrom and A. D. Widstrom of Stockholm, Sweden, in patent No. 1,228,936, suggest the use of a separate commutating generator placed outside the main bearing and formed with a rotating armature and a stationary field structure. The supply leads for the primary winding of the commutation transformer are drawn through a hole bored in the shaft. The stationary field coils are traversed by the main current from the direct-current generator. In this way by means of a transformer a proper commutating emf. is obtained that avoids the use of sliding contacts of any kind for the connections between the commutation generator and the commutation transformer.

CRACKING HYDROCARBON VAPORS BY ELECTRICITY

Vapors Passed Through an Electric Brush Discharge Field, Increasing the Amount of Non-Condensable Gases

A process that aims to obtain by means of an electric discharge a greater yield of fixed gases from hydrocarbon vapors is the development of J. G. Davidson and R. W. Ford of Vancouver, B. C., Canada. Patent No. 1,229,042 has been granted covering the discovery that by passing such vapors through an electric brush discharge field the amount of non-condensable gases is increased. In actual tests it is claimed that by this process the amount of CH₄ in the gas has been increased from about 25 per cent to approximately 40 per cent, while the amounts of C_nH_{2n} were increased from between 7 per cent and 10 per cent to between 20 per cent and 23 per cent. Ordinarily the gas is conducted through a plurality of conduits formed as vertical pipes connected at their lower ends to a supply header and at their upper ends to an outlet header, the discharge electrode being formed as wires hung axially in the pipes from an insulated support. The pipes are grounded and the electrodes are connected by a wire to a mechanical rectifier of the usual rotary type included in the high-tension circuit of a step-up transformer, the rectifier connected to ground.

¹The data in this and in Table X are compiled from a supplement to Bulletin 20, on "Industrial Lighting," issued by the National Lamp Works of the General Electric Company, Sept. 20, 1915.

Engineering Training and Experience

An Analysis of the Qualifications of Forty-two Candidates for Electrical Engineering Position Paying \$4,000 a Year—Their Age, Schooling and Present Salary

BY RICH. D. WHITNEY

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FOR an electrical engineering position the salary of which is \$4,000 a year more than forty men filled out application papers showing their qualifications. The author was called upon to grade the papers, and in the course of the grading and analysis the facts enumerated below were brought out.

The candidates were from all parts of the United States, as the examination was not restricted to men from the State in which the position is open. Forty-two papers were fully answered, and from these this discussion is taken. The weight attached to the different questions may be divided into three parts—first, information; second, training, and third, experience.

Under information, the candidate was asked to give certain facts about himself, such as age, weight, height, etc. If any of these data were omitted, the examiner felt that the one taking the examination should be penalized. This section bore a weight of eleven points.

Under training, the extent of schooling was asked for both in regular schools and colleges and in correspondence courses. Besides which due credit was given to any research work which the candidate had done, any additional studies he had taken up, or any engineering or scientific societies of which he was a member. This section bore a weight of forty points.

Under experience, the candidate was asked to give his past history in the profession and any other qualifications which would tend to fit him for the position sought. This section bore a weight of forty-nine points.

A summary of the results which were obtained from this group of papers is shown graphically in Fig. 1. The abscissas are the numbers of the candidates from one to forty-two inclusive. Curve I shows the ages of the several candidates. Curve II shows the education which the men had received in regular schools and colleges. By adding to the ordinates of curve II the weight given to correspondence school work curve III was formed. A man who had been graduated from high school was rated at five points and the maximum rating of ten was given to a graduate of a technical college. Any academic education in excess of this did not obtain additional credit. Correspondence courses taken were given a maximum credit of four points, the greatest weight going to those who completed their courses and received a diploma.

The relative experience of the candidates is shown in curve IV. Curve V gives the total grade given each man. Curve VI shows the present salaries of the candidates in dollars per month.

Fig. 2 is a "shotgun" diagram which shows a number of points, the abscissas of which are education rating (curve II), and the ordinates salary (curve VI). Fig. 3 is a similar diagram having the same ordinates but ages (curve I) for abscissas. Fig. 4 is another diagram of the same type, having ages for abscissas and education for ordinates.

Some very interesting conclusions may be drawn from the data here shown and attention will be called to some of them. It will be noticed that in most cases a peak in the age curve is accompanied by a depression in the education curve. The salary curve does not seem to bear any definite relation to the age and education curves, but is remarkably similar to the experience curve. The experience curve, however, is more or less dependent on the age and education ratings. It is also interesting to note how symmetrical the salary curve is with respect to the one-hundred-and-fifty-dollar-per-month line.

We learn from these several diagrams that the applicants were divided as follows:

Men having had less than a high-school education.....	8
Men who were high-school graduates.....	10
Men having some college training but non-graduates.....	11
Men who were technical college graduates.....	13

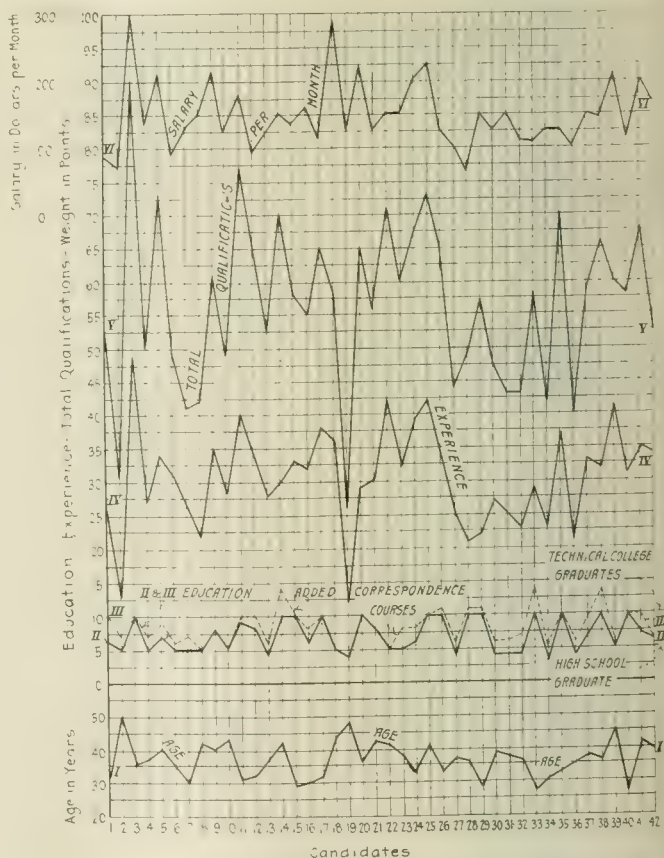
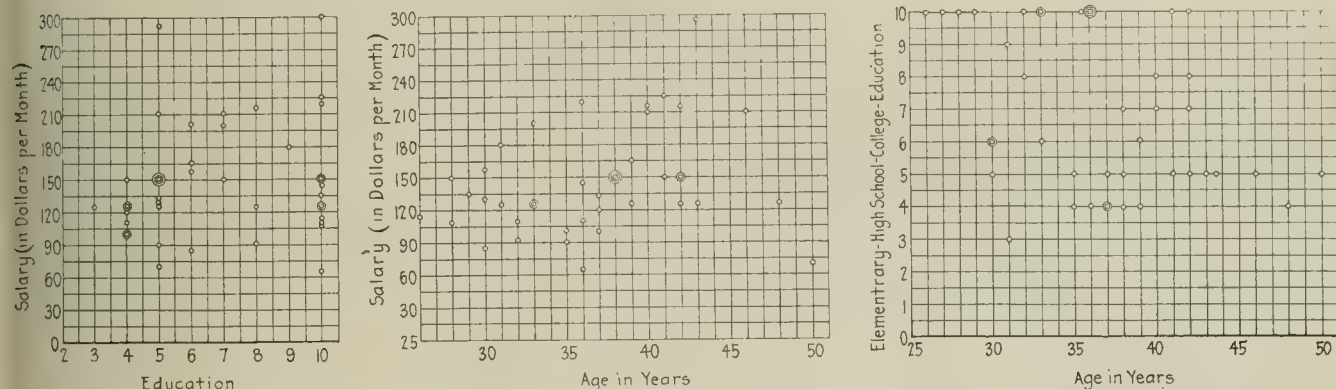


FIG. 1—RESULTS OF ANALYSIS SHOWN GRAPHICALLY

Of this number twenty-six had taken some correspondence course or courses in addition to the above resident schooling, but only four had received a diploma in such a course of any length. Only nineteen candidates were members of scientific or engineering societies, and only eleven had ever contributed anything to the technical press.

The average salary per month of the eight men who had not received a high-school diploma was \$119.38 and the average age 37.6 years; the average salary of the ten high-school graduates was \$150.80 and the average age 40.5 years; the average salary of the eleven college men who did not graduate was \$164.36 and the average age 38 years; the average salary of

its use appearing on the intervening daily log sheets. After the tubes are removed from the tanks and washed they are not always restored to the same tank. All tubes are numbered. Each tank has four tubes, only two of which are used at a time. From the log entries the hours of service of each tube are deduced, no matter how irregular may be their use. In order to keep down



FIGS. 2, 3 AND 4—"SHOTGUN" DIAGRAMS SHOWING RELATIONS BETWEEN AGE, EDUCATION AND EARNING POWER

the thirteen college graduates was \$152 and the average age 33.3 years.

Only twenty men professed knowledge of any foreign language. Thirty-three had never been discharged from a position, and of the remaining nine six had been retired from positions for reasons not to their discredit. Four of the applicants had seen some form of military service for the United States of America.

It is interesting to note that of the fifteen men receiving a total grade of 65 or above on the whole test one was a high-school graduate, four had some college training and the remaining ten were graduates of technical colleges.

HANDLING RECTIFIER TUBES

Tube Life and Factors Affecting It—Value of Washing Tubes—Limits to Operating Temperature

Extended testimony bearing upon the life and handling of rectifier tubes was recently given in the Boston Edison street-lighting case by L. L. Elden, electrical superintendent of the company. Prof. H. E. Clifford of Harvard University, expert witness for the city of Boston, had previously stated that the average life of rectifier tubes was 2500 to 3000 hours. Mr. Elden said that these figures are correct for 4-amp. tubes, but that the life of 6.6-amp. tubes is far less on the average, the manufacturers refusing to guarantee them a life of more than 400 hours. If a tube fails inside of 400 hours, based on a six months' average of all the tubes in service, new tubes will be supplied. This is not considered a satisfactory form of contract, as one long-lived tube in the lot will raise the average above 400 hours, so that the operating company cannot collect for any tube of short life if it happens to come in that settlement period. A few tubes have run from 8000 to 10,000 hours' life.

The rectifiers are operated for a time and are then rested, upon advice of the manufacturers. The rest period may run from a week to three months. The vacuum is retained in better condition and for a longer period by this course. In this way a tube may disappear from service for some months, with no record of

the number of tubes used in figuring the average life, the witness advised making contracts for the tubes required by individual rectifiers, thereby limiting the guarantee to four tubes.

About two years ago a process consisting of a hot washing treatment was devised for restoring the vacuum in used tubes. Since that time the Boston Edison company has installed a washing plant to which idle tubes are taken from time to time from various plants or substations, washed and redistributed without regard to the source from which the tubes are drawn. Up to 1913, which marked the end of about two and a half years' record-keeping experience with lava-tipped tubes, the Boston company found that their life averaged about 2089 hours, but by Dec. 1, 1914, the life had dropped to 1334 hours, or 1274 hours for all tubes in use.

Since the war began manufacturers have had great difficulty in procuring the proper type of glass, the importation of some ingredients used in the tubes having entirely ceased. No more lava-tipped tubes can be obtained by the company, which is obliged to depend upon punched-iron tubes. The new washing process has enabled the company to bring back into service tubes which were formerly considered dead from the standpoint of serviceability. The lighter the load on the rectifier, the longer the life of the tube. When the tube is loaded up to the full rating of the rectifier, a little more than 6000 volts, the tube life becomes appreciably shorter. The operation of the tubes at 50 to 80 deg. Fahr. is urged by the manufacturers. If the tubes get cold they will not operate at all, and if they become overheated the leakage through the glass quickly destroys the vacuum. The temperature of the oil tanks is carefully watched and city water is circulated to keep it within the normal limits.

About three years ago the Boston Edison company nearly reached the point of abandoning rectifiers, and the result of a period of expert supervision led to the adoption of the four-tube sets in order to keep the equipment operating satisfactorily. About \$100,000 worth of rectifiers are used in Boston proper and \$128,000 worth on the entire system.

Transmission-Line Charging Currents—II

Method of Determining Charging Currents in a Three-Phase Line with One Conductor Grounded—Transposed and Non-Transposed Systems Considered

BY R. H. MARVIN

Electrical Engineer R. Thomas & Sons Company

IN THE first part of this article, which was published in the issue of the ELECTRICAL WORLD for Aug. 11, a method of deriving the capacity coefficients of a transmission line from a simple general expression for the potential coefficient, using Maxwell's formulas, was given. The present installment, which completes the discussion, shows how the general principles brought out in the former article are applied to a three-phase line in determining the charging currents under normal conditions and when one conductor is grounded.

CHARGING CURRENTS UNDER NORMAL CONDITIONS

The usual formulas for the capacity of a three-phase line, although they neglect the effect of the earth, are sufficiently accurate for determining the charging current of a transmission line under normal conditions in most instances. It is, however, of interest to determine the charging currents in terms of the capacity coefficients, as this affords a check on the approximate formulas. Two cases will be considered:

I. Neutral grounded. All voltages to ground equal.

II. Neutral either grounded or isolated, but all conductors transposed a complete number of turns, so that all voltages to ground may be assumed equal.

A third case exists where the neutral is isolated and the phases are not transposed. As the exact solution is quite complicated it is omitted.

Let v_1, v_2, v_3 be the instantaneous potentials of the three phases to ground in volts; v the maximum potential from line to ground in volts; V the effective potential from line to ground in volts; q_1, q_2 and q_3 the instantaneous charges on the line in coulombs; i_1, i_2 and i_3 the instantaneous charging currents in amperes; I_1, I_2 and I_3 the effective charging currents in amperes; α_1, α_2 and α_3 the angles of lead of the three currents; n is the frequency in cycles per second; $\omega = 2\pi n$, and l is length of the line. The latter will be in miles if the capacity coefficients are in farads per mile.

Case I.

$$v_1 = v \sin \theta$$

$$v_2 = v \sin (\theta + 120^\circ) = v \left\{ -\frac{1}{2} \sin \theta + \frac{\sqrt{3}}{2} \cos \theta \right\}$$

$$v_3 = v \sin (\theta + 240^\circ) = v \left\{ -\frac{1}{2} \sin \theta - \frac{\sqrt{3}}{2} \cos \theta \right\}$$

$$\begin{aligned} q_1 &= l \left\{ C_{11} v_1 + C_{12} v_2 + C_{13} v_3 \right\} \\ &= lv \left\{ \left(C_{11} - \frac{1}{2} C_{12} - \frac{1}{2} C_{13} \right) \sin \theta \right. \\ &\quad \left. + \frac{\sqrt{3}}{2} (C_{12} - C_{13}) \cos \theta \right\} \end{aligned}$$

$$i_1 = \frac{dq_1}{dt} = \omega \frac{dq_1}{d\theta} \text{ for } \theta = \omega t$$

$$i_1 = \omega lv \left\{ \left(C_{11} - \frac{1}{2} C_{12} - \frac{1}{2} C_{13} \right) \cos \theta - \frac{\sqrt{3}}{2} (C_{12} - C_{13}) \sin \theta \right\}$$

$$I_1 = \omega lV \sqrt{\left(C_{11} - \frac{1}{2} C_{12} - \frac{1}{2} C_{13} \right)^2 + \frac{3}{4} (C_{12} - C_{13})^2}$$

$$\alpha_1 = \tan^{-1} \frac{C_{11} - \frac{1}{2} C_{12} - \frac{1}{2} C_{13}}{-\frac{\sqrt{3}}{2} (C_{12} - C_{13})}$$

In a like manner:

$$I_2 = \omega lV \sqrt{\left(C_{22} - \frac{1}{2} C_{23} - \frac{1}{2} C_{21} \right)^2 + \frac{3}{4} (C_{23} - C_{21})^2}$$

$$\alpha_2 = \tan^{-1} \frac{C_{22} - \frac{1}{2} C_{23} - \frac{1}{2} C_{21}}{-\frac{\sqrt{3}}{2} (C_{23} - C_{21})} - 120^\circ$$

$$I_3 = \omega lV \sqrt{\left(C_{33} - \frac{1}{2} C_{31} - \frac{1}{2} C_{32} \right)^2 + \frac{3}{4} (C_{31} - C_{32})^2}$$

$$\alpha_3 = \tan^{-1} \frac{C_{33} - \frac{1}{2} C_{31} - \frac{1}{2} C_{32}}{-\frac{\sqrt{3}}{2} (C_{31} - C_{32})} - 240^\circ$$

Case II. In this case each phase occupies the position of each conductor for one-third the length of the line. The sine component of the current for one phase in each of the three positions may be determined. Adding these three values gives the total sine component, which is zero. The sum of the three cosine components is likewise determined, and from this the effective current, giving:

$$I_1 = I_2 = I_3 = \frac{1}{3} \omega lV (C_{11} + C_{22} + C_{33} - C_{12} - C_{13} - C_{23})$$

$$\alpha_1 = \alpha_2 = \alpha_3 = 90^\circ$$

In applying the principles outlined in the first section of this article to a three-phase line with one phase grounded, a circuit with an overhead ground wire will be considered. If there is no ground wire, the terms involving its effect simply drop out. Two cases will be considered.

I. Conductors not transposed.

II. Line conductors transposed a complete number of turns.

The line conductors will be called Nos. 1, 2 and 3, No. 3 being grounded. The ground wire will be called No. 4. If it is desired to ground any other line conduc-

tor, the formulas are readily changed by simply changing the subscripts of the capacity coefficients in cyclical order. Thus, if the formulas are desired with conductor No. 1 grounded, change 3 to 1, 1 to 2, 2 to 3, in all the subscripts. Thus, $C_{3,2}$ would become $C_{1,2}$, $C_{2,3}$ would become $C_{3,1}$ or $C_{1,3}$, $C_{2,4}$ would become $C_{3,4}$, etc. The reverse change, that is 3 to 2, 2 to 1, 1 to 3, would give the equations with conductor No. 2 grounded.

It will be assumed that phase No. 1 is connected to conductor No. 1, phase No. 2 to conductor No. 2, and phase No. 3 to conductor No. 3. The current in the grounded phase, No. 3, is divided between the grounded line conductor, the ground wire and the earth. Let e_1, e_2 be the instantaneous potentials to ground of the ungrounded conductors in volts; e , the maximum potential from the ungrounded conductors to ground in volts; E , the effective voltage from line to line and from line to ground; q_1, q_2, q_3, q_4 and q_g the instantaneous charges on the conductors and earth in coulombs; i_1, i_2, i_3, i_4 and i_g the instantaneous charging currents in the conductors and earth in amperes; I_1, I_2, I_3, I_4 and I_g , the corresponding effective charging currents; $\alpha_1, \alpha_2, \alpha_3$ and α_g , the phase angles between I_1, I_2, I_3 and I_g , respectively, and E_1 , the effective voltage from phase No. 1 to ground, and α_2 the phase angle between I_2 and E_2 , the effective voltage from phase No. 2 to ground. The remaining symbols are the same as in the last section.

Case I.

$$e_1 = e \sin \theta$$

$$e_2 = e \sin (\theta - 60^\circ) = e \left(\frac{1}{2} \sin \theta - \frac{\sqrt{3}}{2} \cos \theta \right).$$

The reason that e_2 is displaced 60 deg. behind e_1 is as follows: If the voltage from No. 1 to No. 3 is $e \sin \theta$, then the voltage from 3 to 2 is $e \sin (\theta + 120^\circ)$. Therefore the voltage from 2 to 3, or the potential to ground, is $e \sin (\theta + 120^\circ - 180^\circ) = e \sin (\theta - 60^\circ)$.

$$q_1 = l \left\{ C_{1,1} e_1 + C_{1,2} e_2 \right\}$$

$$= le \left\{ \left(C_{1,1} + \frac{1}{2} C_{1,2} \right) \sin \theta - \frac{\sqrt{3}}{2} C_{1,2} \cos \theta \right\}$$

$$i_1 = \frac{dq_1}{dt} = \omega \frac{dq_1}{d\theta}$$

$$i_1 = \omega le \left\{ \left(C_{1,1} + \frac{1}{2} C_{1,2} \right) \cos \theta + \frac{\sqrt{3}}{2} C_{1,2} \sin \theta \right\}$$

$$I_1 = \omega l E \sqrt{C_{1,1}^2 + C_{1,1} C_{1,2} + C_{1,2}^2}$$

$$\alpha_1 = \tan^{-1} \frac{C_{1,1} + \frac{1}{2} C_{1,2}}{\frac{\sqrt{3}}{2} C_{1,2}}$$

In a like manner:

$$I_2 = \omega l E \sqrt{C_{1,2}^2 + C_{1,2} C_{2,2} + C_{2,2}^2}$$

$$\alpha_2 = \tan^{-1} \frac{C_{1,2} + \frac{1}{2} C_{2,2}}{\frac{\sqrt{3}}{2} C_{2,2}} + 60^\circ$$

$$I_3 = \omega l E \sqrt{C_{1,3}^2 + C_{1,3} C_{2,3} + C_{2,3}^2}$$

$$\alpha_3 = \tan^{-1} \frac{C_{1,3} + \frac{1}{2} C_{2,3}}{\frac{\sqrt{3}}{2} C_{2,3}}$$

$$I_4 = \omega l E \sqrt{C_{1,4}^2 + C_{1,4} C_{2,4} + C_{2,4}^2}$$

$$\alpha_4 = \tan^{-1} \frac{C_{1,4} + \frac{1}{2} C_{2,4}}{\frac{\sqrt{3}}{2} C_{2,4}}$$

$$I_g = \omega l E \sqrt{C_{1,g}^2 + C_{1,g} C_{2,g} + C_{2,g}^2}$$

$$\alpha_g = \tan^{-1} \frac{C_{1,g} + \frac{1}{2} C_{2,g}}{\frac{\sqrt{3}}{2} C_{2,g}}$$

The quadrant in which the angles α_3, α_4 and α_g lie can be easily determined from the condition that I_3, I_4 and I_g must be so located that their resultant with I_1 and I_2 is zero. The total current in phase No. 3 is the vector sum of I_3, I_4 and I_g . The total current in the connection to the ground is the vector sum of I_4 and I_g .

Case II. The transposition of the line conductors causes each phase to occupy the position of each line conductor for one-third the length of the line. The formulas are derived by taking the sine and cosine components of the current for one-third the length of the line with the three phases in each of the three positions, adding these to give the total components for each phase, and combining the components to give the total current. The following simple formulas result:

Let

$$S_1 = (C_{1,1} + C_{2,2} + C_{3,3})$$

$$S_2 = (C_{1,2} + C_{1,3} + C_{2,3})$$

$$S_4 = (C_{1,4} + C_{2,4} + C_{3,4})$$

$$S_g = (C_{1,g} + C_{2,g} + C_{3,g}).$$

Then:

$$I_1 = I_2 = \frac{1}{3} \omega l E \sqrt{S_1^2 + S_1 S_2 + S_2^2}$$

$$I_3 = \frac{1}{\sqrt{3}} \omega l E S_2$$

$$I_4 = \frac{1}{\sqrt{3}} \omega l E S_1$$

$$I_g = \frac{1}{\sqrt{3}} \omega l E S_g$$

$$S_1 + \frac{1}{2} S_2$$

$$\alpha_1 = \tan^{-1} \frac{\sqrt{3} S_2}{2 S_1 + \frac{1}{2} S_2}$$

$$S_2 + \frac{1}{2} S_1$$

$$\alpha_2 = \tan^{-1} \frac{\sqrt{3} S_1}{2 S_2 + \frac{1}{2} S_1} + 60^\circ$$

$$\alpha_3 = \alpha_4 = \alpha_g = -120^\circ.$$

An examination of the expressions for α_1 and α_2 shows that α_1 is greater than 90 deg. by the same amount that α_2 is less than 90 deg., this being due to the charging current between phases Nos. 1 and 2.

Several examples from existing transmission lines will now be worked out.

Transmission Line A.—This line is a 33,000-volt, 40-cycle, three-phase, non-grounded system. The conductors are No. 0 B. & S. solid copper. The wires are transposed every 3 miles (4.8 km.) and are carried on pin-type insulators on wooden poles. There is no ground wire. The length of the line is 32 miles (51.5

TABLE I—DATA ON TRANSMISSION LINE IN FIG. 3

$E = 33,000$ volts
$V = 19,050$ volts
$n = 40$ cycles
$\omega = 251.3$
$l = 32$ miles
$a_1 = a_2 = a_3 = .162$ in.
$(1, 2) = (2, 3) = 36$ in.
$(1, 3) = 51$ in.
$(1, 1') = (2, 2') = 552$ in.
$(3, 3') = 480$ in.
$(1, 2') = 553$ in.
$(1, 3') = 481$ in.
$(2, 3') = 516$ in.

km.). Fig. 3 shows the arrangement of the wires and the spacing between the wires and their images. The necessary data are given in Table I.

For all the following calculations five-place logarithms have been used and the results carried to four figures. Substituting these values in the formulas for the potential coefficients, the following values are obtained:

$P_{1,1} = 3.5324$	$P_{2,2} = P_{1,1}$	$P_{3,3} = 3.4717$
$P_{1,2} = 1.1864$	$P_{1,3} = .9745$	$P_{2,3} = 1.1563$

The preceding values are next substituted in the formulas for the capacity coefficients of three wires, giving in farads per mile:

$C_{1,1} = 1.285 \cdot 10^{-8}$	$C_{1,2} = -.3518 \cdot 10^{-8}$	$C_{1,g} = -.6898 \cdot 10^{-8}$
$C_{2,2} = 1.330 \cdot 10^{-8}$	$C_{1,3} = -.2434 \cdot 10^{-8}$	$C_{2,g} = -.6339 \cdot 10^{-8}$
$C_{3,3} = 1.302 \cdot 10^{-8}$	$C_{2,3} = -.3443 \cdot 10^{-8}$	$C_{3,g} = -.7143 \cdot 10^{-8}$

As the conductors are transposed, the formulas of Case II will be used for the charging current in both the normal condition and with phase No. 3 grounded, giving:

	—Charging Current— Amperes	Per Cent of Normal
Normal current	2.480	100
Phase No. 3 grounded		
I_1	3.134	126
I_2	3.134	126
I_3	1.440	58
I_4	3.123	126
$I_3 + I_4$	4.563	184
$a_1 = 103^\circ 17'$	$a_2 = 76^\circ 43'$	$a_3 = a_g = -120^\circ$

This line was actually grounded when operating at 23,000 volts, and the current to ground, I_g , measured, and found to be 2.4 amp. Reducing the calculated value to 23,000 volts gives 2.176, or 90.7 per cent of the measured value.

Transmission Line B.—This example illustrates the effect of a ground wire. The system operates at 33,000 volts, 40 cycles, three phase, ungrounded. The con-

TABLE II—DATA ON TRANSMISSION LINE IN FIG. 4

$E = 33,000$ volts
$V = 19,050$ volts
$n = 40$ cycles
$\omega = 251.3$
$l = 21$ miles
$a_1 = a_2 = a_3 = .243$ in.
$a_4 = .187$ in.
$(1, 2) = (2, 3) = 120$ in.
$(1, 3) = 240$ in.
$(1, 4) = 132$ in.
$(2, 4) = 228$ in.
$(3, 4) = 340$ in.
$(1, 1') = 1656$ in.
$(2, 2') = (1, 3') = 1416$ in.
$(3, 3') = 1176$ in.
$(4, 4') = 1824$ in.
$(1, 2') = (2, 3') = 1536$ in.
$(1, 4') = 1740$ in.
$(2, 4') = 1620$ in.
$(3, 4') = 1500$ in.

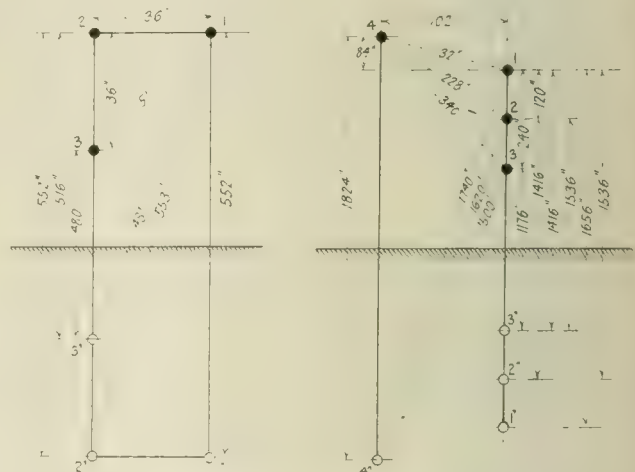
ductors are No. 3/0 seven-strand, hard-drawn copper. The ground wire is $\frac{3}{8}$ -in. (95.2-mm.) diameter Siemens-Martin' stranded-steel cable. The line is carried by suspension insulators on steel towers and is 21 miles (33.7 km.) long. The wires are transposed six times, giving the line two complete turns. Fig. 4 shows the wires, the spacing between the wires, and the spacing between the wires and their images. The data are given in Table II.

From the data given:

$P_{1,1} = 3.8335$	$P_{2,2} = 3.7655$	$P_{3,3} = 3.6848$	$P_{4,4} = 3.9892$
$P_{1,2} = 1.1072$	$P_{1,3} = .7709$	$P_{3,4} = 1.1199$	$P_{2,3} = 1.1072$
$P_{2,4} = .8516$	$P_{3,4} = .6446$		

Substituting these values in the formulas for the capacity coefficients of four conductors gives in farads per mile

$C_{1,1} = 1.210 \cdot 10^{-8}$	$C_{1,3} = -.1354 \cdot 10^{-8}$	$C_{1,g} = -.5585 \cdot 10^{-8}$
$C_{2,2} = 1.233 \cdot 10^{-8}$	$C_{1,4} = -.2608 \cdot 10^{-8}$	$C_{2,g} = -.5414 \cdot 10^{-8}$
$C_{3,3} = 1.193 \cdot 10^{-8}$	$C_{2,3} = -.2919 \cdot 10^{-8}$	$C_{3,g} = -.6711 \cdot 10^{-8}$
$C_{4,4} = 1.101 \cdot 10^{-8}$	$C_{2,4} = -.1444 \cdot 10^{-8}$	$C_{4,g} = -.6012 \cdot 10^{-8}$
$C_{1,2} = -.2553 \cdot 10^{-8}$	$C_{3,4} = -.0946 \cdot 10^{-8}$	



FIGS. 3 AND 4—ARRANGEMENT OF CONDUCTORS FOR TWO TYPICAL CASES CONSIDERED

The charging currents are determined by the formulas for transposed conductors.

	—Charging Current— Amperes	Per Cent of Normal
Normal current	1.448	100
Phase No. 3 grounded		
I_1	1.943	134
I_2	1.943	134
I_3 .....	.686	47
I_4 .....	.503	35
$I_3 + I_4$	1.189	82
$I_3 + I_4 + I_g$	2.284	158
$I_3 + I_4 + I_g$	2.970	205
$a_1 = 100^\circ 10'$	$a_2 = 79^\circ 50'$	$a_3 = a_4 = a_g = -120^\circ$

This line was grounded and the current to ground, I_g , found to be 2.95 amp., with a voltage of 32,160. The calculated value at this voltage is 2.226 amp., or 75.5 per cent of the measured value.

CONCLUSIONS

The agreement between the calculated charging currents and the measured values is not so good as could be desired. However, it does not appear so poor when the conditions which exist on any actual line, but which on account of their unknown amount have to be omitted in a calculation, are considered. One of the factors which affect the agreement between the calculated and measured values is the capacity of the transformers and

the line insulators. Another, and probably the most important one, is the presence of harmonics in the voltage wave. As charging currents are proportional to the frequency as well as the voltage, a small variation in the voltage wave from a true sine form will produce a decided increase in the charging current. Also the unbalanced charging currents in the grounded condition will tend to produce a distortion of the generator voltage which does not exist under normal conditions. However, the calculated values give a fair approximation of the actual values and probably show very closely the relative distribution of the currents between the various conductors and the ground.

LINE CONSTRUCTION COST

Data Presented in a Hearing Before Massachusetts Public Service Commission

Contract costs of setting and equipping transmission-line poles and stringing conductors were presented recently by Harold A. Ley, president of the contracting organization of Fred. T. Ley & Company, in the Boston Edison hearing before the Massachusetts commission. The data are given in accompanying tables. Although these costs are not "war prices," they are of interest as representing the normal amounts which must be paid for such work.

Ninety per cent of the work of the Ley company last year was done on a cost plus a percentage basis. The cost includes a profit figured from a sliding scale that ranges from 7.5 to 15 per cent, the former percentage applying where the total volume of business done in any one year for any one concern exceeds \$1,500,000. Mr.

TABLE I—OVERHEAD-LINE CONTRACT UNIT COSTS

	Malden*	New Haven†	Boston‡
Setting:			
25-ft. poles.....	\$2.50		\$2.25
30-ft. poles.....	2.50	\$4.00	2.25
35-ft. poles.....	2.75	4.25	2.50
40-ft. poles.....	3.50	4.75	2.90
45-ft. poles.....	6.00	6.75	4.00
(One to four poles.....)	4.50		
(Five to nine poles.....)			
(Ten or more poles.....)			
50-ft. poles.....	10.00	8.50	9.00
(Five to nine poles.....)	7.25		6.50
(Ten or more poles.....)	5.75		5.15
55-ft. poles.....	11.50	11.00	10.35
(Five to nine poles.....)	8.50		7.65
(Ten or more poles.....)	7.00		6.30
60-ft. poles.....	13.00	13.00	11.70
(Five to nine poles.....)	9.75		8.80
(Ten or more poles.....)	8.00		7.20
65-ft. poles.....	16.00	16.00	14.40
(Five to nine poles.....)	12.25		11.00
(Ten or more poles.....)	10.50		9.50
Shaving and trimming.....	1.00	1.00	0.90
Gaining (per gain).....	0.25	0.25	0.20
Stepping (per step).....	0.05	0.05	0.05
Painting.....	0.05	0.05	0.04
Stenciling, with background.....	0.10	0.15	0.10
Hauling over 2 miles.....	0.50	0.50	0.30
Excavating, all sizes.....	1.50		1.40
Setting, extra, for furnished walk.....	2.00	2.50	1.50‡
Excavating rock and blasting (per pole).....	7.50	10.00	6.75
Bolting or lagging cross-arms.....	1.25	1.65	1.50
Installing braces (each).....	0.20	0.60	0.25
Installing long outrigger brace (each).....	0.70	0.90	0.90
Installing insulators (each).....	0.03	0.03	0.03
Installing magnetite-arc lamp or the like (each).....	3.00	3.65	
Installing fixtures on incandescent lamp poles.....		1.30 to 1.75	

*1913 prices. †1916 prices. ‡1914 prices. §Brick or block pavement only; concreting under post adds 33½¢ per cent.

TABLE II—UNIT PRICES FOR STRINGING WIRE AT MALDEN, NEW HAVEN AND BOSTON

Size of Equivalent Copper Conductor	CONTRACT PRICE PER 1000 FT.		
	Malden	New Haven	Boston†
4-0 copper.....	\$15.00	\$16.30	\$18.30
Aluminum.....	12.00		14.60
3-0 copper.....	12.00	14.60	14.60
Aluminum.....	10.50		12.90
2-0 copper.....	12.00	14.60	14.60
Aluminum.....	9.80		11.95
1-0 copper.....	11.60	14.20	14.20
Aluminum.....	9.00		11.00
No. 1 and under, copper	8.25	10.15	10.15
Aluminum.....	7.50		9.15

*Includes putting up, tying in and connecting to existing overhead circuit, wires, taps, etc., but not connection to underground cables. †1914 prices.

TABLE III—UNIT COSTS OF VARIOUS LINE CONSTRUCTION OPERATIONS

	Malden	New Haven	Boston*
Hauling‡ slack for 1-0 and larger (per 1000 ft.).....	\$5.50		\$6.80
Hauling‡ slack for 1 and smaller (per 1000 ft.).....	4.00		4.80
Changing‡ 1-0 and larger (per 1000 ft.).....	8.25	\$10.15	10.15
Changing‡ 1 and smaller (per 1000 ft.).....	6.85	8.40	8.40
Changing ties§ (per tie).....	0.50	0.55	
Connecting drop wires to overhead (per ft.).....	0.06	0.075	0.075
Connecting drop wires to underground (per joint).....	0.70		0.90
Installing guys from pole to two-way anchorage (per guy).....	4.00	4.10	4.10
Installing guys from pole to three-way anchorage (per guy).....	6.25	6.40	6.40
Installing guys from pole to four-way anchorage (per guy).....	8.25	8.45	8.45
Removing guys of all kinds (per guy).....	1.35	2.50	1.00
Changing guys (per attachment).....	2.00	2.50	2.00
Cutting in strain insulators in existing guys (per insulator).....	2.00	2.00	2.00
Planting guy anchor (rod and slug), per anchor.....	4.00	4.10	4.10
Installing anchor bolts in rock (per anchor).....	2.00	2.00	2.00
Installing eye-bolts in pole or tree (per bolt).....	0.70	1.00	0.75

*1914 prices.

‡Includes untying, cutting, pulling up, jointing, tying in and changing as required.

§Covers changing tie wires on account of work on pins, insulators or cross-arms.

§On account of change of work on pins, insulators, cross-arms or poles, including care and temporary support of wires during work.

Ley said that a 15 per cent profit is figured on jobs where only labor items enter. The overhead cost of small tools, etc., is taken out of the 15 per cent. Liability insurance on overhead work now amounts to 6 per cent. The cost of digging implements, blasting tools, spikes, pole-raising equipment, ropes, come-alongs, rubber gloves, pliers, etc., figures 3.5 per cent of the payroll.

Roughly, 25 per cent of the work of the Ley organization is for public service corporations. The unit prices charged in different contracts depend on local conditions. A small job under competitive conditions naturally calls for a higher unit price. Mr. Ley said that in 1907 he paid \$1.50 per ten-hour day for common labor with no allowance for holidays and rainy days. Linemen then received \$2.75 for nine hours' work on the job. In 1914 common labor was paid about \$2 for nine hours, and linemen were paid \$3.50 for nine hours' time, traveling one way on their own time and being paid by the Ley company for holidays and all rainy weather. Common labor is now paid on holidays and in bad weather. At present linemen are being paid \$4.50 for nine hours and common labor demands about 30 cents per hour. Nothing like the amount of work of ten years ago is to be obtained from men to-day.

Regulation with V-Connected Transformers

Variation of Secondary Terminal Voltage with Various Combinations of Load Impedance and Power Factor—Effect of Phase Rotation on Secondary Voltage

BY LESLIE F. CURTIS

University of Washington, Seattle

TO DETERMINE the effect of phase rotation and various load conditions and power factors on the secondary terminal voltage of V-connected transformers an investigation* was conducted under the supervision of the writer, the conclusions from which are given herewith. The method of conducting the study follows:

In order to simplify the work, a vector diagram

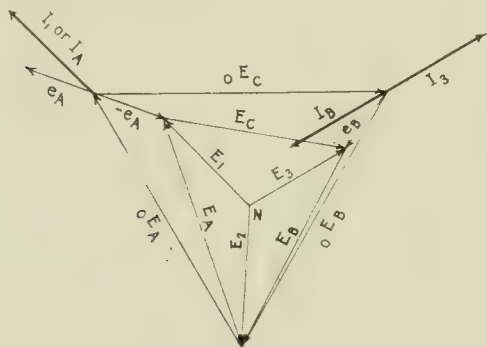


FIG. 1—GENERAL CASE FROM WHICH SOLUTIONS FOR VECTOR LOAD CURRENTS AND LINE VOLTAGES WERE DERIVED

(Fig. 1) was chosen, indicating a general case, and from this equations were developed which give general solutions for the vector load currents and line voltages. In these general equations values of transformer and load impedances were substituted and numerical values of secondary line voltage found for the following conditions: (1) Balanced load impedances for all the phases; (2, 3, 4) equal load impedances for the first and second, first and third and second and third phases respectively; (5, 6, 7) first, second and third phases respectively loaded alone. Curves of the three terminal voltages were plotted against power factor for each of the seven cases given. The load impedances were so selected in each case that the maximum transformer current would be 150 per cent of full-load current at full voltage.

The calculations were made as follows: Let the primary voltages of the three phases, from line 2 to line 1, line 3 to line 2, and line 1 to line 3, respectively, be expressed as follows (readers will please note that vector symbols are indicated by roman letters (*E*, *I*, *Z*, *e*) in contradistinction to the italic symbols employed in all other cases):

$${}_0E_a = E (-0.5 + 0.867j) \quad (1)$$

$${}_0E_b = E (-0.5 - 0.867j) \quad (2)$$

$$\text{and } {}_0E_c = E \quad (3)$$

where *E* is the effective value of the primary voltage, and *j* indicates a rotation of 90 deg. in a counter-clockwise direction, which is taken as positive. The phase rotation is therefore A-C-B.

Assuming that transformers of impedance *Z_a* and *Z_b*

are placed across phases A and B, and that the secondaries are loaded with star-connected impedances *Z₁*, *Z₂* and *Z₃*, terminating in lines 1, 2 and 3 respectively, the drop in transformer A is expressed by

$$e_a = Z_a I_a \quad (4)$$

where *I_a* is the current through it. Likewise the drop in transformer B is

$$e_b = Z_b I_b \quad (5)$$

If *I₁*, *I₂* and *I₃* represent the currents in lines 1, 2 and 3 respectively, and *E₁*, *E₂* and *E₃* the respective voltages to neutral, then

$$E_1 = Z_1 I_1 \quad (6)$$

$$E_2 = Z_2 I_2 \quad (7)$$

$$\text{and } E_3 = Z_3 I_3 \quad (8)$$

Obviously, as in any system,

$$I_1 + I_2 + I_3 = 0 \quad (9)$$

and the relations between the transformer and line currents are as follows:

$$I_a = I_1 \quad (10)$$

$$\text{and } I_b = -I_3 \quad (11)$$

The secondary terminal voltage of transformer A may be expressed as

$$E_a = E_1 - E_2$$

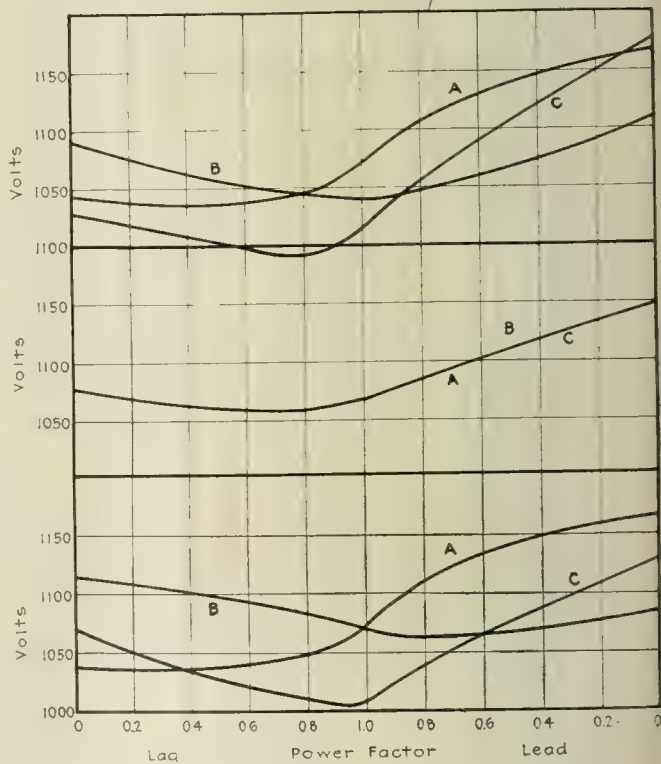


FIG. 2, 3 AND 4—APPLICATIONS OF CASES I, II AND III

which, by substituting (6) and (7), becomes

$$E_a = Z_1 I_1 - Z_2 I_2 \quad (12)$$

The terminal voltage of transformer A may also be expressed from (1) and (4) as $E_a = E (-0.5 + 0.867j) - Z_a I_a$. Substituting (10) in this equation, it becomes $E_a = E (-0.5 + 0.867j) - Z_a I_1$ (13)

*The author is indebted to Verne Hansen for work done on a thesis on the above topic published under the author's direction at the University of Washington (Seattle) in 1915, and to B. F. Jakobsen's paper in the ELECTRICAL WORLD in 1915. Mr. Hansen's work showed experimentally the results obtained by calculation in the present article.

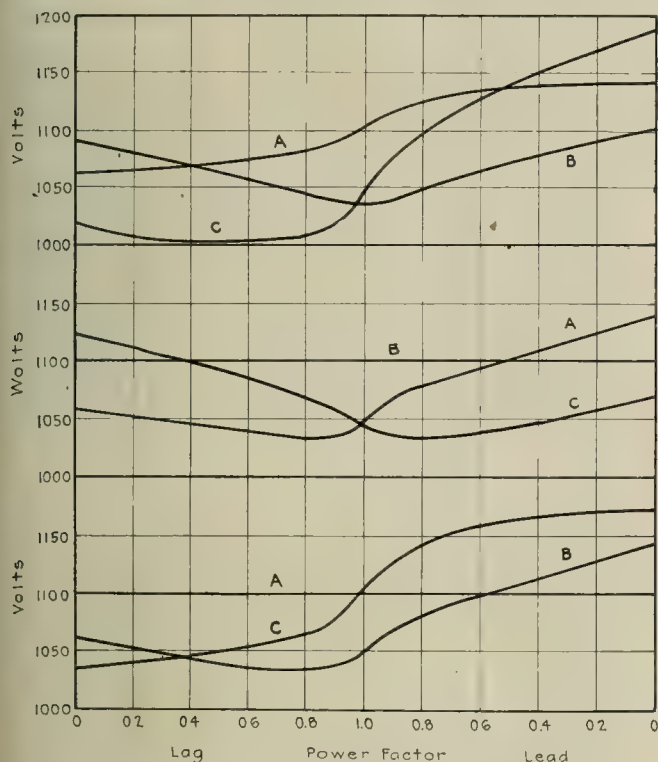
Equating (12) to (13), substituting the value of I_2 from (9) and transposing, gives

$$I_1 (Z_1 + Z_2 + Z_a) + Z_1 I_3 = E (-0.5 + 0.867j) \quad (14)$$

In a like manner from (7), (8), (2), (5), (11) and (9),

$$I_3 (Z_3 + Z_2 + Z_b) + Z_3 I_1 = E (+0.5 + 0.867j) \quad (15)$$

Equations (14) and (15) are simultaneous in I_1 and I_3



FIGS. 5, 6 AND 7—APPLICATIONS OF CASES IV, V AND VI

and are readily solved on substituting the respective values of Z and E .

The third line current is then found from (9) to be $I_2 = -I_1 - I_3$, and the three line voltages from (12) are

$$E_a = Z_1 I_1 - Z_2 I_2,$$

$$E_b = Z_2 I_2 - Z_3 I_3,$$

and

$$E_c = -E_a - E_b.$$

APPLICATION OF GENERAL EQUATIONS

Applications of the general equations are given below. In each case 10-kw., 1100-volt transformers of equal impedance $(4 + 3j)$ ohms are assumed to be operating with load impedances giving all power factors for the seven cases noted below.

Case I. Three Balanced Load Impedances.—The effective value of the impedances to neutral for 150 per cent of normal rated load current at normal voltage is

$$\frac{1100}{\sqrt{3}} \times \frac{1100}{10,000 \times 1.5} = 46.5 \text{ ohms.}$$

The vector quantities corresponding to this effective value at various power factors are

+46.5 ohms at unity power factor,

+46.5j ohms at zero power factor lagging,

−46.5j ohms at zero power factor leading,

and

+46.5 $(0.5 + 0.867j)$ ohms at 0.5 power factor lagging, etc.

Substituting these values in the general equations gives effective values for E_a , E_b and E_c which are plotted against power factor in Fig. 2.

Case II. Phases A and B Loaded.—In this case Z_2 equals zero. The effective values of the impedances Z_1 and Z_3 are $\frac{\sqrt{3} \times 1100 \times 1100}{10,000 \times 1.5} = 140$ ohms. As in case

I, the vector values are substituted and curves of terminal voltages are plotted in Fig. 3.

Case III. Phases A and C Loaded.—This is the same as case II, except that Z_1 instead of Z_2 equals zero. (See Fig. 4.)

Case IV. Phases B and C Loaded.—This is the same as case II, except that Z_3 instead of Z_2 equals zero. (See Fig. 5.)

Case V. Phase A Loaded.—In this case the effective value of the impedance Z_1 for 150 per cent of normal rated current at 1100 volts is $\frac{1100 \times 1100}{10,000 \times 1.5} = 80$ ohms.

Z_2 equals zero and Z_3 equals infinity. (See Fig. 6.)

Case VI. Phase B Loaded.—This is the same as case V, except that the effective value of Z_3 is 80 ohms, Z_2 is zero and Z_1 is infinity. (See Fig. 7.)

Case VII. Phase C Loaded.—This is the same as the last two cases except that the effective value of Z_3 is 80 ohms, Z_1 is zero and Z_2 is infinity. (See Fig. 8.)

CONCLUSIONS

With balanced load impedances at unity power factor, (Fig. 2), it will be noted that the terminal voltages are highest on phase A and lowest on phase C. The terminal voltages of the two transformers (phases A and B) are dependent upon the vector drops of voltage in them. The unbalance is then due to the fact that the current in transformer A leads the supply voltage on that phase by a small angle, thus having a tendency to boost the terminal phase voltage, while the current in transformer B lags behind the supply voltage for that phase, thus having a tendency to lower the terminal phase voltage. The angles of lead and lag noted above will not be just 30 deg., since the terminal voltages are unsymmetrical, giving load currents unbalanced both in effective value and in phase position. The vector relations between the losses in voltage noted are such that the terminal voltage of phase C is lowered most of all.

The relations at other power factors and loads may be explained in a similar way. The conditions of loading chosen are perhaps abnormal, or at least the worst

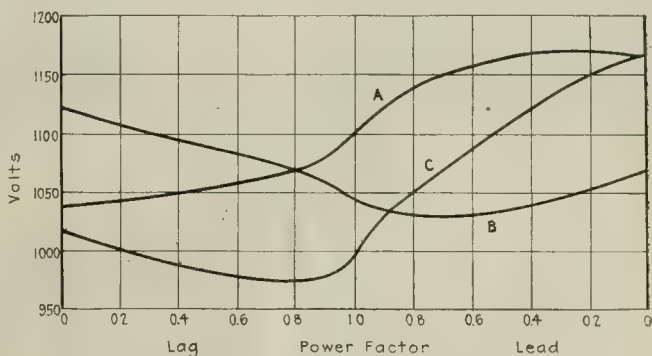


FIG. 8—APPLICATION OF CASE VII

that will ever be met in practice, but show the unbalance of terminal voltage which may be expected with the open-delta or V connection of transformers.

It may be noted that there is a wide variation between the three line voltages in the examples given. An exception is found in case II (Fig. 3), where the terminal voltages of all three phases are alike.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

SELECTING CLAY FIREBRICK

Advantages and Uses of Various Types—Their Resistance to Heat

First-quality hand-made brick should be used where the temperature is high and variable and the heating and cooling are sudden and rapid. A good hand-made brick should be coarse in texture, light buff in color, with no iron spots, and should give a slight ring when struck. The face of a fracture should be rough and coarse-grained. Hand-made brick is highly refractory, expands only slightly under high heat and resists sudden changes of temperature, but wears away rapidly under abrasion. The dry-press grade is almost as refractory as the hand-made, and expands only a little more, resists sudden changes of temperature fairly well and stands up better under mechanical action. The steam-press grade is less refractory and breaks down under sudden changes of temperature, but resists abrasion better than either of the other types mentioned.

UNLOADING COAL FOR EMERGENCY STORAGE

Method Described Found Satisfactory and Cost Much Less than That of Any Method of Digging Coal from Cars

BY WILLIAM C. BELL

Assistant General Superintendent Light and Power, Virginia Railway & Power Company

In storing coal in quantities, in excess of the normal storage and bunker capacity, the cost of unloading and reloading is apt to be excessive. A method which has

Coal in straight hopper-bottom cars or twin drop-flat cars is then pushed on these tracks and the unloading doors in the bottom of the car are opened. The coal is deposited over the tracks and between the ties.

An 8-in. by 8-in. (20.3-cm. by 20.3-cm.) timber inserted in front of the rear trucks serves to spread out the coal and clear the track sufficiently for the empty car to be removed. After the entire length of track has been covered with coal in the manner described, it is only necessary to use ordinary track jacks and raise the track on the coal which has been previously unloaded. If 12-in. by 12-in. (30.5-cm. by 30.5-cm.) timber is used as ties, a 50-ton (45-t.) car of coal can be unloaded in from 50 ft. to 75 ft. (15 m. to 22.5 m.) of track.

It has been found inadvisable to build up a coal track higher than 10 ft. or 15 ft. (3 m. or 4.5 m.), owing to the danger of spontaneous combustion. When the coal pile has reached this height, it is only necessary to reconstruct the track, beginning on the ground and building up a second pile. For reclaiming the coal, the track is constructed on the ground alongside the coal pile, the coal being dug from the pile by a locomotive crane. As the coal is removed the track is moved sideways to keep the locomotive crane at a proper distance from the coal pile. Standard railway cars are used to transfer the coal from the coal pile to the coal-handling equipment. It has been possible with this method to unload from 400 tons to 500 tons (360 t. to 450 t.) of coal per eight-hour working day on 200 ft. (61 m.) of track. This method can only be used when a locomotive is available, inasmuch as considerable power is required to pull the coal cars after they have been dumped.



FIGS. 1 AND 2—TRACK IS JACKED UP AFTER COAL IS UNLOADED; SILL PLACED IN FRONT OF CAR WHEELS TO DISTRIBUTE COAL

the advantage of low cost and relatively great speed has been used by the Virginia Railway & Power Company. This consists of building standard-gage railway tracks on 8-ft. (2.4-m.) ties, spaced on 4-ft. (1.2-m.) centers.

The illustrations explain the method, which has been used extensively in unloading ballast for steam roads, and works out as well with coal as with gravel and other ballast.

FAULT IN ELECTRIC FURNACE CONTROL WIRING REMEDIED

Unsuitable System of Control Connections and
Method Adopted by a Northern Steel Mill
for Rectifying It

When the first of a recently installed battery of Heroult steel furnaces was placed in service in a Northern steel mill, great difficulties were experienced in its regulation and the maintenance of a balanced current either by hand or automatic regulation was found

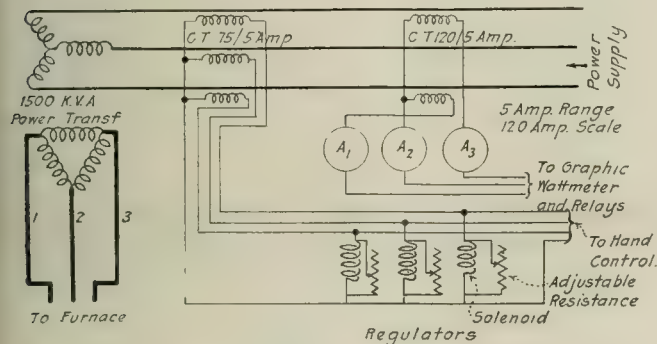


FIG. 1—WIRING BEFORE CHANGE WAS MADE

almost impossible. A balanced reading being obtained on the ammeter, the condition was most unstable, and an increase of current in one line was as likely as not to be further increased by raising the corresponding electrode out of the bath.

The arrangement of the wiring was compared with the diagrams supplied and, as far as was possible, it was found to check perfectly and to be as shown in Fig. 1. The ammeter readings were found to be proportioned to the currents in the regulator coils, and the graphic wattmeter circuits were normal. Some time was taken in determining the connections of the 1500-kva., three-phase transformer, and this was found to be star-delta. It will be seen that with such an arrangement the currents in the ammeters and regulators will not of necessity be proportional to those in the electrodes, for the current in each electrode is the resultant of the currents in two secondary windings of the transformer, which are in turn proportional to those in two of the primary lines. As this system was manifestly useless for control purposes the problem became one of getting significant currents in the meters and

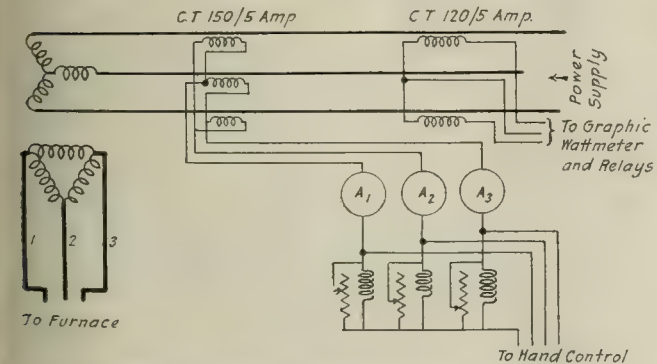


FIG. 2—WIRING AFTER CHANGE WAS MADE

regulators and of doing this, if possible, without allowing the furnace to cool.

A reconnection of the power transformers was out of the question both for electrical and mechanical rea-

sons. Series transformers for the secondaries were suggested, but such transformers suitable for 10,000 amp. could not be purchased or made at short notice.

The problem had a simple solution: The three 75/5 current transformers on the regulator circuits were replaced by 120/5, of which a considerable number, intended for the meter circuits of the other furnaces, were on hand. The secondaries of these were connected in delta, thus duplicating the power wiring; the ammeters were placed in series with the regulators and the wiring was left as in Fig. 2. With these changes made, the furnace was found to operate normally, whether on hand or automatic regulation, and the arrangement was adopted for the other furnaces which were being installed, though it was found desirable to replace the 120/5 current transformers by 150/5 ratio to get more suitable currents in the ammeter and regulator windings.

MAKING TWO COMPENSATORS SERVE A SUBSTATION

Methods of Connecting One Compensator and a
Spare to Serve as Starters for Several
Motor-Generator Sets

In some of the substations of the Pacific Gas & Electric Company at San Francisco where several motor-



SWITCHES THAT PERMIT USING EITHER OF TWO COMPENSATORS
TO START MOTOR-GENERATOR SETS IN STATION

generator sets are installed it has been found that a considerable investment can be saved by starting all machines from one compensator. This had the objection, however, that in case the compensator should become inoperative for any reason starting of any machines would be prevented. Two compensators are therefore installed and connected by six double-throw single-pole knife switches, as shown above.

This arrangement makes it possible to use either compensator for starting any number of machines of the same rating. Since the knife switches would necessarily be de-energized when operated, there is no necessity for additional oil switches.

OUTDOOR SUBSTATIONS OF SOUTHERN COMPANY

**Inexpensive but Substantial Method of Construction
Followed in Providing for the Needs of
Large Power Consumers**

BY N. NESBITT TEAGUE

Augusta-Aiken Railway & Electric Corporation, Augusta, Ga.

Outdoor substations constructed as simply as possible, inexpensively, but at the same time utilizing a good grade of material, are employed by the Augusta-Aiken

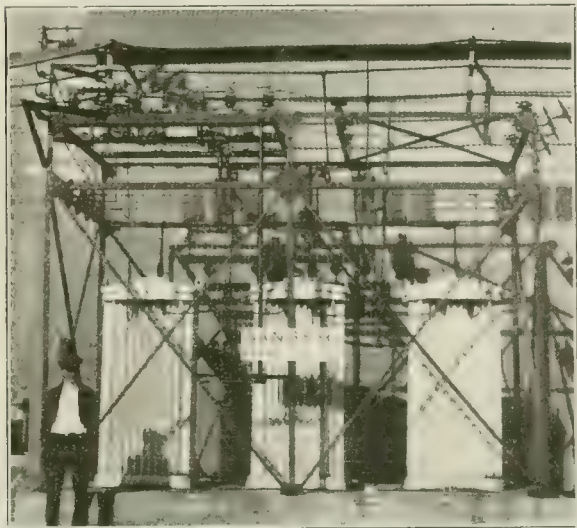


FIG. 1—STANDARD 13,200-VOLT OUTDOOR SUBSTATION

Railway & Electric Corporation for serving large power users. In the average-size installation one, two or three poles are used generally, as shown in Fig. 2. In special



FIG. 2—TWO TYPES OF STANDARD WOOD-POLE SUBSTATION

cases on large installations the use of steel angle-iron framework is employed for supporting the switches, fuses, busbars and meter. The transformers in all cases are placed as near the ground as possible, and when small wood-pole structures are used the trans-

formers are placed directly on the ground, a few old rails embedded in the earth serving as a foundation. This practice makes it convenient to replace or remove transformers. Transformers are raised only when there is occasion to locate the apparatus on some public street. Fences are provided around the transformers, wires, etc., to protect the public and also animals. Metering is accomplished on either the high-tension or low-tension side of the transformers, as conditions require, and generally with outdoor home-made housing such as described on page 1262 of the June 30, 1917, issue of the *ELECTRICAL WORLD*. The cost of the substations, rated from 300 kva. to 900 kva., with steel framework, electrolytic arresters, etc., varies from \$4 to \$6 per kva. This work is carried on under the supervision of J. J. Borger, general superintendent of the electrical department.

MOTION-PICTURE MACHINE TROUBLE EASILY REMEDIED

**Fuses Blew Continually—Upon Investigation Trouble
Was Found to Be Caused by Use of
Short Carbons**

BY J. R. BALDWIN

A motion-picture theater had trouble owing to the blowing of the 60-amp. fuses in the arc-light circuit of the picture machine and the 100-amp. main-line fuses. The arc was controlled by an old-type Edison controller and a 110-volt, 30-40-60-amp. "Compensarc." A contractor was called in and he reinsulated the carbon holders and finally held the current down by connecting two "Compensarcs" in series.

Tests made by an inspector showed that the 60-amp. fuses would blow with one "Compensarc" connected, and this occurred when the carbons were touched together to draw an arc. Both of the carbons were short, and when new long carbons were put in the trouble ceased. The customer had recently changed the style of carbons, having bought soft flaming carbons when he had been using hard ones. The new carbons had a comparatively lower resistance. On the modern style of picture machines the short carbons are used with long ones, the arc being brought to the correct position by having a long vertical adjustment.

POLES IN PAVED ALLEYS

**Protection Should Be Provided from the Hubs of
Wagons Guided by Careless Drivers**

One large Middle Western company is considering the adoption of a new practice with regard to poles set in paved alleys. It is proposed that in the future all such poles be installed with mud guards to protect them from damage caused by the pole being struck with the hubs of passing wagons. Observation of poles in a number of alleys indicates that this damage is more prevalent in alleys which are paved than in those which are not paved. This probably results from the fact that ruts wearing in the unpaved alleys tend to keep the wheels of the vehicles away from the poles. This is a rather fortunate circumstance, because it is not desirable to install guards on poles set in unpaved alleys, since the guards may become useless at a later time when the alley is paved and the grade is changed. Guards used in paved alleys will last a long time.

CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

KEEPING ELECTRIC FLATIRON USERS IN A SATISFIED STATE

**Company Suffers No Loss of Revenue Because It
Loans Irons to Customers While Their De-
fective Ones Are Being Repaired**

Realizing the value of electric flatirons as revenue producers, the Commonwealth Electric Company of Summit, N. J., will not allow a flatiron customer to be without flatiron service for twenty-four hours if it can be helped. Customers are urged to bring in their irons whenever they are out of order for repairs. While the iron is undergoing repairs another iron is loaned to the customer by the company until the damaged one is made serviceable. The "loaners," as they are called in the company's office, are old irons which customers believed could not be repaired satisfactorily. The company, not wishing to antagonize the customer, takes such irons as part payment for new ones and at small cost renders them serviceable again. These irons are in excellent condition, and while they may not have all the appearance of new ones, they serve the purpose remarkably well.

WHERE COOKING EQUIPMENT CAN BE SOLD ON COST ALONE

**Cases Wherein Electricity Actually Is Cheaper Than
Wood or Coal for Cooking in Country Club
and in Public Institutions**

From three electric kitchens in the suburban territory outside St. Louis, Mo., has come the information that for certain classes of cooking at least electricity is actually cheaper than the more ordinary fuels. These kitchens are at the Belle Rives Country Club, at St. Vincent's Institution for the Insane, and at the Marellac Seminary. These places are all served from the lines of the Western Light & Power Company at a 2-cent cook-

ing rate. The information regarding the installations and the costs was supplied by C. B. Kennedy, sales manager for the Light & Development Company of St. Louis,



FIG. 2—A 51.6-KW. KITCHEN WHICH SAVES THE COUNTRY CLUB \$500 A YEAR

which is the parent organization of the Western Light & Power Company.

In the case of the Belle Rives Country Club it was formerly necessary to start fire in the coal range at 5 o'clock in the morning and to keep the stove red-hot until 1 o'clock on the following morning. To let the fire die down was to court trouble, because guests were likely to arrive and want immediate service at any hour. Moreover, it was necessary to keep one man solely to carry coal and to remove ashes. The fuel, which was hard coal, was costing \$75 a month, and the labor incidental to handling coal and ash amounted to \$27 a month. By changing to a complete electric cooking equipment it was possible to eliminate enough of this sort of waste to effect a net annual economy of \$500.



FIG. 1—EXTERIOR OF THE BELLE RIVES COUNTRY CLUB

The club's electric installation, preparing food for about 200 people a day, consumes on the average 3000 kw.-hr.

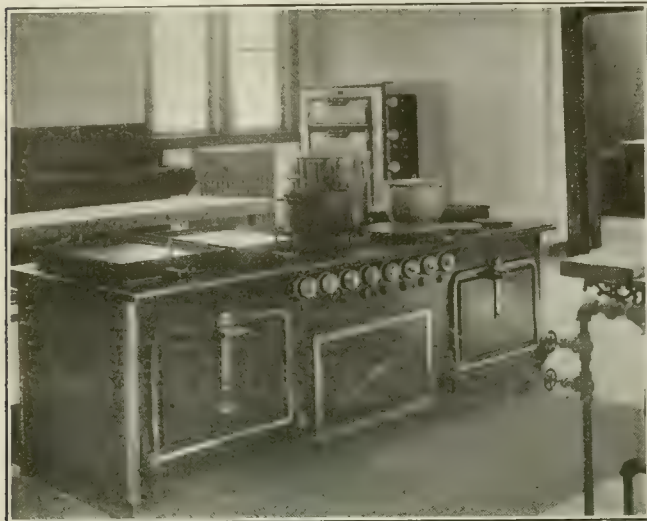


FIG. 3—SIMPLEX RANGE AND HUGHES BAKE OVEN WHICH DO MOST OF THE COOKING AT MARELLAC SEMINARY

a month, making the electricity cost \$60. Here is a list of the electrical equipment which the club purchased:

One Hughes range:	Watts
Four top burners, rated at 4000 watts each.....	16,000
Six top burners, including two broilers, rated at 2200 watts each	13,200
Four ovens, each rated at 3600 watts.....	14,400
One electrified steam table.	
Four Hughes immersion-type water heaters, 2000 watts each	8,000
One Hughes electric bake oven with a capacity of 91 loaves each 20 minutes	10,000
One electric refrigerator	185
Total	61,785

This kitchen has sufficient capacity to care for about 300 people per day. One of its interesting features is the electrified steam table, which was converted from an ordinary steam table by inserting the immersion heaters



FIG. 4—TWO BAKE-OVEN INSTALLATIONS—AN ELECTRIC AND AN OLD-STYLE WOOD-FUEL OVEN

The little electric oven has twice the hourly baking capacity that the wood-fuel oven has and fills only a fraction of the space.

and lining the bottom of the tank with a 2-in. (5.08-cm.) magnesia covering.

At the two public institutions the energy consumption per person is not so high as it is at the country club.

The club uses about 100 kw.-hr. to serve 200 people a day. The Marellac Seminary uses about 83 kw.-hr. to serve 300 people a day. The St. Vincent's Institution uses about 90 kw.-hr. to serve 450 people a day. At the seminary everything is cooked electrically, using Simplex and Hughes ranges and Hughes bake ovens. At the public institutions there is no water-heating load.

All of the installations are giving satisfactory service. Of the one at the country club this seems particularly true. The favorable viewpoint of the stewardess of this club, Mrs. C. W. Mason, on electric cooking, is shown by her letter reproduced herewith:

Mr. C. B. Kennedy, Sales Manager Western Power & Light Company, St. Louis, Mo.

DEAR SIR—In reference to the electric range and bake oven installed at the Belle Rives Country Club, will say that we are very much pleased not only with the cost of operation, but with the general conditions, which were materially changed for the better through electric cooking.

Prior to the time we installed the electric range it was necessary to keep fire in our large coal range from 5 a. m. until after 12 o'clock midnight, so as to be ready at any time to serve meals. Through the use of the electric range we are able to turn on just sufficient heat to cook whatever is required.

One of the advantages we have derived through the use of this electric equipment is that we may now use the rooms directly over the kitchen, which we could not use for club members owing to the excessive amount of heat from the old-type range.

Our bake oven and electric steam table are very satisfactory, and we have no hesitancy in recommending the use of an electric range for hotel and club purposes.

Very truly yours,

MRS. C. W. MASON,
Stewardess.

SERVICE A MEASURE OF PUBLIC UTILITY INCOME

When, for Any Reason, a Company Fails to Furnish Service Required by Its Patrons, Its Income Ceases and Its Expense Continues Unabated

The *Southern Public Utilities Company Magazine* for Aug. 10, published at Charlotte, N. C., contains an editorial on the economics of service which indicates how the utilities managed from that center regard their obligations to their patrons as well as stockholders. It reads in part as follows:

No revenue accrues to a public utility company except when that company is providing and furnishing service.

And the moment that such a company ceases or fails to furnish service to its customers, it not only ceases to receive a revenue, but is actually losing income—not only from the fact that the customer is paying nothing for service he is not receiving, but also by reason of the fact that interest charges, labor charges, depreciation and many other items of expense continue.

Therefore, when for any reason a company fails to furnish service required by its patrons, its income ceases, and its expense continues in at least as great volume, and in many instances greater than when service is being furnished.

In other words, should a street railway car in service on the line stand idle for lack of electricity, the inconvenience and loss of time and money do not lie solely on the patron who desires to make use of that service in the transaction of his business, but the revenue from that car ceases, the wage schedule for every employee connected directly or indirectly with the operation of that car continues, the interest charges on the investment in equipment, roadway, power generation and transmission systems and many other charges continue unabated.

This is likewise true in the matter of lighting. When, for any reason, service is interrupted, the company suffers in loss of dollars and cents in direct ratio to the inconvenience occasioned to its patrons. The moment service is interrupted the disk in the meter which measures the energy used by the consumer comes to a standstill, and when this occurs the income to the company ceases.

Therefore, it is to be easily seen and realized that power interruption, failure to maintain service, even momentarily, is a distinct financial loss to the company, not considering the inconvenience and money loss to customers depending upon that service.

For this reason, when an interruption of power occurs which necessitates a failure of service, every resource at the command of the company is put into action to restore such service immediately, and if this is not practicable to resume service with the least possible loss of time.

To the patron sitting in his home in the evening, enjoying association with his family, the failure of the lighting system is a source of annoyance calculated to exasperate the most even-tempered. But to the company such a failure is not only a great inconvenience, but—not taking into consideration the extra expense of restoring service within the shortest possible time—the company is standing a very real and decided financial loss until such service is again restored.

There is no patron of any public utility company more anxious that the company maintain uninterrupted service 365 days in the year, year in and year out, than the company to which he looks for this service. It is the sole and single purpose of public utility companies to furnish maximum service at all times, in the most pleasant and satisfactory manner possible, to the customer; and when for any reason failure occurs it is not only a source of deep regret to the company, but it is a direct and effective blow at its earnings.

It is the business of such a company to keep the disks of its electric meters revolving every moment there is a demand on the part of its customers. If, for any reason, failure is registered in this function, it means a serious curtailment of the company's earning powers.

To the patron a service interruption means the failure of lamps in a given building, or delay to a specific car, involving only a few, with a small relative loss of money. But to the company such an interruption means the aggregate of thousands of customers, each of whom is being inconvenienced as greatly as all others, so that the company feels exceedingly keenly the multiplied exasperations which come to all customers; and while the individual regrets the failure of the company to maintain absolutely perfect service under any and all circumstances, the company itself faces with mortification each such incident.

INDUSTRIAL HEATING DEVICES IN CHICAGO

Comparative Figures for 1916 and 1917 Show Marked
Increase in Connected Load of Appliances
Owing to Installation of Large Units

A census of electric industrial heating devices on the lines of the Commonwealth Edison Company, completed July 1, 1916, showed the staggering total of 33,270 devices with an aggregate rating of 23,857 kw. In the thirteen months which have elapsed since that time the number of devices in service has increased about 3000 and the connected industrial heating load has increased 14,500 kw. The heavy increase in connected load as compared with the increase in number of devices is attributable to the addition of arc furnaces and such other large industrial applications. Among the smaller articles the commercial flatiron and the glue pots still remain most popular. It is an interesting fact that in such a comparatively recent development, as electric heating only two new applications have been connected

in the last year. In more normal times this might be taken to indicate that the development period was past. But in these strenuous times it is perhaps more accurate to conclude that it signifies, if anything, that energies are all directed toward producing standardized goods and no time or effort can be spared for development. That the electric heating industry is going for-

INDUSTRIAL HEATING APPLIANCES IN CHICAGO

Device	1916		1917	
	Number	Kw.	Number	Kw.
Annealing furnaces*	.....	.....	4	240
Air heaters (industrial).....	40	46	156	161
Baking installations.....	10	127	13	142
Bacteriological ovens.....	7	6	14	13
Branding irons.....	80	28	192	75
Beer-vat dryers.....	11	33	12	36
Can cappers.....	105	36	124	49
Commercial flatirons.....	25,000	17,000	25,850	17,610
Coffee urns (commercial).....	9	14	22	35
Disk stoves (industrial).....	700	385	1,340	1,190
Drying ovens.....	7	18	38	101
Enameling ovens.....	5	603	13	638
Embossing presses.....	11	17	12	18
Extract heaters.....	70	139	107	268
Furnaces (resistance).....	18	38	32	126
Film dryers.....	13	27	13	27
Furnaces (arc).....	4	2,680	13	14,000
Furnaces (electrolytic)*.....	.....	.....	6	240
Glue pots.....	5,000	1,150	6,200	1,380
Glue cookers.....	15	72	17	81
Glue-heating installations (special).....	54	37	88	67
Immersion coils (liquid heating).....	150	170	215	202
Ink dryers.....	160	96	235	141
Linotype pots.....	21	36	24	38
Liquid-heating installations (special).....	65	72	82	94
Metal-melting pots.....	5	11	6	16
Material heaters.....	36	57	62	118
Monotype pots.....	2	4	2	4
Printing-press dryers.....	7	11	7	11
Putty-warming machines.....	5	9	7	12
Pleating machines.....	6	7	9	11
Photo-print dryers.....	4	8	18	22
Pyrographic machines.....	5	29	5	29
Photo-chemical bath heaters.....	7	13	21	36
Popcorn machines.....	14	35	19	47
Roofing-machine heaters.....	4	29	5	36
Radiant heaters (industrial).....	240	144	356	202
Sealing-wax heaters.....	200	40	278	59
Sterilizers.....	90	40	104	49
Soldering irons.....	750	150	920	192
Soldering-iron furnaces.....	30	18	35	49
Solder pots.....	9	5	15	8
Tempering ovens.....	2	9	19	91
Tempering baths.....	1	7	2	14
Toasters (commercial type).....	27	82	68	206
Vulcanizers (industrial).....	18	14	35	26
Varnish heaters (spraying).....	175	105	335	185
Wax-knife heaters.....	34	9	43	12
Wax heaters.....	32	7	37	9
Waffle irons (commercial type).....	12	12	23	23
	33,270	23,857	36,251	38,239

*New applications.

ward on all fronts is evident from the fact that in every case there are as many, and in 96 per cent of the applications there are more, devices in service now than there were one year ago.

The table printed herewith lists fifty different electricity-consuming devices, varying in number from commercial flatirons, of which 25,850 are in use, to tempering baths and monotype pots, of which only two each are recorded.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

WATTMETER FOR DEALING WITH HIGH LOAD CURRENTS

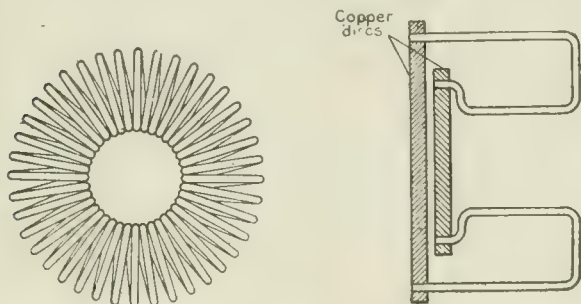
New Concentric Standard Dynamometer Wattmeter for Heavy Currents and Concentric Non-Inductive Standards of Low Resistance Described

THE object of the work carried out by A. E. Moore in an article in the July 6 issue of the *London Electrician* was to provide, in the standardizing laboratory at the School of Technology, Manchester, a precision watt standard for dealing with load currents of upward of 1000 amp., suitable for the verification of

pendently of changes in the frequency of the current, it is necessary that every strand of the conductor have the same time constant (LR). There are many difficulties in the way of the satisfactory stranding of the conductor, if it is intended for currents of upward of 1000 amp.

In the wattmeter described by the author use has been made of the concentric magnetic field which is formed between two concentric conductors when a current is maintained in them in opposite directions.

If a wire be wound uniformly over the surface of a ring as shown in Fig. 1, the magnetic field produced when a current is maintained in the wire is symmetrical



FIGS. 1 AND 2—CLOSED RING WINDING; HOW TURNS OF RING WINDING MAY BE ARRANGED IN PARALLEL INSTEAD OF IN SERIES

sub-standard and other wattmeters and watt-hour meters, etc. A Kelvin watt balance for currents up to 1000 amp. was obtained, but neither this nor other balances fulfilled the necessary requirements exactly, and in the meantime the author had in mind a form of current coil which appeared to be worth developing for a dynamometer-type wattmeter.

Many so-called standard dynamometer wattmeters of the straight-through type designed for currents exceeding 100 amp. are unsatisfactory except for use on circuits of approximately unity power factor. The defects are mainly due to eddy currents and skin effect. Eddy currents in the metal forming the main conductors, and in any other metal work used in the construction of the instruments, cause the active part of the flux in the main-current coil to be out of phase with the main current, while the skin effect may cause variations in the distribution of the current over the cross-section of the main conductors with changes in frequency, and this may consequently affect both the magnitude and the phase of the active part of the main-coil flux. The active conductors of the pressure coil cannot be made to embrace more than a small portion of the main-coil flux, and for successful working this portion must always be a definite fraction of, and in the same phase as, the whole flux. It is not very difficult to eliminate eddy currents by avoiding the use of metal supports, etc., and having the main coils formed of stranded conductors, each strand being insulated; but in order that the current distribution may be maintained constant inde-

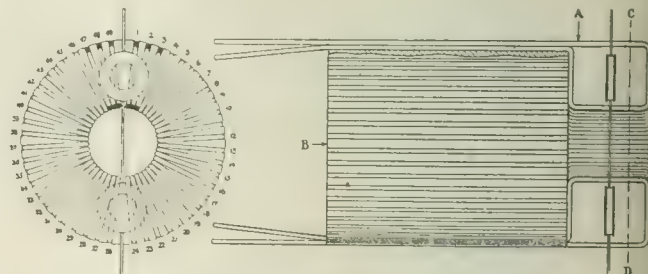


FIG. 3—CURRENT ELEMENT OF CONCENTRIC WATTMETER, MADE UP OF FORMED COILS "A", MOUNTED ON SLOTTED WOODEN CYLINDER "B"

about the principal axis of the ring, so that every turn of the wire incloses the same magnetic flux and, presumably, has the same ohmic resistance and therefore the same time constant. If all the turns are cut and their ends securely connected to copper end plates (Fig. 2), the turns will be connected in parallel instead of in series, and the time constant of any one turn will still remain the same as that of every other turn, since each will be of the same resistance and will embrace the same flux. Therefore, if an alternating current be maintained in the coil thus formed it will be uniformly distributed over the turns, and the uniform distribution of the current will be unaffected by changes in the frequency. The winding must be perfectly symmetrical.

Fig. 3 illustrates how the pressure coils may be arranged within the current coil. Two coils are used in order to render the system astatic to uniform stray magnetic fields. The magnetic axes of the pressure coils are nominally perpendicular to the direction of the flux produced in the main coil, and the result is a turning moment about a vertical axis.

Generators, Motors and Transformers

Duration of Starting Period of Continuous-Current and Induction Motors.—J. SAINT-GERMAIN.—The author, in continuation of an article previously published by him, gives two methods, one graphical and one algebraic, to calculate the duration of the starting period of continuous-current motors and of induction

motors furnished with starting rheostats. The methods described are then applied to particular cases.—*Revue Gén. de l'Elec.*, July 7, 1917.

Lamps and Lighting

Data Concerning Incandescent Lamps in France.—A. BOUTARIC.—Conclusion of a series of articles. In this installment the author classifies incandescent lamps according to length of life and conditions of performance. Investigation of 1234 lamps in twenty-six different establishments showed the great progress made in metallic-filament lamps, to which the author accords the superiority. In 1908 the lamps burning 200 hours were 67 per cent of the total number, those burning 400 hours were 50 per cent, those burning 600 hours were 41 per cent, those burning 800 hours were 37 per cent, and those burning 1000 hours were 31.5 per cent. In 1914 these percentages had risen to 98, 96, 94, 87 and 80 per cent respectively. There was a marked increase in durability after the employment of the pressed filament. Under the heading "Conditions of Performance," the author considers the influence of variations of voltage upon the luminous intensity and energy expended, the relation between voltage and energy expended, the influence of the voltage on specific consumption, the reduction of luminous surface sources for intensive lighting, the performance of lamps under alternating current, the repartition of light, the economic performance of incandescent lamps, and their employment for public lighting. Before the war French factories produced 30,000,000 metallic-filament lamps a year, in addition to those of carbon, and the author looks for an augmentation of this production with the return of peace.—*Revue Gén. de l'Elec.*, June 23, 1917.

Traction

Recuperative Electric Railway from Gergal to Santa Fé, Spain.—LUCIEN PAHIN.—Electric traction with provision for the recuperation of energy is susceptible of producing interesting economic results upon mountain lines if the grade of the road lends itself to the system. The cost fuel at the power house is much reduced, the greater part of the energy necessary for traction on the ascents being furnished by the trains which are descending at the same moment. This system is in force in the 22-km. (13.6-mile) line from Gergal to Santa Fé in the south of Spain, an important mining region, and, the author says, has been found, after six years' trial, much more advantageous from a triple point of view—technical, commercial and financial—than steam locomotives. The latter have, however, been retained for the passenger service, which is not important. The loaded mineral trains on the descent from Gergal weigh 450 metric tons (495 tons), while the empty trains ascending from Santa Fé weigh one-third this amount. The electric energy is three-phase at 6000 volts and 25 cycles and is generated by an alternator directly connected to a Lentz cross-compound engine; but so economical is the system that the power house is called on to take care of little besides the starting period.—*Revue Gén. de l'Elec.*, July 7, 1917.

Installations, Systems and Appliances

An Experimental Investigation of a New System for Automatically Regulating the Voltage of an Alternating-Current Circuit.—JOHN ALAN TERRELL.—The au-

thor has experimentally investigated a new method of automatically controlling the voltage of alternating-current circuits so as to cause the voltage to increase as the load on the apparatus increases, to determine the actions which go on in the apparatus, and to ascertain the commercial value of the invention. The apparatus which the purpose of this thesis was to investigate requires no moving parts, the action being due to change in the electrical and magnetic conditions brought about by changes in load.—*Rensselaer Polytechnic Institute Engineering and Science Series*, No. 9.

Electrophysics and Magnetism

Instability of Electrified Liquid Surfaces.—JOHN ZELENY.—The author in a recent paper gave a brief description of the appearance of a liquid surface undergoing disintegration owing to instability arising from an electric charge. The observations recorded were made in connection with some experiments on the electric discharge from liquid surfaces, and the work was confined to eye observations, through a microscope, of the surface in question when this was illuminated by the light of a spark from a Leyden jar. Some of the phenomena appeared to be of sufficient interest to warrant the making of a more accurate record of them by the aid of photography, and a few results obtained by this method are described in this paper.—*Physical Review*, July, 1917.

Units, Measurements and Instruments

The Thermophone as a Precision Source of Sound.—H. D. ARNOLD and I. B. CRANDALL.—The writers have found that the thermophone, together with a suitable supply of alternating current, can be used very conveniently as a precision source of sound energy. On account of the fact that the published material on this electrical-acoustic effect is largely of a qualitative character, it has been necessary to work out a quantitative theory, and it is the purpose of this paper to give the theory and show how the instrument can be adapted to acoustic measurements.—*Physical Review*, July, 1917.

Effusion Method of Determining Gas Density.—J. D. EDWARDS.—The effusion method of determining gas density, which is based upon the fact that the times required for the escape of equal volumes of two gases under the same pressure through the same small orifice are approximately proportioned to the square roots of the densities of the gases, was investigated in order to determine the accuracy of the method and its sources of error. In co-operation with a number of men employing this method in the natural-gas industry, a series of experiments was made, using their apparatus under field conditions. It was found that results in error by more than 10 per cent were not unusual. The theory of the effusion process was investigated in order to determine the influence of the numerous variables affecting the apparent specific gravity. The relative rates of effusion of air as compared with hydrogen, argon, methane and carbon dioxide at different pressures and with different orifices were determined. A more detailed treatment of the theory in the light of these results will be given in another paper. The results obtained from this study, together with the observations made on the effect of the effusion pressure, the confining medium and the shape and size of the orifice, were used in determining the most favorable conditions

of operation for this method. Recommendations are made as to the most suitable type and form of apparatus for use and specifications given to guide in the construction of the orifice. Although no results of high accuracy can be expected from apparatus of the effusion type, yet it should serve well for approximate results or for work where relative values only are needed, as in control work. It has been shown that the apparent specific gravity as determined by this method can be varied within rather wide limits by changing the conditions. However, by the observance of certain precautions in the construction and use of the apparatus it is possible to secure results accurate to about 2 per cent. The greatest precision is obtained where the physical properties of the gas tested show the least difference from those of air. Some further increase in accuracy, and particularly in reliability, can be gained by standardizing the apparatus as recommended. —*Technologic Paper No. 94, Bureau of Standards.*

Telegraphy, Telephony and Signals

Laws of Inductive Interference.—A. H. FORD.—Inductive interference is a matter of increased importance in Iowa, for some 750 miles (1207 km.) of high-tension lines were built in the last year. The grounded telephone line is in extensive use in this State, so that special consideration is given it in this paper. Electrostatic induction as regards grounded telephone lines is first taken up. Transposition can never entirely overcome interference due to static induction, the author points out, but it serves to reduce it to a negligible amount if the distances between transposition sections are so short that the impedance of the wire in one of these sections is small in comparison with the impedance of the telephone. The customary distance between transposition points in open wire lines is from one-quarter of a mile to 2 miles (0.4 km. to 3.2 km.) Another way to reduce the static induction on a metallic circuit is to place the two wires of the circuit close together. This distance is customarily 10 in. (25.4 cm.) in open-wire lines, as a smaller separation allows the wires to swing together. The wires may have the distance between them reduced to a very small amount where cables are used. The use of cables made up of twisted pairs reduces the interference to an entirely negligible amount. The neutralization of static induction by means of transposition requires that the telephone circuit be perfectly insulated, for the potential between a single wire and the ground is the same for a metallic circuit as for a grounded circuit. The grounding of one wire will therefore reduce a metallic circuit to the equivalent of a grounded one, so far as electrostatic induction is concerned. Interference from static induction, due to insulated power lines, can be reduced by making the telephone line metallic and transposing the telephone wires just as in the case of a grounded power line. Care must be taken in planning the transpositions that the transposition points of the two systems are co-ordinated. Inductive interference is practically always present when telephone lines and power lines parallel each other for distances of 1 mile (1.6 km.) or more, at separations of 50 ft. (15.2 m.) or less, this being the customary separation of the circuits where both follow the country roads. Where the exposure is between a power line and a metallic circuit telephone line, the power line should be transposed

throughout its length so that each wire will have the same capacity to earth as the other wires, there being no transpositions within the limits of the parallel, unless the parallel has a length greater than 6 or 8 miles (9.6 or 12.8 km.). The telephone line should be transposed within the parallel of such points as to cut it up into an even number of sections having equal lengths. —*Telephony, July 7, 1917.*

Book Reviews

REPITORIUM DER PHYSIK. By Rudolph H. Weber and Richard Gans. Leipzig and Berlin: B. G. Teubner. 614 pages, illustrated.

This is the second section of the first volume of a treatise on physics from a mathematical point of view. This section has been prepared by Profs. R. H. Weber and Paul Hertz. It deals with capillarity, heat, thermodynamics and gas mechanics. The book is thorough and carefully drawn up. It will be of value to the advanced student of physics and physical chemistry who is familiar with the German language. The chapters dealing with the subject of capillarity will be found particularly commendable.

"THE ELECTRICIAN" ELECTRICAL TRADES' DIRECTORY FOR 1917. London, England: The Electrician Printing & Publishing Company, Ltd. 1382 pages, with a Biographical Section. Price, \$4.

Much valuable information is contained in this useful annual, now in its thirty-fifth year. The directory section is in six principal divisions, British, Colonial, Continental, Asiatic and African, Central and South American, and United States. In addition to the lists such subjects as the following are treated broadly: Law relating to electric light, power and traction; fire risk and electric wiring rules, etc. Financial information and biographical sketches of men who have attained prominence in the industry are other features that add to the usefulness of the book.

ELECTRICAL MEASUREMENTS IN PRACTICE. By F. Malcolm Farmer. New York: McGraw-Hill Book Company. 360 pages, 230 illustrations. Price, \$4.

This is an excellent and timely text and reference book on electrical measurements from the industrial viewpoint. There are various excellent treatises available on the principles and physical relations of electrical measurements, but there are very few which deal with electrical measurements as they have to be made in electrical engineering laboratories for the purposes of the industry. The book is divided into sixteen chapters dealing with the following subjects: Introductory, galvanometers, continuous emf. measurements, continuous-current measurements, alternating emf. measurements, alternating-current measurements, resistance reactance and impedance measurements, power measurements, energy measurements, maximum-demand instruments, inductance measurements, capacitance measurements, frequency and slip measurements, wave-form determinations, magnetic measurements, curve-drawing instruments. The treatment is clear, thorough, practical and up to date. The chapter on maximum demand instruments is particularly timely.

Higher Boiler Pressures and Temperatures

To the Editor of ELECTRICAL WORLD:

Sir: The feasibility, advisability and desirability of employing higher steam pressures and temperatures follow the natural and important endeavor continually being made to increase the efficiency in using heat. Since it is now quite common practice to obtain and maintain a vacuum within 1 in. (2.54 cm.) of absolute, the simplest—in fact, only—other direction in which more energy may be obtained from the steam is to raise the steam pressure. That doing so is full of promise, which should act as a powerful incentive, was brought out in the April 28, 1917, issue of the ELECTRICAL WORLD. It was only the theoretical gains that were discussed at that time, however.

In discussing higher steam pressures 200 lb. per square inch (14.06 kg. per sq. cm.) may be considered high for small stations, although it is commonly used in the larger ones, whereas 225 lb. per square inch (15.82 kg. per sq. cm.) is being used in some stations, with 350 lb. per square inch (24.61 kg. per sq. cm.) in possibly a few isolated and exceptional instances. It will probably be a long time before pressures in excess of 225 lb. per square inch (15.82 kg. per sq. cm.) will be considered for the small stations, partly from considerations of safety and because of the necessary limitations in personnel and facilities, and partly because operating conditions are rarely such as to permit offsetting the higher cost of apparatus. The smaller stations might find it a more fruitful move to give greater attention to careful and scientific firing, high vacuum, than to higher steam pressures. It is a very different matter with the large stations, however, with their much heavier loads, load factors and better facilities for repair, maintenance and supervision.

Probably the standard pressure may be said to be 200 lb. per square inch (14.06 kg. per sq. cm.) in the majority of stations, at 200 deg. Fahr. (93.3 deg. C) superheat, equivalent to a temperature of 600 deg. Fahr. (315.6 deg. C.). When the pressure is increased above about 350 lb. per square inch (24.61 kg. per sq. cm.) to those proposed from time to time—for example, 600 lb. per square inch (42.18 kg. per sq. cm.), it is then that the practical considerations might be expected to interfere with the theoretical gains. While some of these factors mitigating against increased efficiency in the use of the steam are certainly metallurgical limitations due to the metals or their treatment, some of them are otherwise. Higher pressures require higher strength of structures withstanding them—boiler, pipes and fittings, economizers, turbine parts, etc.—but higher heat losses are also to be expected. While in time doubtless design and the treatment of metal will solve the mechanical problems, a stage must be reached when the greater heat losses and mechanical difficulties will cancel the gain in over-all efficiency.

Readers' Views and Comments

Increase of steam pressure means that there will be a lower temperature drop between the furnace gases and the steam inside the boiler heating surface, which in turn means that the furnace gases will leave the heating surfaces at a higher temperature than where lower pressures are used. If heat is not to be wasted by passing up the stack, additional heating surface—in the form of economizers, usually—must be installed. The economizer is finding increasing application in central stations where load factor is favorable, and possibly will be a necessary adjunct where the high steam pressures are utilized.

As regards greater strains upon metallic parts, boilers, economizers and steam pipes and fittings will, of course, have to be made stronger. This will mean modified design of the boilers, no doubt, and of the economizer to a small extent, above about 350 lb. per square inch (24.61 kg. per sq. cm.), adding to the initial cost. While the steam pipes will require greater care in installation and as regards strength, they may also be smaller for a given output, since the density is higher at the higher pressure and hence the passage of steam is lower. The cost of steam piping may be expected to remain about the same. The welded flange joint, first employed at the Fisk Street station of the Commonwealth Edison Company, and described in the March 18, 1916, issue of the ELECTRICAL WORLD, may be expected to come into greater use in the interests of safety and reliability and lower cost for upkeep.

It is possible the chief problems in utilizing such high pressures as 600 lb. per square inch (42.18 kg. per sq. cm.) will occur in the prime mover—the turbine. Higher pressures will add to the leakage and friction losses of the turbine, of the high-pressure element particularly, tending to lower the efficiency and nullify the gain due to increased pressure. Corrosion and erosion of the turbine blades may be expected likewise to occur to a marked extent, due in part to the entrained moisture in the steam, adding to the cost of maintenance and making the drop in efficiency decrease with time more rapidly. The moisture formed thus, while a disadvantage so far as the turbine blades are concerned, is somewhat equivalent in effect to increased condenser cooling surface. The higher cost for blade maintenance can then be balanced against lower condenser cooling surface and the labor required to keep it in fit condition.

Large companies will be the ones to assist the manufacturer develop apparatus that is safe, reliable and efficient.

J. C. RUTHERFORD.

Chicago.

A Common Forum Needed

To the Editor of ELECTRICAL WORLD:

Sir: From time to time I notice editorials in the ELECTRICAL WORLD setting forth the necessity for an organization where the representatives of central stations, manufacturers, jobbers, dealers and contractors can get together and discuss their common problems. In your issue of July 28 you have an editorial upon this subject in which you say, "An organization of this sort cannot be successfully constructed on short notice and there may be obstacles to overcome."

The Society for Electrical Development is such an organization, and the members of the society, through their representatives on the board of directors and upon the executive committee, meet and discuss their common problems. It is possible that more can be done along these lines, and possibly the scope of the society can be enlarged. The point that I have in mind is that there is such an organization, and that the ELECTRICAL WORLD should, it seems to me, advocate enlarging the scope of the existing organization rather than the formation of another one. The feeling exists that there are already enough organizations in the electrical field. Why increase them?

There are no problems common to the interests in the electrical field which cannot be handled by the Society for Electrical Development, whose membership is made up of central stations, manufacturers, jobbers, dealers and contractors. Any member can suggest any problem which he would like to have taken up by the board or the executive committee of the society, and I should appreciate your calling attention to this fact. I am afraid that any one reading your editorial "A Common Forum Needed" would feel that no such organization existed, or that the ELECTRICAL WORLD did not know of it, or else did not appreciate its possibilities.

As your paper is a member of the society and has representation upon its board of directors through James H. McGraw, who constantly sits in its meetings, is interested in its activities and expresses his appreciation of the good work done by the society, I feel that we are entitled to recognition, which we do not get in your editorial. The publication of this letter as a comment upon your editorial would be appreciated.

J. M. WAKEMAN,

General Manager Society for Electrical Development, Inc., New York City.

[We are not unmindful of the excellent work of the Society for Electrical Development in popularizing and fostering the use of electricity. Too much cannot be said of its achievements along these lines. However, the forum which the editorial suggests would be wider in scope and would not duplicate or usurp any of the functions of the society. In a previous editorial on the subject (May 26, 1917) reference to the work of the Society for Electrical Development was included.—EDITOR.]

Scientific and Industrial Research

A Department Devoted to Interchange of Ideas, Investigations Contemplated, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University

COAL ECONOMY RESEARCH

Necessity of Considering New Ways of Increasing Fuel Production, Burning Substitutes for Coal and Eliminating Losses

The problem of coal economy, important as it is at all times, has assumed unusual proportions of late owing to the war and the tremendous increase in the demand for coal. There is an actual shortage of miners, freight cars, ships, mining machinery and supplies. The gravity of the situation was explained to some representatives of the coal trade by the chairman of the fuel committee of the Council of National Defense as follows: "Italy wants 1,000,000 tons of Pocahontas coal per month for the coming year; France is depending upon this country for industrial and domestic coal; England's South American trade is transferred to us to supply, and Canada is in for 2,500,000 tons of Eastern coal, due to her own miners having been drawn from the Nova Scotia field to be used in the war. Our own transports, troop ships and convoys, together with added merchant ships, will mean additional drain for our own needs. Furthermore, it is not unreasonable to assume that the activity of our own navy will mean a larger consumption of coal."

Another thing made clear by the fuel committee was that the Northwest lake trade must be supplied at all hazards with every available pound of coal, even to the exclusion of all other home markets. This Great Lakes trade is considered a very serious matter because 60,000,000 tons of iron ore must be transported to the various manufacturing centers while navigation is open.

While various private and governmental agencies are attacking the problem vigorously and are taking administrative measures to alleviate the immediate dangers of the situation, the great fundamental problem of more economical production of heat remains for engineering experts and scientific investigators to solve. Among the various research problems in this connection the following suggest themselves as being the most important ones for electric power supply and consumption:

Mining by machinery to reduce manual labor and to increase production; electricity has a wide field of applications here, in undercutting coal, drilling holes, exploding charges, moving cars, loading, hauling, crushing, screening, telephone communication, lighting, mine ventilation, pumping, etc.

Utilization of thin seams, which are unprofitable to be mined by hand labor, but which may be mined by scrapers, conveyors and other similar machinery.

Better combustion of coal in industrial boilers and in domestic furnaces.

The reason for which certain coals (for example Illinois coals) do not burn well unless abundantly wetted with water, with a resultant loss of heat. Arrangements that would enable such coals to be burned well dry.

Utilization of lower grades of coal, peat, lignite, etc.

Burning coke and gas in place of raw coal; a combina-

tion of by-product ovens with a boiler plant, to avoid handling and drenching coke with cold water after its production.

Use of pulverized coal, the problem of briquetting, etc.

Indicators and automatic regulators for maintaining the best combustion in a boiler with varying load.

Conversion of coal into electricity at the mines, with a minimum of handling and storage of coal, and also for the purpose of making electric power supply independent of railway transportation of coal.

Reduction in steam losses between the boilers and the prime movers.

More economical prime movers and plant auxiliaries.

Scientific lighting and higher efficiency illuminants to reduce waste of electricity.

More economical use of electric power in industries.

Reduction in power consumption by electric railways.

Introduction of efficient electric power in places where now wasteful small steam plants are used.

In conclusion the two familiar old-new problems for the inventor may be mentioned, namely, (a) the gas turbine, and (b) direct production of electricity from coal (thermo-electricity) without first converting heat into mechanical power.

Summary of Investigations, Available Apparatus and Research Suggestions

INVESTIGATIONS UNDER WAY OR COMPLETED (RESEARCH WORK REPORTED SINCE JULY 21)*

CORONA.

A study of the corona at continuous potentials. A large number of direct-current generators are available which may be operated in series and which make it possible to obtain potentials up to 25,000 volts with current capacity of 0.5 amp.—E. B. Paine, University of Illinois.

IGNITION APPARATUS.

The characteristics of electric ignition apparatus for gasoline engines.—E. B. Paine, University of Illinois.

INSULATORS.

Experiments on a large scale to determine the effects of porosity in porcelain.—H. J. Ryan, Stanford University, California.

INTERFERENCE.

In the last few years a great deal of work has been done to protect telephone systems which parallel high-voltage transmission lines. As the system now used has practically stopped all telephone instrument trouble, the measures adopted are evidently complete.—E. P. Peck, Georgia Railway & Power Company, Atlanta, Ga.

IRON AND ALLOYS.

An investigation of the effect of alloying substances on the magnetic and other properties of iron. Continuous work has been done in the department for several years. The properties of electrolytic iron of great purity have been determined, and also the influence of various percentages of boron, silicon, aluminum and nickel. Samples of iron having magnetic permeability far surpassing that reported by other investigators have been produced. Permeabilities of 50,000 or more have been found in testing certain of the high-permeability alloys. In the nickel-iron series some alloys have been found whose permeability varies greatly with the temperature of the specimen, the permeability ranging in some cases from about 700 at room temperature to a value of two or three at the temperature of boiling water.—E. B. Paine, University of Illinois.

LIGHTNING PROTECTION.

A large number of 11,000-volt and 22,000-volt outdoor meters have been used by this company. This equipment consists of one tank containing current and potential transformers in oil, with the meter in a separate compartment. Some trouble was experienced at first with this apparatus, owing to the current transformers and transformer leads becoming short-circuited by lightning and line surges. This trouble has been greatly reduced, however, by the connection of a vacuum-tube spark gap across the two terminals to each current transformer, the connection being made at the top of the bushing.—E. P. Peck, Georgia Railway & Power Company, Atlanta, Ga.

MAGNETIC TESTS.

Influence of joints in ferric magnetic circuits. The distribution of magnetic flux in high-permeability iron and its effect upon the magnetic properties. The influence of mechanical stress on the magnetic properties of iron. This investigation was suggested by difficulties encountered in testing high-permeability iron on account of variations in the tightness with which joints were clamped together in making tests.—E. B. Paine, University of Illinois.

PUMPS.

A study of electrically operated reciprocating deep-well pumps.—E. B. Paine, University of Illinois.

SUGGESTION FOR RESEARCH

FUSES.

High-voltage fuses for use on the line side of customers' stations, for voltages from 11,000 to 45,000 and for transformer capacities of from 25 kva. to 45,000 kva. Such fuses have not been sufficiently developed.—E. P. Peck, Georgia Railway & Power Company, Atlanta, Ga.

*The names of individuals given after each institution reporting investigations are those of persons with whom others interested should communicate. All institutions reporting research work should give such names.

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

INSULL INTERESTS BUY

WISCONSIN PROPERTIES

Controlling Share in Wisconsin Power, Heat & Light Company Is Purchased from John I. Beggs

A controlling interest in the Wisconsin Power, Heat & Light Company, which was formerly held by John I. Beggs of Milwaukee, has been purchased by Samuel Insull and Marshall E. Sampsell of Chicago and a group of other utility men identified with the associated Insull companies.

The property of the Wisconsin Power, Heat & Light Company consists of several small generating stations and of distribution systems in twenty-seven Wisconsin cities and towns, among which are Beaver Dam, Berlin, Baraboo, Burnett, Fox Lake, Horicon, Juneau, Lohrville, Neshkora, Minnesota Junction, Red Granite, South Beaver Dam, Portage and Wautoma. A portion of the energy is generated locally, and the remainder is purchased from the Southern Wisconsin Power Company, which has a hydroelectric plant at Kilburn.

Mr. Beggs, who is president, treasurer and general manager of the Southern Wisconsin Power Company, will remain director of the Wisconsin Power, Heat & Light Company. Samuel Insull is chairman of the new board of directors.

While definite plans have not been announced, it is understood that the Wisconsin company will become a part of the Middle West Utilities Company.

ELECTRIC WORK ON THE LOUISVILLE CANTONMENT

Installation by Louisville Gas & Electric Company While Contractors Pool Forces for Interior Construction—Quantities of Materials

Work of installation of the electric lighting system at the new National Army cantonment just outside of Louisville is now well under way. The outside lighting is being provided for according to the plan of the army engineers, installation being made on a cost and material basis by the force of the Louisville Gas & Electric Company, while the Louisville electrical contractors have pooled their forces to install the interior lighting systems in the numerous buildings.

A detailed description of this work is not available at the Louisville cantonment at this time, but it is of interest to note the approximate quantity of materials used. For the interior wiring, which will be of open construction, a total of approximately 20,000 sockets are to be used. The transmission wire which has been erected to the camp will deliver energy at the usual transmission voltage of 13,200. There will be three 400-kw. step-down transformers erected on steel towers

for step-down substations, which will reduce the voltage to 2300 volts, three-phase, 60-cycle. Elsewhere about the plant will be established ninety transformers ranging from 1 kw. to 20 kw.

A total of about 1100 cedar poles will be required, 30 ft. and 35 ft. (9 m. and 10.5 m.) in height. There will be 320 lamps, of 6.6 amp., 100 cp., installed in series. About 20,000 ft. (6096 m.) of Nos. 1, 0, 2 and 6 wire will be required, as well as 125,000 ft. (38,100 m.) of No. 10 copper-clad service wire.

Practically all of the time up to Sept. 1, before or on which date the cantonment is to be ready for occupancy, will be required to complete the construction work. About every available unit of labor in the vicinity is now employed at the camp, and very nearly all incoming applicants are given a chance to show what they can do.

ELECTRIC SERVICE AT THE WRIGHTSTOWN CANTONMENT

Public Service Electric Company of New Jersey Will Supply 900 Kw. for Lighting and Power at New Camp

The Public Service Electric Company, Newark, N. J., will supply the army cantonment at Wrightstown, N. J., with 900 kw. for lighting and power purposes, of which 600 kw. will be for lighting and the rest for power.

For this purpose it is necessary for the company to extend a transmission line about 12 miles (19.3 km.) from its power plant at Burlington to Mount Holly, using poles now in service, and to build an entirely new line for an additional distance of about 8 miles (12.8 km.) to a substation to be erected at the cantonment. This work is now under way and it is hoped to have it completed early in the coming month.

The company will not handle the distribution system at the cantonment, that being in charge of the army engineers.

RIGHT OF EMINENT DOMAIN GRANTED FOR ARMY SERVICE

New England Power Company Secures Transmission-Line Rights from Commission for Cantonment Service at Ayer, Mass.

The New England Power Company has been granted authority to build a transmission line from Leominster to Ayer, Mass., to supply 1500 kw. to the United States cantonment, Camp Devens, at the latter point. Permission to take land by right of eminent domain is granted by the Massachusetts Gas and Electric Light Commission, which finds that public convenience and necessity demand the construction of the line. The order points out that more than 35,000 troops will be supplied with electrical service at the cantonment.

RAISE CAPITAL FUNDS BY SHORT-TIME NOTES

Many Companies Resort to Securities of Early Maturity at High Net Cost to Provide for Capital Extensions

A number of central station companies have taken advantage of present conditions in the security markets to obtain funds for capital investment through the issue of short-time notes. The conditions governing the investment markets at this time are especially favorable to this form of financing. While financing by means of short-maturity notes is as a rule more expensive than the raising of capital by long-time securities, it is recommended by many bankers now.

SOME OF THE COMPANIES ISSUING SHORT-TIME NOTES

Recent issues of such securities are:

Consolidated Gas, Electric Light & Power Company, Baltimore.—An issue of \$5,000,000 of five-year 6 per cent notes, dated Aug. 1, 1917, of the Consolidated Power Company, a subsidiary, was sold at 97½ by Alex. Brown & Sons, Brown Brothers & Company, Jackson & Curtis and Lee, Higginson & Company.

Columbus (Ohio) Railway, Power & Light Company.—Sold \$576,000 of 6 per cent one-year notes, dated Aug. 1, 1917.

Reading Transit & Light Company.—An issue of \$2,300,000 of two-year 6 per cent notes, dated Aug. 1, 1917, was sold at 98½ by Bonbright & Company, Inc.

El Paso (Tex.) Electric Company.—Stone & Webster offered at 97½ \$300,000 of three-year 6 per cent notes, dated Aug. 1, 1917.

Texas Power & Light Company.—Issued, through Coffin & Burr, \$900,000 of two-year 6 per cent notes, dated Sept. 1, 1917, at 98%.

Middle West Utilities Company.—An issue of \$1,000,000 of three-year 6 per cent collateral 6 per cent notes, dated July 1, 1917, was offered at 97¼ by the Illinois Trust and Savings Bank; Russell, Brewster & Company; McCoy & Company; Halsey, Stuart & Company of Chicago, and A. H. Bickmore & Company of New York.

Buffalo General Electric Company.—Stockholders were offered the opportunity to subscribe to \$4,400,000 of five-year 6 per cent bonds, dated Aug. 1, 1917, and convertible after two years into common stock at par. The issue was underwritten by Lee, Higginson & Company.

Utah Power & Light Company.—A block of \$1,000,000 of two-year 6 per cent notes, dated Aug. 1, 1917, has been sold at 98¼ by Harris, Forbes & Company, the Harris Trust and Savings Bank, and Coffin & Burr.

West Virginia Traction & Electric Company.—There has been sold at 98¼ by Bonbright & Company, Inc., \$1,800,000 of two-year 6 per cent notes, dated May 1, 1917.

West Penn Power Company.—Halsey, Stuart & Company, A. B. Leach & Company, and the Continental and Commercial Trust and Savings Bank, Chicago, have sold at 98¼ \$2,000,000 of two-year 6 per cent bonds, dated Aug. 1, 1917.

Alabama Power Company.—Issued, through Harris, Forbes & Company, the Harris Trust and Savings Bank and Coffin & Burr, at 99½, \$1,900,000 of five-year 6 per cent notes, dated July 1, 1917.

Philadelphia Electric Company.—Through Brown Brothers & Company, \$2,500,000 of one-year 5 per cent notes, dated Aug. 1, 1917, were sold at 99¼.

Toledo Traction, Light & Power Company.—An additional block of \$486,000 of 6 per cent five-year bonds of 1913 has been sold at 100 by Harris, Forbes & Company and the Harris Trust and Savings Bank.

New Bedford Gas & Edison Light Company.—An issue of \$1,500,000 of five-year 6 per cent debentures, dated June 1, 1917, has been sold at 100 by Harris, Forbes & Company, the Harris Trust and Savings Bank, Coffin & Burr and Curtis & Sanger.

Lockport Light, Heat & Power Company.—Issued, through John Nickerson, Jr., \$350,000 of one-year 6 per cent notes, dated July 16, 1917, at 99½.

Southern California Edison Company.—Issued, through Harris, Forbes & Company, the Harris Trust and Savings Bank, E. H. Rollins & Sons and Curtis & Sanger, at 98½, \$10,000,000 of two-year 6 per cent bonds, dated July 1, 1917.

This list does not comprise all of the companies in the electrical industry which have done financing within a short period. The General Electric Company, of course, issued \$15,000,000 of three-year 6 per cent notes. In addition to the central stations mentioned in the foregoing list, a number of companies have put out additional blocks of bonds under existing mortgages or have sold additional capital stock to their shareholders. Such companies have been fortunate in financing capital requirements by these means under the uncertain influences affecting the investment markets. By placing bonds through bankers with permanent investment holders or stock with their own shareholders they reduce the underwriting costs on these particular capital requirements to the minimum. The companies which sell short-time securities will have to pay another banking commission when those securities mature in order to raise funds for the purpose of redeeming them.

The question of what form of financing shall be adopted during the critical conditions of 1917 is, however, largely beyond control of central station operators. They are obliged to rely upon the judgment of the bankers, who are guided by the temper of their own particular investment clientele. If their following among investors will buy short-time notes readily, but is disinclined to place funds in long-time securities at this juncture, the bankers make their recommendations to the borrowers accordingly.

Naturally securities, to meet quick sale now, have to present special attractions to borrowers. Obligations of the national government, issued and to be issued, have the first call because of patriotic motives and the premier character of the security which they offer. But with the Liberty Loan well placed and details of the subsequent issue still unsettled there is an excellent opening for corporate financing which the central station companies have prudently taken.

HIGH COST OF MONEY UNDER PRESENT-DAY CONDITIONS

Net cost of funds raised by short-time notes put out under prevailing conditions is high. When this high cost is considered in relation to the proportionately higher cost of the improvements which the funds finance it will be seen that the transaction implies a burden upon the companies much greater than that which is represented by borrowing cost and construction cost at normal levels. But, since companies cannot forecast either money cost or material cost in the future, they gain a large advantage by putting out securities when the bankers say that the moment is ripe, even though the net interest expense is greater than usual.

In the foregoing list the prices mentioned are those at which the securities were sold to the public. From the proceeds yielded at these prices there must be deducted the commissions or underwriting expenses of the bankers and the legal and other costs incident to the preparation and issue of the securities.

The unprecedented demands for power, stimulated still more by war activities, make it necessary for many of the companies to raise capital funds even though the cost of so doing is heavy.

SITE FOR NEW TURBINE PLANT AT HARTFORD, CONN.

High-Powered Station Will Be Erected When
Present Development at Dutch Point
Reaches Its Limit

The Hartford (Conn.) Electric Light Company has purchased a site covering about ninety-five acres in the South Meadows district which will be held in anticipation of the construction at some future time of a large central station. Samuel Ferguson, vice-president of the company, states that the plant will not be erected until the present development at Dutch Point reaches its limit, and that no immediate construction is contemplated. The company has been growing rapidly, however, and it appears to be only a question of time when a high-powered modern station complete in every engineering detail and designed for systematic extension along the latest lines of practice will be necessary. The newly purchased site borders on the Connecticut River.

HUMAN ENGINEERING IN UTILITY CORPORATIONS

Professors of Electrical Engineering Speak to De-
partment Heads of Commonwealth Company
on Practical Education of Graduates

On Aug. 9 the five university professors who are spending a large part of their summer vacation in the employ of the Commonwealth Edison Company, Chicago, were entertained at a dinner given by the Central Station Institute. Practically all department heads of the Commonwealth Edison Company and its associated companies were present. About 125 attended the dinner. Fred R. Jenkins, manager of the Central Station Institute, which is the educational department of the Commonwealth Edison Company, acted as toastmaster.

Prof. V. Karapetoff of Cornell University, the first speaker of the evening, sounded the keynote of the educational talks, urging the necessity of continual education for all the employees of any industrial concern. "Where education and development stop," said he, "decay sets in. Mental education is only a small part of the total development of an individual. The complete education comprises that of the body, the intellect, the will and the emotions. At present the intellect only is being developed, with some attention being paid to physical training. But the time is coming when proper education will comprise such things as the will to do things and the proper emotions, such as love of one's neighbor and loyalty to one's employer. These will be the required parts of one's education." Professor Karapetoff also made a plea for human engineering which ought to do for human beings what various physical, chemical and heat treatments do for metals in improving their quality. "It is the duty of every head of a department," he said, "to realize the importance of training for his subordinates. The technique of education, however, has advanced to such a point that a separate department is necessary, conducted by men skilled in the art of inspiring and developing personality."

The other speakers of the evening were Prof. C. Francis Harding of Purdue University, Prof. Murray C. Beebe of the University of Wisconsin, Prof. Ellory B. Paine of the University of Illinois, Prof. Hugo

Kuechenmiester of the School of Commerce, University of Wisconsin, and W. L. Abbott, chief operating engineer of the Commonwealth Edison Company.

NEW JERSEY COMMISSION DENIES RATE INCREASE

In Bridgeton Case, Board Shows that Many Com-
panies Have Applied Higher Schedules to
Large Power Customers Only

An application of the Bridgeton Electric Company and the Electric Company of New Jersey for authority to increase rates has been denied by the New Jersey Board of Public Utility Commissioners on the ground that such an advance would be unjust and discriminatory toward the small consumer who pays the base rate.

It was proposed by the companies to ascertain at the end of each calendar month the average cost of coal delivered at the power houses and to add to consumers' bills 1 per cent of the amount for each 10 cents per ton of cost in excess of \$3.50 f.o.b. Bridgeton, the average prevailing price prior to June 30, 1916; or to deduct 1 per cent for each 10 cents below \$3.50.

Testimony showed that in the early months of 1917 coal delivered in Bridgeton cost approximately \$7.25 per ton. The increase proposed by the companies, the commission found, did not appear to be warranted by the operating expense data submitted by the companies. The decision says:

Where energy is sold at very low rates, as is the case with the energy furnished the street railway and large power customers, the proportionate increase in cost due to increased cost of coal is higher. It is due to this fact that many companies in adopting a schedule which will take into account increases in fuel cost have applied such schedules to the large power customers only. The additional cost of service due to increases in coal cost are not proportional to the rate charged, but are proportional to the fuel portion of the cost.

TESTS ON LIFE OF RUBBER INSULATING COMPOUNDS

Underwriters' Laboratories' Investigation in Con-
nection with Work on Rubber-Covered Wires
and Cables Yields Valuable Data

In connection with its work on rubber-covered wires and cables, the Underwriters' Laboratories, Inc., has in progress a series of tests bearing on the life of the rubber insulating compounds employed on these materials. This work has been conducted along with and supplementary to the regular work of inspection and labeling of these products carried on in co-operation with manufacturers throughout the United States on rubber-covered wires and cables manufactured in accordance with Underwriters' Laboratories' standards for rubber-covered wires and cables as prescribed and summarized in the National Electrical Code. These tests have now been in progress about two years, and during this time tests have been conducted on over 1500 samples. The tests have yielded data of value.

The samples of rubber-covered wire subjected to the tests included products of thirty-three manufacturers employing the label service of the Laboratories. All samples were from product manufactured as "National Electrical Code standard," in accordance with the Underwriters' Laboratories' standards.

MEETING OF ASSOCIATION OF EDISON LIGHTING COMPANIES

Officers Will Be Elected and Necessary Business Will Be Transacted, but No Printed Reports Will Be Presented

Arrangements have been made to hold the annual meeting of the Association of Edison Illuminating Companies at 29 West Thirty-ninth Street, New York, Sept. 11, 1917. Owing to unusual conditions caused by the existing state of war, the reports of committees were not printed this year and will not be presented for discussion at the September meeting. It has also been thought advisable to abandon the customary entertainment program. The meeting this year will be devoted solely to the transaction of necessary routine business, in accordance with the association's bylaws, and to the discussion of such other matters as may demand immediate attention. Unless otherwise requested, no special arrangements will be made for transportation or hotel accommodations, as it has been assumed that the holding of the meeting in New York and the absence of entertainment features this year will naturally tend to limit the attendance to member company representatives.

"TRADING WITH THE ENEMY" CLAUSES AFFECTING PATENTS

Provisions in the Act Now Before the Committee on Commerce of the United States Senate

As reported in the *ELECTRICAL WORLD* of July 21, 1917, page 128, the "trading with the enemy" act, which has been referred to the committee on commerce of the United States Senate, contains a number of clauses relating to patents. These are as follows:

(a) An enemy or ally of enemy may file and prosecute in the United States an application for letters patent, or for registration of trade-mark, print, label or copyright, and may pay any fees therefor in accordance with and as required by the provisions of existing law. Any such enemy or ally of enemy who is unable during war or within six months thereafter, on account of conditions arising out of war, to file any such application, or to pay any official fee, or to take any action required by law within the prescribed period, may be granted an extension of nine months beyond the expiration of said period, provided the nation of which the said applicant is a citizen, subject or corporation shall extend substantially similar privileges to citizens and corporations of the United States.

(b) Any citizen of the United States, or any corporation organized within the United States, may pay to an enemy or ally of enemy any tax, annuity or fee which may be required by the laws of such enemy or ally of enemy nation in relation to patents and trade-marks, prints, labels and copyrights; and any such citizen or corporation may file and prosecute an application for letters patent or for registration of trade-mark, print, label or copyright in the country of an enemy or of an ally of enemy after first submitting such application to the Secretary of Commerce and receiving license so to file and prosecute.

(c) Any citizen of the United States, or any corporation organized within the United States, who desires to manufacture or cause to be manufactured a machine, manufacture, composition of matter, or design, or to carry on or cause to be carried on a process under any patent or copyrighted matter owned or controlled by an enemy or ally of enemy at any time during the existence of a state of war, may apply to the Federal Trade Commission for a license; and said commission is hereby authorized to grant such a license, non-exclusive or exclusive as it shall deem best, provided it shall be of the opinion that such grant is

for the public welfare, and that the applicant is able and intends in good faith to manufacture or cause to be manufactured the machine, manufacture, composition of matter, or design, to carry on or cause to be carried on the process or to use the copyrighted matter. The Federal Trade Commission may prescribe the conditions of this license and the rules and regulations under which it may be granted and the fee which shall be charged therefor, not exceeding \$100, and not exceeding 1 per centum of the fund deposited as hereinafter provided.

(d) The licensee shall file with the Federal Trade Commission a full statement of the extent of the use and enjoyment of the license, in such form and at such stated periods (at least annually) as the commission may prescribe; and the licensee shall pay at such times as may be required to the alien property custodian (or to such other officer as the President shall direct) not to exceed 5 per centum of the gross sums received by the licensee from the sale of said inventions or use of the copyrighted matter, or, if such commission shall so order, 5 per centum of the value of the use of such inventions or copyrighted matter to the licensee as established by the Federal Trade Commission; and sums so paid shall be deposited by said alien property custodian (or by such other officer as the President shall direct) forthwith in the Treasury of the United States as a trust fund for the said licensee and for the owner of the said patent or copyright registration as hereinafter provided, to be paid from the Treasury upon order of the court, as provided in subdivision (f) of this section, or upon the direction of the alien property custodian or such other officer as the President shall direct.

(e) Unless surrendered or terminated as provided in this act, any license granted hereunder shall continue during the term fixed in the license, or in the absence of any such limitation during the term of the patent or copyright registration under which it is granted. Upon violation by the licensee of any of the provisions of this act or of the conditions of the license, the Federal Trade Commission may, after due notice and hearing, cancel any license granted by it.

(f) The owner of any patent or copyright under which a license is granted hereunder may, after the end of the war and until the expiration of the year thereafter, file a bill in equity against the licensee in the District Court of the United States for the district in which the said licensee resides, or, if a corporation, in which it has its principal place of business (to which suit the Treasurer of the United States shall be made a party), for recovery from the said licensee for all use and enjoyment of the said patented invention or copyrighted matter; provided, however, that whenever suit is brought as above notice shall be filed with the alien property custodian (or with such other officer as the President shall direct) within thirty days after date of entry of suit; provided, further, that the licensee may make any and all defenses which would be available were no license granted. The court on due proceedings had may adjudge and decree to the said owner payment of a reasonable royalty. The amount of said judgment and decree, when final, shall be paid on order of the court to the owner of the patent from the fund deposited by the licensee, so far as such deposit will satisfy said judgment and decree; and the said payment shall be in full or partial satisfaction of said judgment and decree, as the fact may appear; and if after payment of all such judgments and decrees there shall remain any balance of said deposit, such balance shall be repaid to the licensee on order of the alien property custodian (or such other officer as the President shall direct). If no suit is brought within one year after the end of the war, or no notice is filed as above required, then the licensee shall not be liable to make any further deposits, and all funds deposited by him shall be repaid to him on order of the alien property custodian (or such other officer as the President shall direct). Upon entry of suit and notice filed as above required, or upon repayment of funds as above provided, the liability of the licensee to make further reports to the Federal Trade Commission shall cease.

If suit is brought as above provided, the court may at any time terminate the license, and may, in such event, issue an injunction to restrain the licensee from infringement there-

after, or the court, in case the licensee prior to suit shall have made investment of capital based on possession of the license, may continue the license for such period and upon such terms and with such royalties as it shall find to be just and reasonable.

(g) Any enemy or ally of enemy may institute and prosecute suits in equity against any person other than a licensee under this act to enjoin infringement of letters patent and copyrights in the United States owned or controlled by said enemy or ally of enemy, in the same manner and to the extent that he would be entitled so to do if the United States were not at war.

(h) Except as provided in this section, nothing in this act shall be construed to authorize the prosecution or maintenance of any suit or action at law or in equity by an enemy or ally of enemy in any court within the United States prior to the end of the war; provided, however, that an enemy or ally of enemy may defend by counsel any suit in equity or action at law which may be brought against him. All powers of attorney heretofore or hereafter granted by an enemy or ally of enemy to any person within the United States, in so far as they may be requisite to the performance of acts authorized in subsections (a) and (g) of this section, shall be valid.

ENGINEERING COUNCIL NAMES ITS STANDING COMMITTEES

Body Which Was Organized in June Is Now
Engaged in Active Work on Matters of
Concern to All Engineers

Calvert Townley, secretary of the Engineering Council, has advised us that that body, which was organized in June, as previously announced in these columns, is now engaged in active work on matters of concern to all professional engineers. Subsequent to the organization meeting held on June 27, the council held two other meetings during July. Its standing committees are:

On Public Affairs—C. W. Baker, G. F. Swain, S. J. Jennings and E. W. Rice, Jr.

On Rules—J. P. Channing, Clemens Herschel, N. A. Carle and D. S. Jacobus.

On Finance—B. B. Thayer, I. E. Moulthrop, Calvert Townley and Alexander C. Humphreys.

Many matters coming before the council, both from the several founder societies and from the council's predecessor, the Joint Conference Committee of National Engineering Societies, have been considered and referred to appropriate standing committees.

The council has also created a war inventions committee, comprising H. W. Buck, A. M. Greene, Jr., and E. B. Kirkby, to co-operate with the Naval Advisory Board and other departments at Washington if desired in the promulgation to engineers of war problems now before the government and for which there are opportunities for solution by means of inventions. It also created a committee, comprising George J. Foran, E. B. Sturgis, A. S. McAllister and A. D. Flinn, which is to collect and compile such information regarding engineers of the country as will enable it to co-operate with the different departments of the federal government.

While the council comprises only members from the four founder societies, and, of course, can claim no right to speak for members of other societies nor for engineers at large, the council members feel that the body will not have accomplished the results for which it was created unless it early establishes means of cordial co-operation with engineers, organized or otherwise. Every effort toward this end is contemplated.

ANNUAL MEETING OF THE PENNSYLVANIA ASSOCIATION

Program Will Consist Principally of Addresses by
Prominent Men and the General Discussion of
the Conditions Brought on by the War

The tenth annual meeting of the Pennsylvania Electric Association (State branch N. E. L. A.) will be held at the Bedford Springs Hotel, Bedford Springs, Pa., Sept. 7 and 8. There will be no papers prepared and no printed reports, the meeting consisting principally of addresses to be delivered by W. D. B. Ainey, chairman of the Pennsylvania Public Service Commission; Joseph B. McCall, president of the Philadelphia Electric Company, and J. W. Lieb, president of the National Electric Light Association. Provision has been made for a general discussion of questions of importance brought about by war conditions and for reports of the standing committees. There will be no entertainment features whatsoever, all of the time allotted to the convention being taken up by serious consideration of problems awaiting solution, the officers feeling that these were important enough to warrant this. George B. Tripp of Harrisburg is president and Henry M. Stine of Harrisburg is secretary of the association.

CONSOLIDATION OF CONNECTICUT PLANTS

Commission Does Not Commit Itself as Approving
Purchase Price as Fair Value in Any Future
Cases Before It

A controlling interest has been acquired by the United Gas Improvement Company in the Connecticut Light & Power Company, a new corporation formed by consolidation of the Housatonic Power Company, the United Electric Light & Power Company and the Seymour Electric Light Company with the Rocky River Power Company.

In approving the consolidation of properties in connection with the general transaction the Connecticut Public Utilities Commission says:

The data submitted by the several companies is, of course, available for whatever value it may have in any later matters involving rates or service of the consolidated company, but such data would not be binding upon the commission, and the commission would not consider itself bound to give controlling weight to such figures in any case involving the adequacy of the service or the reasonableness of the rates of the consolidated company. In the present case it appears that there is no divergence between the amount stated as the purchase price of the several companies and the book value of their assets which is sufficient to warrant serious objection by the commission.

It is not assumed, however, from any order of approval issued by the commission in this case that the proposed purchase price is found and decreed to be the fair value of the properties of the company for rate making, capitalization or any other purposes than those involved in the question now before us. In any rate case, for instance, that portion of the capitalization of the public service company which represents inactive and undeveloped property must be carefully weighed so far as it can be ascertained, to avoid approval of rates designed to secure a full return on such capitalization.

A map and general outline of the consolidation plans were published in the issue of the ELECTRICAL WORLD for July 21, 1917, page 124.

INDIANA RATE CASES BEFORE THE COMMISSION

Testimony of Indianapolis Light & Heat Company
and Merchants' Heat & Light Company
Shows Increased Operating Costs

The Indiana Public Service Commission, after hearing the first evidence on petitions of individual electric companies for increased rates because of the tremendously increased costs of operation, took the cases under advisement. The petitions for authority to add surcharges to each regular bill were filed by the Indianapolis Light & Heat Company and the Merchants' Heat & Light Company of Indianapolis. The evidence introduced was of a nature to show conclusively that electric companies face in 1917-18 the hardest winter of their history. The commission probably will give no decision until it has heard the majority of the similar cases which have been filed by many companies.

A great mass of testimony was introduced at the hearings on Aug. 8 to show that high costs of coal, materials, and labor and increased taxes, etc., have increased operating expenses to such an extent that companies must have relief.

A memorandum presented by the Merchants' Heat & Light Company said that on account of the extraordinary increases in operating expenses it finds "that with proper allowance for depreciation—not exceeding 3 per cent—it has a deficit from operations from July 1, 1916, to June 30, 1917, of \$154,358, and for the year ending June 30, 1918, its operations, based upon careful estimates, will show a loss of approximately \$560,000, basing income upon the present rates for service. The losses resulting from last year's operation cannot now be recouped." The memorandum adds:

But the commission can grant, upon sufficient showing, such relief as will materially lessen the losses of the company's operation for the next year and make it possible for the company to finance the usual necessary extensions and betterments of its plant to such an extent that its losses may not result in the curtailment of its service or the substantial deterioration of its property.

The memorandum also sets forth that when the present rate schedules were filed coal was 75 cents a ton for screenings and \$1.10 for mine run, but to-day coal on the open market is "what the traffic will bear." It was estimated at the hearing that the average cost of coal for the next year will be \$3.15 a ton, delivered at the plant.

C. C. Perry, president Indianapolis Light & Heat Company, testified that a great burden had been added to operating expenses because many private electric plants of manufacturing firms and office buildings have been closed. In such cases application has been made to his company for service under present rates. These rates meant much smaller expense to consumers than they would have had in operating private plants under prevailing conditions of coal cost. Mr. Perry pointed out that the more the company added of this class of customers the more it lost, but that it was compelled, to give such service wherever asked, under existing rules and schedules.

From questions asked by E. I. Lewis, chairman of the commission, the possibility was suggested that if the right to make a surcharge should be granted to

companies, such a surcharge might be made to fall more heavily on manufacturing consumers than on residence consumers.

Mr. Lewis questioned Mr. Perry extensively on the relative percentage of power and light business. Both of the Indianapolis companies were asked by the commission to submit data on this point. Mr. Perry testified that in order to take care of largely increasing business his company must expend \$600,000 for additions and improvements by July 1, 1918. About \$400,000 bonds would have to be issued.

Mr. Perry added that since 1914, when the present rates went into effect, his company had not shown a very favorable balance in any year, and that it was not now making money. The Indianapolis Light & Heat Company has about 35,000 residence connections, he said, with an average payment of \$1.10 a month. He contended that the company makes nothing from thousands of residence consumers, who pay less than \$1 a month. He urged a minimum rate of \$1 a month in place of the present minimum charge of 50 cents.

HOW FAR ARE CONTRACTS BINDING?

Mr. Perry gave testimony regarding clauses in a new coal contract which he has signed, showing the general trend toward price control by the coal operators' association. He said that during December, January, February and March of 1916-17 the coal companies failed to live up to their contracts and the lighting company was compelled to buy 9033 tons (8129 t.) on the open market at an average price of \$3.71 a ton, while contract prices ranged from \$1 to \$1.16. He estimated that the company would consume 154,000 tons (138,600 t.) of coal during the next year. Mr. Perry declared that it might be extremely difficult to force adequate deliveries under contracts as mine operators were contending that contracts bind them to fulfill contract agreements only when mines are in full operation.

H. H. Harrison, president of the Merchants' company, said it was desirable for his company to store between 30,000 and 40,000 tons (27,000 and 36,000 t.) of coal to provide against emergencies next winter, but that storage now is impossible except at excessive costs. Under his contract—and Mr. Harrison testified that he was afraid that it would not be carried out—he had bought screenings last year for from 55 to 60 cents a ton, while screenings on the open market now are up to \$2.50 a ton. In the latter part of last November Mr. Harrison declared the coal company with which he had his contract notified him that it would be impossible to fill his contract and that coal must be bought on the open market.

Mr. Harrison said that because of the rise in coal prices his company had been at an excess expense of \$123,000 for the year just closed and more than \$100,000 of this amount now is the subject of litigation. He estimated that his company this year is paying an average of \$2.17 a ton for coal, and it is estimated that it may go to \$3.15 a ton.

Both Mr. Harrison and Mr. Perry gave details of many other increased expenses, including additional burdens of taxation. The point was reiterated that the business of both companies is growing rapidly and that they must have sufficient money for necessary extensions.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Safe Place to Work When Making Repairs.—It is the duty of an employer to furnish the employee a safe place within which to work and to provide him with proper tools and equipment, a duty which includes that of making reasonable inspection and repairs, the Appellate Court of Indiana held (116 N.E. 600). Actionable negligence in an employer cannot be predicated on mere failure to inspect, when inspection would disclose only what was known and appreciated by the employee. An employer's duty to furnish a reasonably safe place to work and to use ordinary care to keep it safe is a qualified duty. In a case where the overseer of lines of a telephone company engaged in dismantling a line at the company's direction was injured when a telephone pole which he had climbed broke off at the ground because it was rotten, the telephone company was not liable for the injuries, since the servant was engaged in dismantling work, was experienced and in full charge, and determined for himself whether poles were sound or unsound.

Electric Companies Cannot Maintain Dangerous Wires Near Human Beings.—In the case of *Dwight Manufacturing Company vs. Word* (75 S.R. 979), the Supreme Court of Alabama approved as sound the following rules of law which are well settled by the most authoritative decisions in this country: (1) The duty of an electric company in conveying a current of high potential to exercise commensurate care under the circumstances requires it to insulate its wires and to use reasonable care to keep the same insulated, wherever it may reasonably be anticipated that persons pursuing business or pleasure may come in contact therewith. This statement of the rule implies that, in the absence of statute or municipal ordinance, it is not necessary to insulate wires which are so placed that no one could reasonably be expected to come in proximity to them. (2) The fact that it may be expensive to place a proper insulation upon electric wires is no excuse for a failure to do so. (3) An electric company maintaining a dangerous wire through or near a tree is bound to anticipate that persons may lawfully climb the tree, and it is bound to exercise due care to prevent injuries to such persons from its wires. (4) The maintenance of a wire through a tree requires frequent inspection, for the company is charged with knowledge that the swaying of the limbs is likely to abrade the insulation and permit the dangerous current to escape. These last two propositions are, of course, to be qualified by the nearness or remoteness

of the tree with respect to human beings and their natural and probable associations therewith. (5) From the foregoing it is clear that courts judicially know that even wires carrying very high voltage may be so insulated as to lessen at least materially the danger of shock to those who come in contact therewith. (6) But the extent of such protection and the particular physical conditions, if any, under which insulation may become entirely useless are matters for expert opinion. The merit of the fourth count of the complaint is rested upon the assumption that defendant is guilty of a breach of duty to employees of a telephone company in maintaining and operating a wire carrying a dangerous current of electricity in such proximity to the telephone wires that telephone employees are likely to come in contact therewith while in the proper discharge of their duties; but it is clear that the maintenance and operation of such a wire by defendant is wrongful only when the dangerous proximity complained of is caused by defendant.

Flowage Rights Not Secured by Eminent Domain.—The Supreme Court of New Hampshire, in the case of *Thompson & Nesmith vs. Manchester Traction, Light & Power Company* (101 A. 212), held that the public service commission act giving railroads and public utilities the right to petition the Public Service Commission to take lands needed for the construction of a line, branch line, extension or pipe line, conduit, line of poles, etc., to meet the reasonable requirements of service to the public, does not give public utilities the power to secure flowage rights by eminent domain, though the words "rights and easements" and "land" in the statute make it broad enough to include flowage rights. Many companies under special acts of the Legislature have been granted the power to acquire flowage rights by eminent domain without paying 50 per cent more than the actual damages occasioned by the flowage. These companies, however, have been largely aqueduct companies for the purpose of supplying towns with water, and some of them were municipal water companies, but the rights granted do not imply the use of water for power. Only a very few of these companies chartered previous to the public service commission act were hydroelectric companies similar to the defendants' company. It will be noted that some of the largest companies of this character that have in recent years been granted the right to obtain flowage rights for power by special legislative act have been required to pay 50 per cent more than the actual flowage damages. Since the passage of the public service commission act in 1911 several public utility companies have been granted by special acts of the Legislature power to acquire flowage rights by paying only the actual flowage damages. If the position of the defendants is correct, there was no occasion for these companies to seek such rights by special acts from the Legislature, and no reason why they should have been granted.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Rate of Return in Oregon.—The Oregon Public Service Commission has rendered a decision affecting electric and water rates of the California-Oregon Power Company. The commission found that from its electric operations the company during 1916 had received returns amounting to less than 5 per cent, and from its water operations returns amounting to approximately 5 per cent, and in view of this decided not to make any reductions. The decision said: "The commission is satisfied that the company has not received an unreasonably high return upon its property, but on the other hand has obtained less than investors might reasonably be entitled to expect from investments involving like risks, and less than the prevailing rate of interest throughout the territory. In view of these findings no general reduction in rates is justified, nor is it believed that total returns can be satisfactorily increased by advanced charges. All changes in present tariffs will, therefore, be designed to maintain as nearly as practicable the present total income and to erase any possible unjust discrimination between customers."

Free Service Prohibited by Oregon Commission.—The Public Service Commission of Oregon has handed down a decision against the Home Telephone & Telegraph Company of Portland, Ore., restraining it from placing a supplementary rate schedule in effect whereby no charge is made to new subscribers for residence telephones for the first three months' service. It was contended that by giving three months' free service to subscribers the company would be enabled eventually to increase its revenues without adding to its present expense of operation and without throwing any added burden on its present subscribers, and that new business could thus be procured at a much less expense. It was held by the commission that the inevitable result of such a practice would mean the practical annulment of the utilities act, permit the establishment of a method to stifle legitimate competition, bring ruin to the weaker utilities and in many cases bankruptcy to the one adopting such a method. The public is therefore vitally interested in preventing any practice which would in any way affect the financial condition of such a utility. Any utility which furnishes or offers to furnish service at free or reduced rates, or which makes any concession whatsoever to new subscribers, not only violates both the letter and the spirit of the act, but subjects those to whom such service is furnished to severe penalty.

Current News and Notes

Timely items on electrical happenings throughout the world, together with notes of general interest.

Municipal System Seeks to Raise Rate.—The cost of running its plant having increased from \$7,000 a year to \$14,000, the Utilities Commission of Easton, Md., is seeking permission to increase the rates for electric service. A year ago the city contracted for coal at \$3.85 a ton which now costs from \$7.50 to \$8 a ton.

City May Establish Rates.—The Ohio Public Utilities Commission handed down a decision holding that the city of Dayton cannot protest the rate made by the Dayton Power & Light Company, but may, however, establish a rate itself. Should that rate not be satisfactory to the Dayton Power & Light Company, the latter may appeal to the commission to determine the case.

Jovian Insurance Progressing Favorably.—The actual sales up to date of Jovian health and accident insurance policies show a total premium income of about \$4,000. While the central office of the Jovian Order has no definite comparative data by which to judge this sales record, the insurance people who are interested in the proposition are entirely satisfied with the progress which is being made. The indications are that Jovians who carry insurance are changing to the Jovian plan at the expiration of the policies which they now hold.

Brooklyn's Electrical Growth.—That the borough of Brooklyn is being developed rapidly is shown by the report of the commercial organization of the Brooklyn Edison company covering sales for the first six months of 1917. Contracts for 18,982 new customers were signed covering light and power customers. By the power customers 32,010 hp. was contracted for. Five hundred and eighty-six old houses were rewired and 494 old stores rewired. If the number of contracts for light in houses and stores be placed on a candlepower basis, it is found that 16,827,502 cp. in light, with the new tungsten units, was contracted for. Over 6650 appliances were sold. In this number have been included more than 1500 electric irons, more than 1000 vacuum cleaners, 500 electric vibrators, 300 heating pads, etc. Thirty-seven independent power plants have been replaced with Edison service during the first six months of the year. A large amount of additional power business was added to existing Brooklyn Edison power customers, the Bush Terminal alone taking nearly 4000 additional, the Rockwood Company 1000 hp. and the Metropolitan Engineering Company 1500 hp. Contracts were taken for wiring more than 1200 new residences.

Electric Vehicles in Shanghai.—United States Consul General Thomas Sammons reports that electric vehicles made their first appearance in Shanghai, China, during the year. The municipal department of electricity bought several cars and trucks and contemplates the addition of others. There are a few private electric cars.

Electrical Equipment of Hotel Commonwealth, New York.—The General Electric Company is to have a part in the construction of the Hotel Commonwealth, soon to rise twenty-eight stories in the Times Square district of New York, under the supervision of Charles E. Knox, consulting engineer. The electrical equipment for power will be sufficient for a city of 20,000 inhabitants. Not only electrical apparatus for the lighting, heating and ventilating but electrical devices for operating and controlling the machinery used in the kitchen, laundry and refrigeration departments, the pneumatic-tube service, vacuum-cleaner system and the various pumps necessary in a building of this type will be furnished by the General Electric Company. This company will also provide the electrical conduits, wires, cables and incandescent lamps. The hotel is to contain 2500 rooms. To be designed, built, decorated and equipped under a single contract originated by W. J. Hoggson, a well-known builder of banks, it will cost \$15,000,000, and will be owned and operated on a co-operative basis by more than 100,000 shareholders, each of whom may subscribe for from one to ten shares of stock, value \$100.

Energy for Georgia District to Be Supplied by Gregg Shoals Plant.—As a temporary expedient to supply the Franklin district of the Georgia Railway & Power Company centered around Royston, Ga., with hydroelectric power until the ultimately projected line from Tallulah Falls can be built, power is to be purchased from the Gregg Shoals plant, now under lease to the Southern Power Company, and a line will be built from Gregg Shoals to Elberton and from Elberton to Royston for the transmission of this supply. Under the terms of the agreement, an equivalent amount of power will be returned to the Southern Power Company from the Tallulah plant. This arrangement will defer until conditions in the material market improve the heavy expense of connecting Tallulah with the Franklin district by way of Toccoa. The line to be built between Elberton and Royston will become a part of the permanent equipment of the Franklin district, and it is probable that the Gregg Shoals-Elberton line also will remain for the purposes of interchange of power between the Southern Power Company and these companies. Right-of-way for the Gregg Shoals-Elberton line is reported as approximately ready, and right-of-way for the Elberton-Royston line is ready and is being surveyed. Construction will be started as soon as the engineers finish their work.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Missouri Electrical Contractors' Association.—The Missouri Electrical Contractors' Association held its semi-annual meeting at the Colonial Hotel, Springfield, Mo., July 28. Several short talks were made regarding the contracting situation, and it was urged that the members form a closer union between the contractors and architects. F. B. Adams of St. Louis is the president and Robert Baker of Kansas City the secretary of the association.

Iowa Section, N. E. L. A.—The executive committee of the Iowa Section, N. E. L. A., held a meeting at Davenport recently which took the place of the usual annual convention. At this meeting there was a general round-table discussion of topics interesting to the state association, and a great deal of time was spent in discussing the coal situation. R. H. Fowler, assistant secretary, Des Moines, tendered his resignation as he is entering the government service. His work will be carried on in the future by L. E. Caldwell, secretary-treasurer, Iowa City.

Ohio Electric Light Association.—The members of the various committees of the Ohio Electric Light Association for the coming year are as follows: Advisory—W. W. Freeman, Cincinnati; E. P. Matthews, Dayton; F. J. Derge, Toledo. Finance—E. L. Franklin, Warren; Norman McD. Crawford, Columbus; J. H. Scobell, Cleveland. Illuminating—F. C. Caldwell, Columbus; Ware Parsons, Springfield; G. E. Merrill, Cleveland. Meters—G. E. Snider, Toledo; C. P. Gorman, Dayton; Roy Walford, Newark. New-Business Co-operations—Commercial lighting and merchandising—C. E. Yacoll, Youngstown; O. A. Acuff, Massillon; C. H. Felker, Columbus; W. P. Whittington, Springfield; C. J. Eichelberger, Cincinnati. Industrial power, heating and lighting—F. B. Steele, Dayton; W. B. Wilkinson, Newark; C. D. Carlson, Cleveland. Station Operating—H. B. Dates, Cleveland; William Long, Toledo; R. J. Feathers, Columbus; B. G. Sloat, Sandusky; H. W. Bromley, Youngstown; Mr. Aldrich, Cleveland; C. H. Speihler, Dayton; C. W. De Forest, Cincinnati. Transmission and Distribution—M. H. Wagner, Dayton; R. R. Krammes, Newark; W. E. Beatty, Cincinnati; J. B. Johnson, Elyria; C. A. Harrington, Youngstown; M. E. Grah, Toledo; Prof. A. M. Wilson, Cincinnati. Standardization of Voltages—H. L. Wallau, Cleveland; H. B. Dates, Cleveland; C. I. Crippen, Youngstown. The officers elected at the recent meeting of this association were given in the July 28 issue of the ELECTRICAL WORLD.

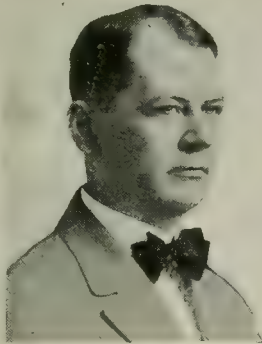
Thomas Pitts continues as manager of the Northwestern Light & Power Company at Hutchinson, Minn. This company was recently acquired by the Northern States Power Company.

J. W. Campbell, Jr., continues as manager of the Minnesota Valley Light & Power Company, Montevideo, Minn., which was recently acquired by the Northern States Power Company.

Carl Oppen has been appointed manager of the Pipestone (Minn.) district of the Northwestern Light & Power Company, which was recently acquired by the Northern States Power Company.

R. A. Gordon has been transferred from the local managership of the Hamilton (Ill.) branch of the Keokuk Electric Company to become commercial agent of the company, succeeding R. R. Ralston, who has been transferred to Paducah, Ky.

J. H. Prior, formerly chief engineer of the Illinois Public Utilities Commission, has left the service of the



J. H. PRIOR

Illinois Commission to open an engineering office in Chicago. Mr. Prior entered the service of the Illinois Commission about three years ago as assistant chief engineer and a year later was appointed chief engineer. Before that time, during the years 1905 to 1914, Mr. Prior was engineer of design of the Chicago, Milwaukee & St. Paul Railway and was engaged in the design of all structures on that railway and on its 2000-mile (3219-km.) extension known as the Puget Sound Lines. Mr. Prior made two of the earliest valuations of railroad properties required by railroad regulatory and taxing bodies. Mr. Prior was educated at the Armour Institute of Technology and the University of Chicago.

Robert Montgomery, manager of the commercial department of the Louisville Gas & Electric Company of Louisville, Ky., has passed the examination for admission to the officers' training camp and will go to Fort Benjamin Harrison, Ind., on Aug. 27. His position will be reserved for him until he returns, T. B. Wilson, secretary of the company, taking up the executive duties

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

of the office, while the routine work will be taken up by others.

Rich. D. Whitney has recently been promoted from assistant professor of electrical engineering to associate professor of electrical engineering in Syracuse University, Syracuse, N. Y.

G. W. Atkinson has recently been appointed electrical engineer for the Springfield Armory, Springfield, Mass., after having served eight years in the supervising architect's office, Treasury Department, Washington, D. C.

H. L. Nichols has purchased a controlling interest in the Minnesota Gas & Electric Company at Albert Lea, Minn., and has taken over the active management of the property. He has been elected secretary, treasurer and manager of the company, succeeding F. A. Otto, who has resigned.

R. R. Ralston, for the last four years commercial agent of the Keokuk (Iowa) Electric Company, has been transferred by the operators, the Stone & Webster Management Corporation, to Paducah, Ky., where he will have charge of the new-business department of the Paducah Light & Traction Company.

Adrian Tobias, who has been superintendent of the meter department of the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, since 1915, has returned to the employ of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., which he left some time ago to take up central station work.

Edward A. Wickes has resigned as president of the Niagara Falls Power Company, the Niagara Junction Railway Company and the Niagara Development Company. Mr. Wickes has been active in the management of the affairs of the power company since its inception in 1890 and has been president of the company for many years. Advancing age led him to seek retirement from active responsibilities.

George A. Harris has been appointed auditor and treasurer of the Edison Electric Light & Power Company of Amsterdam, N. Y., and the Fonda, Johnstown & Gloversville Railroad Company. Mr. Harris has been secretary and general auditor of the electric company and general auditor of the railroad since July, 1907. This promotion is in recognition of his services with both companies for a twenty-five-year period. Mr. Harris is also secretary and treasurer of the East Creek Electric Light & Power Company of St. Johnsville, N. Y. Lyman K. Brown, formerly treasurer of the railroad company, resigned on account of ill health.

Anson Marston, dean of the College of Engineering at Ames, Iowa, has been mustered into federal service as a major in the Iowa engineering battalion.

William A. Bittner, until recently purchasing agent of the Union Electric Company of Pittsburgh, Pa., has severed his connection with that firm to engage in the business of manufacturers' agent. He is associated with Ralph C. Sperry, operating under the name of Sperry & Bittner.

Ralph C. Sperry, until recently Pittsburgh district manager of the Brilliant Electric Division of the National Lamp Works, has severed his connection with that company to engage in the business of manufacturers' agent in Pittsburgh, with William A. Bittner, under the name of Sperry & Bittner.

D. Roy Blaicher, who was purchasing agent for the Minneapolis General Electric Company and all divisions of the Northern States Power Company, has been called to Washington, D. C., to serve on the board of buyers. He will have charge of purchasing all elec-



D. ROY BLAICHER

trical equipment for the various government work throughout the country. Mr. Blaicher's selection came as the result of a sweeping offer made by H. M. Byllesby & Company to loan the government any of their employees during the period of the war. Mr. Blaicher, who is thirty-eight years old, was born in Hamilton, Canada. He has been purchasing agent for the Baldwin Locomotive Company at Pittsburgh, was connected with the service department of the General Electric Company at Schenectady, was purchasing agent for the Toronto Electric Light Company, and was later employed in the purchasing department of the Toronto Street Railway Company and the Toronto Power Company. In 1913 he entered the employ of the Minneapolis General Electric Company as purchasing agent, and during the last two years he has supervised the buying of all material for the Northern States Power Company, as well as for the Minneapolis company. Mr. Blaicher is an active worker in Jovian and N. E. L. A. affairs and is at the present time treasurer of the Association of Edison Purchasing Agents.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

JOBBER AND MANUFACTURERS TIGHTENING UP ON CREDITS

Considerable More Capital Is Now Required than Formerly to Do Business—Accounts Collected Promptly Where Possible

A factor which is becoming of considerable consequence is the tendency of some dealers in electrical equipment and fittings, particularly retailers, to endeavor to obtain increased credit. The credit men of the different concerns are watching this situation very closely, because this demand for increased credit does not necessarily mean increased business or an increase in the quantity of goods sold. In fact, it has been stated that in some lines the purchaser "now requires from 50 to 100 per cent more capital to do business than was necessary two or three years ago. The merchant may not have this capital. Therefore, instead of borrowing, he is prone to expect the wholesaler to carry him and in many instances tries to enforce this requirement. The wholesaler is in no better condition than the retailer. Raw materials in many instances have advanced from 100 to 500 per cent, and it follows that the wholesaler is in no position to assume the load of the retailer as well as his own." Hence, in view of the fact that prices are still advancing and that they will probably continue to advance, the tendency is not to grant extensions where it can be avoided. The policy of the more conservative concerns appears to be to collect accounts promptly when they are due wherever it is possible to accomplish this.

RIGID CONDUIT MARKET IN SOUTH AMERICA

Any Big Development in Electrical Exports to West Coast Must Come as a Result of Investment of American Capital

The following is taken from a recent report of P. S. Smith, special agent of the Bureau of Foreign and Domestic Commerce, investigating opportunities for trade with South America in electrical goods:

"There is no market for rigid conduit in Ecuador, Peru or Bolivia. Several reasons may be given. There are no rules or regulations covering electrical installations which would require the use of conduit. That being the case, no one is going to put in the material when it only adds to the cost of his installation without giving him any advantage. In fact, it would be a disadvantage, because every householder does most of his own wiring and wants to have the wires exposed, so that he may get at them easily. There is no advantage in any of these countries, with the possible exception of cases in the city of Guayaquil, in using conduit as a protection against fire caused by damaged wires, as all the houses, including inside walls and partitions, are made of adobe or volcanic rock, both of which are non-inflammable. It would be necessary to run the conduit on the outside of the walls—that is, not concealed as is the practice in frame houses—and the flexible cord which is universally used for house wiring is less conspicuous. The high cost of the steel conduit laid down in these countries, on account of freight and duty charges, is quite prohibitive. It is largely for this reason that not even the European systems of tubing are used to any extent.

"Rigid conduit is in favor only in connection with companies which are formed with American capital and manned by American engineers. So far as the three countries men-

tioned are concerned, it is a waste of time for any one to try to sell material of this sort to any company except one that is run on American capital. If any big development in our electrical export trade is to take place on the west coast of South America it will come as a result of the investment of American capital in mines, railways, electric companies and general mercantile stores, which will be truly American selling agencies, and not jobbers who pretend to handle American goods but in reality hold agencies for manufacturers in the States while making attempts to sell only the products of other countries."

CANADIAN ELECTRIC IMPORTS

IN 1916-17 ARE \$6,342,490

United States Furnished 97 Per Cent of the Total During the Fiscal Year Which Ended March 31 Last

Figures are now available showing the foreign trade of Canada for the fiscal year ended March 31, 1917. The total imports of electrical merchandise during that period were \$6,342,490, as compared with \$4,896,106 for the corresponding period a year previous. Of the 1916-17 total, \$176,700 came from the United Kingdom and \$6,149,342, or 97 per cent, from the United States.

While these figures show that virtually the entire amount of Canadian electrical imports originated in the United States, they do not show the extent to which Canada depends on electrical goods manufactured under supervision of interests in the United States. Many of the larger manufacturers in this country have Canadian branch factories where electrical goods for Canadian consumption are produced. The goods are identical with those manufactured in the States. They are made in Canada so as to avoid import duty.

UNIFORM ACCOUNTING FOR WASHING-MACHINE PRODUCERS

Believe That It Will Make for Particular Convenience in Applying for Credit to Federal Reserve Banks

Seventy-five delegates, representing fifty different manufacturers, attended the meeting of the American Washing Machine Manufacturers' Association held at the Hotel Sherman, Chicago, not long ago. President Sam T. White of Davenport, Iowa, presided. It was decided to make use of the Federal Reserve bulletins on uniform system of keeping accounts, with the feeling that this will make for particular convenience in applying for credit to banks holding membership in the Federal Reserve system. The question of trade acceptances was also discussed, the discussion ending with a resolution favoring their use by every member of the association.

Of special interest to the manufacturers were the reports presented by Raymond Marsh, secretary of the association, who has made several trips to Washington to ascertain the attitude of the government toward the washing-machine industry. Mr. Marsh assured the delegates that the Council of National Defense believes there will be no shortage of materials for the remainder of 1917. An instructive paper on the subject of billing, invoicing and handling of customers' accounts was read by Howard Power of the White Lily Manufacturing Company, Davenport. Mr. Power expressed his opinion, based on long ex-

perience, that there is a tendency on the part of manufacturers to ship on too low ratings. He advised more caution and care in handling low rating accounts.

GERMAN MANUFACTURERS FIX PRICE INCREASES

Quotations Based on Practice Followed Before the War and War Practice Using Substitute Metals

From information recently published in German papers it is learned that the eleven leading electrical manufacturers of Germany are working together for the purpose of fixing prices on common accounts. This is reported in the London *Electrical Review*, no German papers having reached this country for many months. The report states that at the present time the conditions in the market for castings, sheet insulating materials, etc., are such that almost all the firms that supply these state that they are unable to accept orders at definite prices. The prices for raw materials in Germany are now quoted as of the date of delivery, and for that reason the electrical manufacturers have been compelled to quote in the same way. In order, therefore, to inform a customer of the situation of prices within a certain period, these eleven firms have undertaken to issue circulars to their customers in the future.

In these circulars, it is stated, the situation of prices at any time will be expressed by war price increases on certain basic prices. Basic prices for manufacturers made according to the prices followed in peace times are considered to be the prices which prevailed before the war, copper, brass, bronze, etc., being used; for machinery and other manufacture with substitute metals—iron, zinc aluminum, etc.—also, the basic prices are those which ruled for materials and wages before the war.

These firms fixed for June of this year and for manufactures for which definite prices could not be quoted four war-price increases, which vary according as to whether the orders are executed by peace-practice or war-practice methods, as shown in the table. Three of these relate to peace practice; that is, using copper, brass, bronze, etc. The fourth increase applies to the war method of execution with substitute metals.

PERCENTAGE INCREASE ON BASIS OF PRE-WAR PRICES

	No. 1: Direct War Orders Executed According to Peace Time Practice with Copper, Brass, Bronze, Etc., Per Cent	No. 2: Indirect War Orders for which Copper, Brass, Bronze, Etc., Are Released by the Government for Each Order, Per Cent	No. 3: Orders for Peace Purposes, Per Cent	No. 4: Orders with Substitute Metals (Iron, Zinc, Aluminum, Etc.), Per Cent
Small motors up to 5 kw. (1000 revolutions), including crane and lift motors etc.	125	140	200	35
Generators and motors over 5 kw. and up to 100 kw. (100 revolutions)	150	165	210	100
Generators and motors of over 100 kw.	160	175	230	110
Electric locomotives	160	170	190	140
Turbo-generator sets	140	145	....	....
Steam turbines	140	145	....	....
Starting switches, regulating resistances, etc.	125	140	180	125
Transformers (not oil-insulated)	150	165	225	150
Switching apparatus	110	125	170	100
Switchboard fuses and high-tension fuses	115	130	200	115
Excess voltage protecting apparatus	120	135	190	120

It is explained in the German account that the electrical firms receive supplies of copper and copper alloys from the controlling departments at fixed prices for classes Nos. 1 and 2, these being higher for No. 2. In the case of class 3, and in so far as orders for peace purposes can be carried out, it is mentioned that for these must be used exclusively any stocks released for this purpose, supplemented as far as possible by imports. The State War Department make no range of prices for substitute metals, while materials for the manufacture of cables are allotted for each other, and the customer is charged on the basis of the prices paid for these materials.

THE WEEK IN TRADE

THE repressing effect of existing uncertainties has become more sharply defined, and in some of its most important branches business is characterized by rather more than the usual midsummer halting. With the continued doubts about prices, and with the widening scope of the export embargo, the quietness natural at this season is intensified. Not only buyers but also sellers are in many instances disinclined to commit themselves further pending a clearer insight into the future, and in steel, lumber, textiles and elsewhere governmental purchases take precedence over all other requirements. Despite its various drawbacks general business remains in a strong position and the absence of heavy speculation is encouraging. As far as the metal market is concerned, things seem to have come to a standstill.

All interest centers in Washington, and advices from there say that many manufacturers and producers of war materials are ranging themselves to oppose the administration program of the same prices to the Allies as to the United States.

NEW YORK

Trade conditions remained quiet in the New York district during the past week. Prices changed but slightly, owing to the general uncertainty of business conditions and the continued doubt about prices. The labor situation is improving, but it is expected that the draft will affect a great many factories. Stocks are being replenished rapidly and deliveries of raw materials to manufacturers are improving.

Jobbers and manufacturers are tightening up on credits, accounts being collected as promptly as possible. It is said that in many lines purchasers require from 50 to 100 per cent more capital to do business than was necessary two years ago.

SAFETY SWITCHES.—There is a heavy demand for safety switches, with manufacturers' stocks in fair condition.

FANS.—Owing to the cooler weather the demand for fans has slackened. Stocks are in fair shape.

SECOND-HAND MACHINERY.—The demand for this type of machinery is larger than ever before, and high prices are being obtained in all lines. The heavy demand is due to the inability of manufacturers to make deliveries in many lines of equipment.

LINE MATERIAL.—Demand for insulators heavy, with deliveries slow. Other line material is reported to be moving more slowly.

FIXTURES.—Building activity remains about the same, stocks in good condition.

STORAGE BATTERIES.—Manufacturers are enlarging plants because of heavy demand. Automobile manufacturers continue to place heavy orders for batteries and ask for rapid delivery.

WIRE AND CABLE.—Stocks in smaller sizes of wire in poor shape because of recent heavy demands, but show signs of picking up as demand slackens. Deliveries on power cables are slow.

CREDITS AND COLLECTIONS.—These continue good and prospects for collections during August are better than ever before.

LAMPS.—Certain of the Eastern incandescent lamp factories, because of the expensive additional equipment which will be in effective operation in the near future, are again preparing to make strenuous efforts to sell incandescent lamps. It is generally understood that certain manufacturers have not been pushing incandescent lamp sales very hard because they could not deliver the lamps; but this condition has, in certain instances, now been corrected and aggressive sales campaigns will be inaugurated. Factory stocks are known to be increasing.

CHICAGO

When war broke out some one immediately came forward with the slogan "Business as usual." Important financial men at once pointed out that, while there would be business in plenty, it would not be "as usual." An attempt to discover wherein business is not as usual in the Chicago territory this week developed the following interesting situation:

Distributors of electrical supplies in general have two barometers by which they gage business. One barometer registers the volume of material; the other registers dollars and cents. The latter shows "fair weather"; the former does not present such an optimistic outlook. It may be said definitely that central stations and electrical contractors are not buying so heavily as they were at this time last year. This is probably due in part, as far as the central stations are concerned, both to the war and to high prices. The contractors' business is being influenced by prices of material and unfavorable labor conditions. The volume in dollars of the distributors' business is therefore being held up, not by business as usual, but by government orders and the like.

Nevertheless, distributors in their buying have been optimistic. They have on hand stocks of fall lighting equipment bought on the basis of 1916 sales. There is a conviction that this class of goods will soon begin to move.

RUBBER-COVERED WIRE.—Some distributors have dropped from a 39-cent to a 35-cent base, while others have held at 37 cents. This is taken not so much as an indication of a falling market as of the fact that at the 39-cent base certain distributors were endeavoring to hold off business. They are now in a position to take on business and have dropped to the lower base to get it. This is another indication of the spotty condition of the market in the Chicago territory.

LIGHTING FIXTURES.—Business in lighting fixtures has fallen off considerably in Chicago, owing to the fact that practically no building is going on. In the first week of August there was one day on which only one building permit was issued.

BAKE OVENS.—In the electric heating field the bake-oven business is claiming first attention of manufacturers.

HEATING APPLIANCES.—There will be another advance in the prices of heating devices, with the exception of flatirons, on Sept. 1. Agents of some devices manufactured in the Chicago territory report gross business satisfactory but volume not so great as in 1916. They see retail buying falling off.

WASHING MACHINES.—The demand continues steady and the factories are being operated at top speed.

BOSTON

Jobbing interests report a moderate recession in business this week, although in exceptional cases trade is extremely active. Prices rule at substantially last week's levels, but it is rumored that a reduction in the price of rubber-covered wire is in early prospect. Electrical manufacturers as a whole are still finding it difficult to accumulate extensive stocks, and the recent extreme heat cut down production temporarily on account of the need of closing plants in the middle of the day to safeguard the health of employees. With more seasonable weather conditions full-time operation resumes. In some lines deliveries are improving. Parallel with the slight recession in demand for new products a perceptible falling off is seen in the market for second-hand electrical equipment and machinery. Collections are reported as better, and one representative Boston jobber states that these are at present in splendid shape. Although business conditions are now largely a matter of deliveries, no immediate increase in the price of central station electrical supplies is anticipated.

WIRE AND CABLE.—Demand continues about the same, with a tendency at present to fall somewhat behind in production and factory stock.

LAMPS.—Very little change appears in the lamp situation compared with a week ago. Prices remain virtually unchanged, and no immediate increases are forecast.

FANS.—Jobbers report exhaustion of stocks by the recent heated spell; retailers were also pretty thoroughly cleaned out, and a large central station reports that its fan sales will exceed last year's, although fans have been sold only on the charge or cash basis, the former custom of deferred payments being given up.

ELECTRIC RANGES.—In recent weeks the sale of these shows an increase, and the prospects for a good August record are excellent. One central station in Massachusetts has averaged seventeen ranges a week in three weeks recently passed.

FLATIRONS.—These are moving well, despite the fact that the warm weather caused a virtual stagnation of business in the larger cities, with the minds of families on draft numbers rather than on the purchase of electric appliances.

AUTOMOBILE STARTING AND LIGHTING SETS.—An increased demand for these equipments is noted by manufacturers since Aug. 1.

STORAGE BATTERIES.—Deliveries are improving, owing in some cases to better facilities for securing raw material and to factory expansion.

ELECTRICAL MACHINERY PRODUCTION.—Large manufacturing interests report capacity orders and continued demand for full production in all important lines, with shortage of labor, both skilled and unskilled.

ATLANTA

Reports from individual jobbers in Georgia, North and South Carolina and Virginia indicate business in all lines for June and July as being the best they have ever had. While cantonments in the states mentioned are making abnormal drafts on the industry, there seems to be no slackening in normal requirements and a very healthy condition prevails.

Good progress is reported on the Columbia (S. C.) cantonment and 40 per cent of the ultimate work for all trades has been completed. The exterior wiring at Charlotte, N. C., is progressing rapidly. Rows of poles are being set up back of proposed tent streets with the idea in view of serving from four to six tents from each pole. The secondary leads will be of sufficient length to handle all cut-ins without difficulty.

LAMPS.—Jobbers report an improvement in the lamp situation with increasing demand from industrial sources.

ELECTRIC RANGES.—Almost dormant as compared with last year.

BELLS AND GONGS.—A price advance of 15 per cent has been registered in the last ten days, but this line continues normal.

LABOR.—There is no indication of a scarcity of electrical workers at this time, and all government and industrial work is progressing without delay. Wages are comparatively higher than three months ago.

SWITCHES, SOCKETS AND RECEPTACLES.—The demand for all lines of general supplies is excellent and deliveries are holding up well.

CONDUIT.—Deliveries are getting longer on both the white and the black enamel rigid products, and there is a slight tendency to draw on the flexible-conduit stock temporarily. Small lots are being quoted at list plus.

SPECIALTIES.—The demand for the household varieties shows a gain over last week.

HEATING DEVICES.—Toasters seem to be the only article showing any strength at this time.

FANS.—The last few weeks of seasonable weather have increased sales materially. The delayed seasonal weather and long deliveries have given a few dealers the opportunity to cancel orders. The South has experienced rainy weather for the last week, and temperatures considerably below normal. This has again slowed up fan sales.

POLES.—Cantonment requirements and industrial extensions have created an abnormal demand and deliveries are slowing up.

CROSS-ARMS.—In spite of a 10 per cent price advance Aug. 1 the demand is very strong.

ST. LOUIS

Business is holding up and executives continue to be optimistic. As an index on general business conditions in this territory, the postmaster of St. Louis announces that the business of the office for the past month has been the greatest in its history.

No decreases in prices on electrical equipment or supplies have been reported to the ELECTRICAL WORLD. On the other hand, some advances, notably in porcelain insulators, rail bonds and switchboard accessories, have been announced in the week. The general feeling seems to be that prices have about reached the maximum limit. Two reasons for this are advanced. One of them is that purchasers, except where absolutely necessary, are declining to buy at the present prices and hence will show greater hesitancy in buying at increased prices. The second is that the price-control movements inaugurated in Washington by legislation and otherwise will ultimately have some effect on all commercial lines. There has been no appreciable change in collections. They continue to hold up well. One manager says that "people are paying who never paid before." This, of course, is an exaggeration, but it indicates the general sentiment.

For some unaccountable reason the labor situation as regards manufacturing-shop help appears suddenly to have improved. One morning last week forty men applied for jobs at the gates of one of the electrical industrial plants, whereas the applications previously received at the same plant had been discouragingly few. Deliveries on raw materials to the manufacturers seem to be gradually improving.

FARM LIGHTING OUTFITS.—Threshing of the wheat in this territory has been completed, and the yields are even greater than anticipated. The outlook for the sales of electrical equipment in farming communities is excellent.

WIRE AND CABLE.—The general situation is unchanged. No large orders or large receipts of material have been discovered.

TRANSFORMERS.—The smaller manufacturers of transformers seem able to offer materially better deliveries than some of their larger competitors. Because of this fact a number of orders, it is said, have been obtained in this territory recently by the smaller concerns.

FAN MOTORS.—The fan season is about over. On the whole, it has been disappointing, and, as has been predicted, it is almost certain that dealers and jobbers in this territory will carry over some fans into next season.

COAL-MINING EQUIPMENT.—This type of equipment continues to be in great demand, provided prompt delivery can be obtained. It is understood that at least one concern was compelled to decline substantial orders for this apparatus because it could not meet the delivery requirements of the would-be purchaser.

SEATTLE

The labor strike continues to affect material conditions in the Northwest adversely. The failure of the conference to end the strike, which has tied up practically all of Washington's logging camps and lumber mills, closed a normal week in business. Lumbermen give assurance that all demands of the government in its war preparations will be promptly met as received. Shipbuilding operations are going ahead uninterrupted. Electrical dealers and jobbers report no particular change in prices as compared with last week. A little uncertainty exists, however, not that it is expected business will drop off, but rather as to how much business the trade should prepare to care for. Dealers are fearful of overloading, knowing that a decrease in prices is certain. Generally it is believed that the peak in prices has been reached. Demand in most cases, excepting lumber and milling industries, is about the same as reported for last week.

POWER EQUIPMENT.—The demand for motors, turbines and generators far exceeds the supply on a majority of types. Deliveries are slow owing to the heavy demand on factories.

LINE MATERIAL.—The demand for maintenance work is light, proposed improvements and extensions being held

up until prices on materials decrease. Utility companies feel that return from heavy investment would not justify expenditures.

POLES AND CROSS-ARMS.—These are hard to obtain owing to lumber conditions. The demand is light.

WIRE AND CABLE.—The demand is light; prices firm, but expected to increase.

FIXTURES.—The demand for fixtures continues light because of the scarcity of building. Deliveries are fairly good.

LAMPS.—Shipyards and public utility companies are buying a considerable amount of carbon lamps. Deliveries are comparatively easy to obtain.

SAN FRANCISCO

Although practically no new building construction is in prospect, and slack conditions attendant upon such inactivity have been anticipated, yet the completion of work under way is keeping up the trade volume and the expected falling off has not yet actually commenced. Payments from large and small concerns are coming in promptly, and on the whole the situation is very satisfactory. Since the organization and general educational movement among contractors and dealers has improved conditions, it has been possible for jobbers to sell more generally on terms making payments coincident with the completion of contracts. This has helped to stabilize trade conditions. It is notable that the retail trade shows no evidence of a tendency on the part of consumers to forego luxuries. For example, one representative San Francisco firm reports more percolator sales in the fifteen-dollar style than in the styles at \$6 and \$8. Retail trade is now as brisk as before our entry into the war, and retailers are realizing a larger percentage of profits. Prices are practically unchanged since last week, and the demand for all household labor-saving devices continues brisk. The opening of the irrigation season has increased the demand for small motors and transformers, but there are practically no stocks on these lines, and deliveries are slow and uncertain. For the first time in many months labor in the electrical field is plentiful, owing to the inactivity in building construction.

METAL MARKETS INACTIVE

Copper Dull and Easier—Other Metals Remain Unchanged—Metal Markets Quotations

The metal markets displayed little activity during the past week. It is rumored that the price the government may have to pay for copper will probably be more than 20 cents. It is understood that this price is based on the higher cost of production, principally through the higher prices paid for labor and the uncertainties in the labor situation. At present the shortage of labor is a serious menace to the production of copper and adds considerably to the cost. Many refineries are running half time.

Prompt and August electrolytic is offered at 27 to 27.50 cents, September at 26.50 to 27 cents, October at 26 to 26.50 cents, and last quarter at 25 to 26 cents.

NEW YORK METAL MARKET PRICES

	Aug. 6			Aug. 13		
	f	s	d	f	s	d
Copper:						
London, standard spot	125	0	0	125	0	0
Prime Lake	29.50	to	30.00*	28.50	to	29.50*
Electrolytic	28.00	to	28.50*	27.00	to	27.50*
Casting	26.50	to	27.00*	26.00	to	26.50*
Wire base	33.00	to	33.50*	33.00	to	33.50*
Lead, trust price	11.00			11.00		
Nickel, ingot	50.00			50.00		
Sheet zinc, f.o.b. smelter	19.00			19.00		
Spelter, spot	8.55	to	8.67½	8.67½		
Tin, Straits	63.60			62.50*		
Aluminum, 98 to 99 per cent.	46.00	to	48.00*	46.00	to	48.00*

OLD METALS

Heavy copper and wire	24.00	to	24.50	25.00	to	26.00
Brass, heavy	15.00	to	15.50	15.50	to	16.25
Brass, light	12.50	to	13.00	13.50	to	14.00
Lead, heavy	8.75	to	9.00	9.00	to	9.25
Zinc, old scrap	6.25	to	6.50	6.25	to	6.50

*Nominal.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List, per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor

No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 solid:	
Less than coil.....	\$54.90 to \$61.00
Coil to 1000 ft.....	48.80 to 59.17
No. 12 solid:	
Less than coil.....	63.90 to 71.00
Coil to 1000 ft.....	56.80 to 68.87

Twin-Conductor

No. 14 solid:	
Less than coil.....	\$78.00 to \$104.00
Coil to 1000 ft.....	75.00 to 80.00
No. 12 solid:	
Less than coil.....	121.50 to 135.00
Coil to 1000 ft.....	108.00 to 130.95

DISCOUNT—CHICAGO

Single-Conductor

Less than coil.....	+10%
Coil to 1000 ft.....	-10%

Twin-Conductor

Less than coil.....	+10%
Coil to 1000 ft.....	-10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	-10% to 12%
1/5 to std. pkg.....	10% to 20%
Std. pkg.....	34% to 44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+20% to 12%
1/5 to std. pkg.....	10% to 20%
Std. pkg.....	34% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28	.29

BATTERIES, DRY—Continued CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 30.....	.35	.35
50 to barrel.....	.31 to .31%	.32 to .32%
Barrel lots.....	.28 to .28%	.29 to .29%

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less than Coil	Coil to 1000 Ft.
3/8-in. single strip.....	\$67.50 to \$75.00
3/8-in. double strip.....	71.75 to 75.00
1/2-in. single strip.....	90.00 to 100.00
1/2-in. double strip.....	95.00 to 100.00
3/4-in. single strip.....	100.00 to 105.00
3/4-in. double strip.....	105.00 to 110.00

NET PER 1000 FT.—CHICAGO

Less than Coil	Coil to 100 Ft.
3/8-in. single strip.....	\$75.00
3/8-in. double strip.....	78.75
1/2-in. single strip.....	100.00
1/2-in. double strip.....	105.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
5/8.....	.15	2.....	.55
3/4.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$55.00	\$24.50-\$25.50
1/4-in.—	\$40.00-\$60.00	\$27.00-\$30.00
		\$23.50-\$27.00

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$36.67-\$55.00	\$25.50-\$27.50
1/4-in.—	\$40.00-\$60.00	\$30.00
		\$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List Elbows, List

1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.60
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

1/4 in. to 1/2 in.	1/2 in. to 3 in.
Less than 2500 lb.....	6% to 8% 8% to 10%
2500 to 5000 lb.....	9% to 11% 11% to 13%
(For galvanized deduct six points from above discounts.)	

DISCOUNT—CHICAGO

1/4 in. to 1/2 in.	1/2 in. to 3 in.
Less than 2500 lb.....	3.8% to 7.8% 5.8% to 9.8%
2500-5000 lb.....	6.8% to 10.8% 8.8% to 12.8%
(For galvanized deduct six points from above discounts.)	

FLATIRONS

NEW YORK

Net.....	\$3.50
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CHICAGO

Net.....	\$3.75 to \$4.20
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FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

Per 100 Net

Less than 1/5 std. pkg.	\$5.75 to \$6.30
1/5 to std. pkg.	4.50 to 5.25
Standard package, 500.	List, each, \$0.07.

CHICAGO

Per 100 Net

Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500.	List, each, \$0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B.	100	\$0.27
60-watt—B.	100	.36
100-watt—B.	24	.65
75-watt—C.	50	.65
100-watt—C.	24	1.00
200-watt—C.	24	2.00
300-watt—C.	24	3.00
Round bulbs, 3 1/4 in., frosted:		
15-watt—G 25.	50	.50
25-watt—G 25.	50	.50
40-watt—G 25.	50	.50
Round bulbs, 3 1/2 in., frosted:		
60-watt—G 30.	24	.72
Round bulbs, 4 3/4 in., frosted:		
100-watt—G 35.	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

Per 1000 Ft. Net

Less than coil (250 ft.)	\$30.00 to \$34.88
Coil to 1000 ft.	21.00 to 26.52

CHICAGO

Per 1000 Ft. Net

Less than coil (250 ft.)	\$37.20 to \$37.84
Coil to 1000 ft.	27.90 to 28.38

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100.	\$18.00 to \$29.00
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CHICAGO

Net per 100.	\$15.00 to \$30.00
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OUTLET BOXES

Nos.	List, per 100
101—A, A1 1/2, 4 S.C., 6200, 320.	\$30.00
102—B.A., 6200 S.E., 300, A.X. 1 1/2.	30.00
103—C.A., 9, 4K, B 1 1/2.	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list	List to 33%	List to 27%
\$10.00 to \$50.00 list	List to 42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list	40%	35%
\$10.00 to \$50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

Per 1000 Net

Less than 1/5 std. pkg.	\$14.00 to \$20.00
1/5 to std. pkg.	13.00 to 15.00
Standard package, 2200.	List per 1000, \$20.

CHICAGO

Per 1000 Net

Less than 1/5 std. pkg.	\$15.80 to \$18.00
1/5 to std. pkg.	13.00 to 14.80
Standard package, 2200.	List per 1000, \$20.

PORCELAIN KNOBS

NEW YORK

5 1/2 N.C.—Solid Nail-it—N.C.

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
Less than 1/5 std. pkg.		
1/5 std. pkg.	\$10.50 to \$24.30	\$28.00
1/5 to std. pkg.	9.75 to 12.15	21.50

CHICAGO

5 1/2 N.C.—Solid Nail-it—N.C.

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
Less than 1/5 std. pkg.		
1/5 std. pkg.	\$11.85 to \$18.00	\$20.75 to \$30.75
1/5 to std. pkg.	9.00 to 11.40	16.30 to 24.30

SOCKETS AND RECEPTACLES

	Std. Pk.	List
1/8-in. cap key and push sockets	500	\$0.33
1/8-in. cap keyless socket	500	.30
1/8-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No. Fuse

High Grade:	List
30-amp. S. P. S. T.	\$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

High Grade:	
Less than \$10 list.	List to—5%
\$10 to \$25 list.	11% to 16%
\$25 to \$50 list.	14% to 24%

Low Grade:	
Less than \$10.00 list.	5% to—5%
\$10.00 to \$25.00 list.	11% to 16%
\$25.00 to \$50.00 list.	14% to 24%

DISCOUNT—CHICAGO

High Grade:	
Less than \$10 list.	—5%
\$10 to \$25 list.	—11%
\$25 to \$50 list.	—14%

Low Grade:	
Less than \$10.00 list.	+ 5%
\$10.00 to \$25.00 list.	—16%
\$25.00 to \$50.00 list.	—24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole.	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole.	100	.48
10-amp. single-pole, ind.	100	.54
5-amp., three-point	100	.54
10-amp., three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	.50	.70
10-amp. double-pole	.50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	20% to Net
1/5 to std. pkg.	15% to Net
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar	List, Each
No. 155	\$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list	List to 23%	18%
\$2.00 to \$10.00 list	20% to 23%	18%
\$10.00 to \$50.00 list	23% to 30%	18%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list	25%	15% to 20%
\$2.00 to \$10.00 list	25%	20%
\$10.00 to \$50.00 list	25% to 35%	20% to 25%

TOASTERS, UPRIGHT

NEW YORK

Net price	\$3.10 to \$3.50
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CHICAGO

Net price	\$3.35 to \$3.50
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WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

No. 18, less than full spools.	\$0.52
No. 18, full spools.	0.48

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	\$0.565 to \$0.65
No. 18, full spools.	0.495 to 0.55

WIRE-RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14 ...	\$15.00-18.00	\$12.00-14.50	\$11.50-12.50
12 ...	21.06-28.35	18.96-24.30	18.01-20.25
10 ...	29.60-39.83	26.64-34.14	25.31-28.45
8 ...	42.40-56.49	38.16-48.42	36.25-40.35
6 ...	72.19-89.39	64.98-76.62	61.73-63.85

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14 ...	\$18.00	\$16.00	\$14.00
12 ...	28.08-28.99	24.02-25.62	21.35-22.46
10 ...	39.24-41.51	33.57-35.58	29.65-31.39
8 ...	56.07-60.13	47.97-51.50	42.95-44.86
6 ...	75.24-82.20	64.37-75.35	60.19-60.50

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$40.25 to \$45.00
25 to 50 lb.	39.25 to 42.00
50 to 100 lb.	38.00 to 38.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	\$42.35 to \$45.50
25 to 50 lb.	41.35 to 44.50
50 to 100 lb.	40.35 to 43.50

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Single-Point Screw-Type Bracket

The National Metal Molding Company of Pittsburgh, Pa., has added to its line of wall brackets a single-point screw-type bracket like the one shown. The insulator on this bracket is of the same design as on other brackets made



ADAPTABLE FOR SUPPORTING WIRES TO WOOD SURFACES

by this company; the necessity of using "tie-wires" has been entirely eliminated, and it is intended that the wires be threaded through "iron-bound" insulators, very similar in construction to strain insulators. The design of the insulators, however, is such that "tie-wires" may be used when desired.

This bracket, it is claimed, is especially adaptable for supporting wires to wood surfaces. A 2-in. (5.08-cm.) No. 20 wood screw is firmly attached to the sherardized base, in such a manner as to entirely eliminate the possibility of its turning or pulling loose. The bracket is rugged in construction and also neat in appearance.

Variable-Speed Controller

The Northwestern Electric Company of Chicago has brought out a controller for printing-press motors. The controller is built in 1-hp. and 6-hp. styles. The 1-hp. type consists of a push-button switch, a transformer and an indicating dial. By means of the transformer the speed of the motor is varied by changing the applied voltage in 5.5-volt steps.

The 6-hp. controller is similar to the 1-hp. unit except that it is arranged for reversing and for inching the



FRONT AND REAR VIEW OF CONTROLLER FOR 1-HP. MOTOR

motor. A triple-pole, double-throw switch is connected so that two blades are used for the series field, and the third blade is connected to the no-voltage release coil on the magnetic switch. When the pointer on the control dial is in the inching position, the third blade

of the switch is open. When the starting button is pressed under these conditions the machine starts, but is immediately stopped because no current is passing through the no-voltage release coil.

"Unit Type" I-Beam Busbar Support

In many installations it is necessary to support buses from I-beams, and for this service the "unit type" equipment will be found desirable. The insulator base is provided with adjustable clamps which securely grip the beam, and after being placed in position is firmly locked by means of steel set screws so



I-BEAM BUSBAR SUPPORT

located as to bind the base to the beam. Two sizes of base are supplied, the smaller designed to clamp any size beam up to 8 in. (20 cm.), the larger clamping any beam between 8 in. (20 cm.) and 24 in. (60 cm.). When beams vary in depth, they cannot ordinarily be used for supporting straight runs of bus. By using pipe extensions of suitable length in connection with these supports, the buses can be run straight. These supports, made for all voltages up to 44,000, are manufactured by the Delta-Star Electric Company, Chicago.

Reversible Split Knob

The Findlay Electric Porcelain Company of Findlay, Ohio, has brought out a reversible knob with two available wire grooves and an interlocking feature which keeps the pieces in place while the knob is being installed. It has liberal screw protection and can be installed with screws or nails. The wire way is triangular, insuring a tight grip.

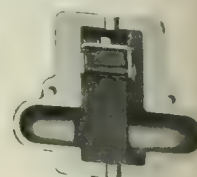
Alternating-Current Oil Switch for Reversing Service

Oil switches for use with small alternating-current motors which can be started by connecting them directly to the supply current have been developed by the Crocker-Wheeler Company, Am-pere, N. J. The moving contacts are mounted on a fiber-insulated rod. These moving contacts make contact with the center row of stationary contacts and one of the outside rows of contacts when the switch is in the "forward" position and with the center row of stationary contacts and with the other outside row of contacts when the switch is in the "reverse" position. This switch movement gives a very large break on two points per pole.

The moving contacts are free to turn on their axis so that a new contact surface is continually presented to the fixed contacts, thereby prolonging the life of the switch. The contacts are easily removable and of copper of liberal size. The tank holding the oil in which the contacts are immersed is bolted to the upper part of the switch. Oil cannot splash into the wiring chamber under ordinary conditions of use. A removable cover permits easy access to the terminal board, which is provided with heavy binding posts. No special bells or fittings are required in the case of conduit wiring.

These switches can be furnished with or without latches for holding the contacts securely in the desired position. No latches are needed where the switch handle is operated by an arm or rod for controlling from a nearby point. Such an arm or rod has sufficient friction with its supports to serve for holding the switch contacts in the proper position.

The normal rated capacity of these switches are four-pole, 20 amp. per pole.



INTERIOR OF CONTACT SECTION AND OIL CHAMBER

suitable for use with motors up to 5 hp., 220, 440 or 550 volts, two-phase or three-phase, and three-pole, 40 amp. per pole, suitable for use with motors up to 10 hp., 220, 440 or 550 volts, three-phase, and with motors up to 10 hp., 220 and 440 volts, two-phase, three-wire.

Motor-Driven Wire Pointers

For those wire-drawing shops which prefer individual motor drive, the Morgan Construction Company of Worcester, Mass., has arranged to supply its wire-pointing rolls with Westinghouse motors mounted on the frame. This



BATTERY OF WIRE POINTERS

makes the unit very compact, since there are no external apparatus and no overhead connections. It is also easy to start and stop by means of the conveniently located starting-box handle.

The wire pointer consists simply of a pair of rolls revolving so as to feed material toward the operator. There are a number of grooves to care for various sizes of wire. The cross-section of these grooves diminishes around the circumference, so that the end of a wire placed in the open part of a groove is pushed back by the rolls and reduced into a tapering end. This pointed end is then threaded through the die in which the wire is to be drawn down. The motor illustrated is a type CS induction motor of 3 hp., 1700 r.p.m.

Cleat-Wiring Devices with Concealed Terminals

The Arrow Electric Company of Hartford, Conn., has brought out two devices for cleat wiring, one a plain porcelain fuseless rosette, the other a base for the Arrow 20 interchangeable brass-shell line. These devices have concealed terminals. With this base it is possible to make a complete line of sockets, key, keyless and full, with all modifications, such as "Arrolock" extension attachment, etc., also a complete line of pull switches, bottom outlet, etc.

Electric Grill with Three Heats

With the radiant electric grill made by the Hotpoint Electric Heating Company, Ontario, Cal., three heats are provided. Food may be started on the "high" heat, and when brought to the boiling point the "medium" or "low" connection may be used to complete the cooking. A composition switch plug with three receptacle positions provides for the changing of heats. It is pointed out by the manufacturer that by plac-

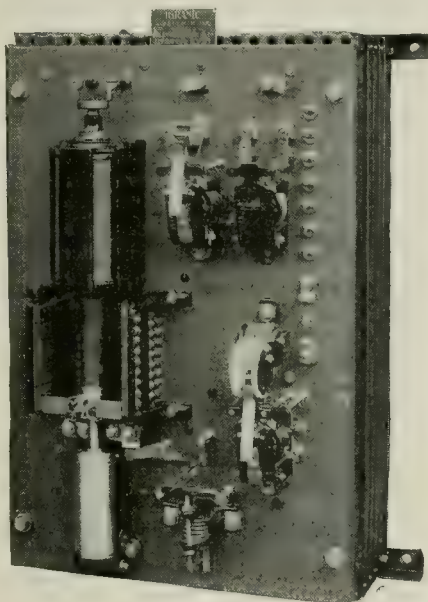
ing food both above and below the heating element two cooking operations may be carried on at the same time.

Toy Motor

The A. C. Gilbert Company of New Haven, Conn., has developed a die-cast toy motor which incorporates a number of interesting features. This motor, it is said, has been designed as a rugged toy for operation on batteries. It has a reversing switch attachment so that it is a practical unit for all purposes for which a toy motor could be used, and in addition can be used for practical work requiring a motor of small rating for operation on a battery

Compensated-Solenoid Push-Button System

A push-button system of motor starting and speed regulation, based on the fact that the pull of an electric solenoid varies according to the position of the plunger, has been developed by the



COMPENSATED SOLENOID-TYPE STARTER AND SPEED REGULATOR

Igranic Electric Company, Ltd., London, England. When the plunger is out to the full extent the pull is comparatively weak, and it grows stronger as the plunger is drawn in. In order to produce a controller of which the contactor will remain in any position, it is necessary to compensate the solenoid so as to make the pull equal throughout the whole travel of the plunger.

In this controller the solenoid is so compensated with the result that the same pull is always exerted on the movable contact maker when the solenoid is excited, no matter whether it is on the lowest or the highest or any intermediate contact. In addition to the solenoid and cross-head contactor, a magnetically operated clapper switch is mounted upon the slate base and is used to open and close the motor circuit.

A master switch with four buttons

is furnished. If the starting button be depressed, it excites the clapper switch coil and causes it to close the motor circuit, and the clapper switch will remain closed after the pressure is withdrawn. But if the depression is only momentary, the accelerating solenoid, which controls the movement of the cross-head, is not excited. By means of the "start" button, the motor can be either started or accelerated. If, instead of the "start" button, the "inching" button be pressed, it has the effect of exciting the clapper switch and thereby closing the motor circuit, but it does not excite the accelerating solenoid, and the clapper switch will remain closed only so long as the pressure on the button is maintained.

The function of the "retarding" button is to slow down the motor. When pressure of the "retard" button ceases the motor will continue to run at the speed it had attained when the finger was removed from the button. A depression of the "stop" button will always, under any circumstances, cause the clapper switch to open and the accelerating solenoid to be de-energized, so that the motor circuit will be broken and the cross-head will fall to the bottom, reinserting the starting resistance ready for the next start.

This controller can also, if desired, be fitted with armature diverting resistance for the purpose of obtaining a speed lower than can possibly be obtained by means of series resistance.

Conduit-Box Receptacles with Adapter Cap

The General Electric Company of Schenectady, N. Y., has produced a "standard" conduit-box receptacle with adapter cap and steel strap for use with Sprague and Thomas & Betts small non-adjustable floor outlet boxes. These devices have been developed to provide current supply to portables of all kinds, fans, heating devices, etc., from an outlet in the floor. If the device is installed under a rug, a small opening is made



RECEPTACLE, ADAPTER, CAP AND STEEL STRAP COMPLETE

so that the stem of the adapter can be inserted. This stem is the only part of the device appearing above the surface of the rug. When used on power or heating circuits the rating is 10 amp., 250 volts. On lighting circuits the rating is N. E. C. S. standard.

Trade Notes

GEORGE B. NORTH has been appointed general sales manager of the Hazard Manufacturing Company of Wilkes-Barre, Pa. The offices will be at 533 Canal Street, New York City.

ROBERT W. ADAMS, manager of the Providence (R. I.) office of the General Electric Company, was elected president of the Providence Engineering Society at its recent annual meeting.

THE ROSS POWER EQUIPMENT COMPANY has been appointed Indianapolis representative of the Lincoln Electric Company of Cleveland, Ohio, with offices at 617 Merchants' Bank Building, Indianapolis, Ind.

CLINTON DOYERT, who has been representing the St. Louis branch house of the Western Electric Company in southeast Missouri, has been appointed sergeant major in the Sixth Missouri National Guard and is now in a training camp in that State.

SPERRY & BITTNER, Pittsburgh, Pa., is the name of a new firm that has opened offices in the First National Bank Building as manufacturers' agents. Ralph C. Sperry, one member of the firm,* was formerly Pittsburgh district manager of the Brilliant Electric Division of the National Lamp Works. William A. Bittner, the other member, has for the last ten years been connected with the Union Electric Company of Pittsburgh as office manager and purchasing agent. Both are well known to the electrical fraternity. At present they represent the Steel City Electric Company of Pittsburgh, A. O. Schoonmaker Company of New York City and the Argus Lamp & Appliance Company of Cleveland, Ohio.

THE GEORGE CUTTER COMPANY, South Bend, Ind., announces the appointment of R. W. Ten Broeck and A. B. Sonneborn as sales representatives for the State of Michigan, with offices at 426 Ford Building, Detroit. In connection with the sale of street and industrial lighting equipment, switches, panelboards, switchboards, cut-out boxes and other products of the George Cutter Company, an engineering department will be maintained for the purpose of drawing up plans and specifications for the installation of such equipment. Mr. Ten Broeck was associated with the Packard Motor Company for a number of years, later with the Davis Slate & Manufacturing Company, and for the last two years with the Mutual Electric & Machine Company of Detroit. Mr. Sonneborn was connected with the latter company for three years and during the last year was district representative of the Detroit Electric Welder Company of Lansing, Mich., with offices in Detroit.

THE DIAMOND POWER SPECIALTY COMPANY has established at Detroit the first plant devoted exclusively to the production of "Insuluminum" soot-blower units. The process originated and was perfected in the laboratory of the General Electric Company, the latter company having granted to the Diamond Power Specialty Company the exclusive rights as lessee to its use. The essential point of difference between the effects of this process and any hitherto used commercially, such as galvanizing or sherardizing, is that the insulating material is not imposed as a coating upon the surface of the metal to be treated, but enters into intimate association with it, so that the whole outer region of the body affected changes its composition. A homogeneous alloy is formed, which cannot be destroyed except as the mass of which it is a part is destroyed. The richness of the alloy is proportional to the depth of impregnation, which varies with the length of time of the treatment.

THE WESTERN ELECTRIC COMPANY'S Kansas City branch, responding to the need for more energy on the farm, is planning an intensive campaign to present electric generating units and equipment to the farmers of several states. A meeting of salesmen in the farm-lighting department was held in Kansas City on Aug. 2 and 3, at which H. L. Harper, sales manager, outlined the program and drilled the men in the promotion of equipment suitable for farms. The campaign will be based on the practical demonstration of equipment to farmers and communities. Salesmen who are now covering territory by automobile, carrying small units in the backs of their cars, will be provided with trailers in which will be more elaborate equipment and samples of devices. The trailers and the items which will be furnished were shown and the ways of using

them most effectively explained. Each trailer will carry a storage battery, a small gasoline engine, a generator, a switchboard, a long cord and sockets, and such devices as a fan, iron and similar pieces. The equipment will be demonstrated to the farmers and their wives in the farm homes, as heretofore. But with the trailer there will be the advantage that the entire outfit can be left at home for trial use, the salesman calling next day to get the order. One of the most important advantages of the trailer method has to do with selling to organizations and to leading business men in small towns. For instance, the trailer may be provided for a community meeting, the engine and generator being strong enough to provide ample light for a hall. Not only will the organization or the owner of the hall see the advantage of the equipment, but every person attending the meeting will have a practical demonstration.

Trade Publications

ELECTRIC RANGES.—The National Electric Utilities Corporation, 103 Park Avenue, New York City, is distributing a bulletin descriptive of its electric ranges.

TRUCKS.—"Driver Dan the Sterling Man" is the name of the new publication now being distributed by the Sterling Motor Truck Company of Milwaukee, Wis. This bulletin should be of interest to every user and driver of automobile trucks.

KNIFE SWITCHES.—The Leonard-Bundy Electric Company of Cleveland, Ohio, is distributing a bulletin descriptive of its safety-type knife switches, panelboards, cabinets, etc. It is also distributing a bulletin descriptive of knife switches only.

PORTABLE LIGHTING OUTFIT.—Bulletin No. 819, descriptive of the Edison electric portable lighting outfit, is being distributed by the Edison Storage Battery Company of Orange, N. J. This bulletin describes this outfit and explains the method of using it.

WASHING MACHINE.—The American Washing Machine Manufacturers' Association, 10 South La Salle Street, Chicago, has issued a booklet entitled "Who Washes Your Clothes?" It is the story of the washing machine for household use in both city and rural homes.

PNEUMATIC PAINTING EQUIPMENT.—The Spray Engineering Company, 93 Federal Street, Boston, Mass., has prepared a bulletin describing its Spraco pneumatic painting equipment. This is a further development of the Spraco paint gun which was recently developed.

USES FOR ELECTRIC FANS.—A bulletin descriptive of sales methods for the selling of electric fans is being distributed by the Society for Electrical Development, Inc., 29 West Thirty-ninth Street, New York City. This bulletin takes up the method of using electric fans for the drying of fruits and vegetables. It outlines a campaign for the selling of electric fans and the building up of the fan load.

THE SOCIETY FOR ELECTRICAL DEVELOPMENT, INC.—"Aims and Achievements" is the title of a bulletin being distributed by the Society for Electrical Development, Inc., 29 West Twenty-ninth Street, New York City. This is a brief summary of what the society is accomplishing for its members and for the entire electrical industry. This bulletin describes just what this society is, how it has grown, what its work includes, its members, its officers, and committees.

SYNCHRONOUS MOTORS FOR POWER-FACTOR CORRECTION.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently issued an enlarged and up-to-date circular on the theory and application of synchronous motors for power-factor correction. The publication furnishes a clear and concise explanation of the underlying principles of power-factor correction and its control. A complete set of accurately plotted curves, accompanied by examples showing their application to cases in actual practice, are shown. These curves give the operating man and those unversed in technical calculation a simple graphical solution for all problems in power-factor correction likely to arise in ordinary practice. Illustrations and detail description show standard Westinghouse machines for capacities from 200 kva. to 15,000 kva. and for all commercial voltages from 220 to 6600 volts. Exact operating figures, furnished in several cases by members of operating staffs of the companies concerned, show the success of synchronous motors in improving operating conditions.

New Incorporations

THE ELECTRIC LABORATORIES of Fresno, Cal., has been incorporated with a capital stock of \$10,000 by D. K. Cawker, L. L. Davenport and C. E. Davenport.

THE SORDEL ELECTRIC COMPANY of Milwaukee, Wis., has been incorporated with a capital stock of \$25,000 by W. R. Sordel, Frank L. Fawcett and Paul R. Newcomb.

THE PAUL M. EVANS COMPANY of Philadelphia, Pa., has been chartered with a capital stock of \$25,000 to manufacture electric storage batteries. S. H. Evans is treasurer.

THE REUSCH ELECTRIC COMPANY of Lincoln, Neb., has been chartered with a capital stock of \$5,000. Orvis B. Dresbach is president and Herman Reusch is secretary and treasurer.

THE LA FRENCH POWER SPARK PLUG COMPANY of Dayton, Ohio, has been chartered with a capital stock of \$100,000 to manufacture spark plugs by F. A. Eastman and others.

THE UNIT VENTILATION COMPANY of Queens, N. Y., has been incorporated by A. Bautz, Jr., of College Point; W. F. Brown, 911 Whitlock Avenue, the Bronx, and J. F. Maguire, 375 Fulton Street, Brooklyn, N. Y.

JOHN N. BOWMAN of New York, N. Y., has filed articles of incorporation with a capital stock of \$500 to deal in electrical material and devices. The incorporators are: John N. Bowman, M. C. Bowman and Charles F. Klaus.

THE AMERICAN LAMP COMPANY of Dover, Del., has been incorporated by Joseph E. and Harold B. Parker and Everett P. and Harold F. Collins. The company proposes to manufacture electric-lighting fixtures.

ENGHOLM & PARTNERS of Toronto, Ont., have filed articles of incorporation with a capital stock of \$100,000, to do a general structural, civil and mechanical engineering business, and to construct hydraulic and electric plants.

THE BAY STATE INSULATED WIRE & CABLE COMPANY of Boston, Mass., has been chartered with a capital stock of \$300,000. The directors are: John H. H. McNamee, president and treasurer; Daniel T. O'Connell and M. J. Cashman.

THE PUBLIC LIGHT SERVICE COMPANY of Bayonne, N. J., has been chartered with a capital stock of \$25,000 to manufacture lighting fixtures. The incorporators are: Edward Sweeney, Louis Lehr and Murray Bell of Bayonne, N. J.

THE FLASHLIGHT & ELECTRICAL MANUFACTURING COMPANY of Cleveland, Ohio, has been incorporated with a capital stock of \$15,000 by Richard E. Murphy, Louis J. Rieske, Ernest J. Hileman, L. L. Rood and William C. Schaefer.

THE GENERAL RADIO CORPORATION of New York, N. Y., has been chartered by E. F. Chandler, D. Westreich and J. M. Kornfield, 206 Broadway, New York, N. Y. The company is capitalized at \$20,000 and proposes to manufacture special radio apparatus.

THE ABELL-HOWE COMPANY of Wilmington, Del., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$50,000 and proposes to manufacture electrical and mechanical specialties. The incorporators are C. M. Ringlinger and Henry M. Robinson of Wilmington, Del., and Clement M. Egner of Elkton, Md.

THE BOUND BROOK ENGINE & MANUFACTURING COMPANY of Philadelphia, Pa., has been incorporated by Wray C. Arnold, Root C. Finder and H. Foldenden of Philadelphia. The company is capitalized at \$300,000 and proposes to manufacture engines, electrical apparatus, etc.

THE NEW HAVEN RIVET COMPANY of New Haven, Conn., has been incorporated with a capital stock of \$5,000 to manufacture hardware and electrical supplies. Henry C. Smith is president and Frank S. Day is secretary and treasurer.

THE STRINGSON FIRE SIGNAL COMPANY of New York, N. Y., has been chartered by H. Strongson, R. W. Thompson and H. R. Sanford, 6 East Thirty-sixth Street. The company is capitalized at \$20,000 to manufacture fire alarm equipment.

THE GIRTANNER MANUFACTURING & SALES COMPANY of St. Louis, Mo., has been incorporated by Fred Girtanner, Herman Mueller and L. L. Kraft. The company is capitalized at \$20,000 and proposes to manufacture house supplies and accessory equipment.

New England States

PORTLAND, ME.—New construction and repair work being done by the Cumberland County Power & Light Company in Portland will involve an expenditure of more than \$60,000 and will include relaying tracks, placing overhead wires underground, conduits now being built for that purpose.

SQUIRREL ISLAND, ME.—The installation of an electric-lighting system at Squirrel Island is under consideration. The cost of installing a plant is estimated at \$15,000.

BOSTON, MASS.—The Revere Rubber Company is planning to erect a new transformer house, 20 ft. by 60 ft., at its plant on Eastern Avenue, to cost about \$10,000.

CHICOPEE, MASS.—Bids will be received at the office of the Electric Light Department, Front Street, Chicopee, until Aug. 21, for the erection of a garage and storehouse. Plans and specifications may be obtained at the above office upon deposit of \$25.

CLINTON, MASS.—The Metropolitan Water and Sewerage Board has awarded a contract for the erection of the 16-mile electric transmission line from the Wachusett dam in Clinton to the dam at the Sudbury Basin in Southboro to the F. T. Ley Construction Company of Springfield at \$74,477.

PITTSFIELD, MASS.—The Barrett Company is contemplating erecting an extension to its local power plant. The main offices of the company are located at 35 Wendell Street, Boston, Mass.

SPRINGFIELD, MASS.—The United Electric Light Company has purchased the property of the United Button Company on both sides of Olive Street, consisting of six buildings and land, 360 ft. by 160 ft., to be used in connection with its proposed extensions. The Button company will occupy the premises for the present.

PROVIDENCE, R. I.—The stockholders of the Narragansett Electric Lighting Company have voted to increase the capital stock of the company by \$1,700,000.

HARTFORD, CONN.—The Hartford Electric Light Company has purchased a site, embracing nearly 95 acres in the "South Meadows," on which it will erect a power house at some future time.

NEW HAVEN, CONN.—Work has begun on the extension of the ornamental lighting system in Elm, George, Orange and Church Streets. Later on the lamps will be extended down Meadow Street. Application has been made for an appropriation to extend the ornamental lighting system down Grand Avenue to the railroad crossing.

NEW HAVEN, CONN.—Preparations are being made by the Connecticut Light & Power Company, which has taken over the properties of the Rocky River Power Company, the Housatonic Power Company of New Haven, the United Electric Light & Power Company of Waterbury and the Seymour (Conn.) Electric Light Company, for the development of an 18,000-kw. hydroelectric plant at a site known as Stevenson on the Housatonic River. The company, it is reported, has also purchased a site, placed orders for equipment and material, and will soon begin work on the construction of an additional steam generating power station at tidewater, which, it is understood will have an ultimate capacity of 100,000 kw. The plans provide for an initial installation of 20,000 kw. The estimated total capacity of the undeveloped water rights acquired by the consolidation on the Housatonic and Rocky Rivers is approximately 75,000 kw., including the Stevenson site, which is now being developed.

NEW LONDON, CONN.—Extensive improvements are being made to the power system of the Housatonic and Middletown divisions of the Connecticut Power Company. The 66,000-volt transmission line which connects the hydroelectric plant at Falls Village with Torrington, Thomaston, Bristol and Hartford will be extended from near Beckley Station to a 3000-kw. transformer station which will be erected in Cromwell on the company's property near the river front; from the Cromwell station a 13,200-volt transmission line is being erected to connect with the company's power station in Middletown. This connection will be made through another 3000-kw. substation, located adjacent to the present power plant. Equipment for the extension to the Van Dyke substation, as well as the present connection between the substation and the Dutch Point power station of the Hartford Electric Company, will be duplicated so as to double the present capacity of the system. Improvements are also being made to the systems at Falls Village, Torrington, Thomaston and Bristol, consisting of the installation of electrolytic lightning arresters, etc. The Stone

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

& Webster Engineering Corporation of Boston, Mass., has charge of the engineering work.

WATERBURY, CONN.—The contract for an addition, 61 ft. by 97 ft., to the power plant of the Housatonic Power Company on West Main Street has been awarded to Tracy Brothers Company.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 21, for furnishing range finders and transmission systems and wire and cable, etc., at the Brooklyn Navy Yard. Proposal blanks may be obtained on application to the above bureau or to the supply officer, Navy Yard, Brooklyn.

BUFFALO, N. Y.—The Sizer Forge Company is erecting an electric furnace building, a steel and brick coal house and a covered scrap-iron yard, to cost, with equipment, \$110,000, at its plant at Larkin Street and Erie and Lake Shore Railroads.

BUFFALO, N. Y.—Contract has been awarded by the International Railway Company, it is reported, for the construction of a substation, 75 ft. by 90 ft., to be erected at North Division and Oak streets.

BUFFALO, N. Y.—The Pullman Company, 1770 Broadway, has begun work on the construction of a new carshop, 235 ft. by 540 ft., one story, at its local works, to cost about \$175,000. A new power house and electric power plant, 60 ft. by 110 ft., will also be built.

BUFFALO, N. Y.—The stockholders of the Buffalo General Electric Company have voted to authorize an issue of \$4,000,000 in bonds, the proceeds to be used to finance extensions, including additional construction at the steam generating plant outside of Buffalo.

ELLISBURG, N. Y.—Application has been made to the Public Service Commission by Harlow E. Ralph for authority to erect a new electric transmission line between Henderson and Ellisburg.

FLUSHING, N. Y.—The New York & Queens Electric Light & Power Company contemplates the construction of a new two-story substation, to cost about \$50,000, on Lawrence Avenue, Flushing.

MONROE, N. Y.—The Orange & Rockland Electric Company has applied to the Public Service Commission for permission to issue \$180,000 in capital stock, the proceeds to be used to pay for new construction, including transmission lines.

NEW HAMPTON, N. Y.—Bids will be received by the Commissioners of Correction, Municipal Building, New York, until Aug. 30 for construction of power house, tunnels and chimney at New Hampton.

NEW YORK, N. Y.—The New York Edison Company has awarded a contract for the construction of a one-story extension to its substation on West Twenty-seventh Street, to cost about \$35,000.

NEW YORK, N. Y.—Bids will be received at the United States Immigration Station, Ellis Island, N. Y., until Aug. 20, for alterations and new boilers for the power house at the United States Immigration Station, Ellis Island. For further information apply to United States Commissioner of Immigration, Ellis Island.

SHERMAN, N. Y.—The Public Service Commission has given the borough officials permission to establish and operate a municipal electric-light plant in Sherman.

SYRACUSE, N. Y.—The City Council has approved an issue of \$13,000 in bonds for the purchase of new boilers and auxiliary equipment for the city hall plant.

CALDWELL, N. J.—The lowest bid for electrical work at the penitentiary at Caldwell was submitted by the Beaver Engineering Company, 59 Mechanic Street, at \$3,474.

DOVER, N. J.—The New Jersey Power & Light Company has completed a new 11,000-volt transmission line from its power station at Mount Arlington to the Stanhope-Netcong district, a distance of about 5 miles. The new line will supply energy for distribution by the local company in Stanhope and Netcong for lamps and motors.

ESSEX FELLS, N. J.—Bids will be received by the committee on street lighting

until Aug. 24 for lighting the streets with 32-cp. lamps for a period of five years from Sept. 1, 1917.

FLEMINGTON, N. J.—The property of the Flemington Electric Light, Heat & Power Company is reported to have been purchased by the Lambertville (N. J.) Public Service Company. Arrangements are being made to extend the transmission lines to connect the Lambertville and Flemington systems.

MADISON, N. J.—The Borough Council has extended the time for the municipal electric-light plant to discontinue service to non-resident subscribers until Sept. 1, in accordance with the ruling of the Board of Public Utility Commissioners prohibiting the sale of power generated by municipal plants outside of the borough limits.

MOUNT HOLLY, N. J.—The Public Service Electric Company has been awarded contract for lighting the new army cantonment at Wrightstown. Service will be supplied from the power station at Burlington. A new transmission line will be erected from Burlington to Mount Holly and thence to Wrightstown, about 20 miles. A new substation will be erected at the camp.

NEWARK, N. J.—The Murphy Varnish Company is planning to build a new boiler house at its plant on Beecher Street, to cost about \$8,000.

NEWARK, N. J.—The lowest bids for the installation of a new lighting system at the Center Market was submitted by the Jennings Fixture Company.

NEWARK, N. J.—Bids will be received by the board of education, Essex Building, Newark, until Aug. 22 for one motor-generator set, with panels and auxiliary apparatus, and electrical equipment for shop lighting for the County Vocational Schools. Wesley A. O'Leary is director.

PITMAN, N. J.—The borough officials have entered into a new contract with the Electric Company of New Jersey for a period of five years, under the terms of which the company is to furnish not less than 123 modern street lamps of 80 cp.

EASTON, PA.—The Taylor-Wharton Iron & Steel Company has entered into a five-year contract with the Pennsylvania Utilities Company of Easton for furnishing energy to operate its furnaces and other plant equipment.

LANCASTER, PA.—The contract for electric wiring, telephone, fire-alarm and clock systems at the new Boys' High School building has been awarded to the Lancaster Supply & Construction Company, at \$9,287.

MARCUS HOOK, PA.—Contract has been awarded by the Benzol Products Company to F. W. Van Loon, 4 North Eleventh Street, Philadelphia, for the construction of a new main switch and transformer station at its plant, to cost about \$10,000.

PENNSBURG, PA.—The Perkiomen Paper Company is contemplating the construction of an addition to the boiler house at its plant.

PHILADELPHIA, PA.—The Thomas Potter's Sons Company is planning to build an addition to its engine house on Second Street.

PHILADELPHIA, PA.—The Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia, manufacturers of electrical specialties, has awarded a contract to John L. Gill & Company, Otis Building, Philadelphia, for the construction of an addition, three stories, to its plant.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 27, for heating system for machine and electric shop, at the navy yard, Philadelphia, Pa. Drawings and specifications (No. 2590) may be obtained on application to the bureau or the commandant of the navy yard named.

PITTSBURGH, PA.—Plans are being prepared by the Pittsburgh Products Company, Frick Annex, Pittsburgh, for the erection of a large seamless-tube plant at Allentown, opposite Fayette City. The company, it is understood, will soon purchase an extensive line of equipment, including cranes, shears and seamless-tube machinery.

TEMPLE, PA.—The new plant of the Temple Malleable Iron & Steel Company, it is reported, will consist of a one-story malleable foundry, 136 ft. by 288 ft.; hard-iron mill, 32 ft. by 170 ft.; soft-iron mill and annealing works, 95 ft. by 260 ft.; one-story pattern shop, 36 ft. by 90 ft.; core house, 50 ft. by 70 ft., and power house, 65 ft. by 80 ft. The cost of the buildings, with equipment complete, is estimated at \$500,000. Frank D. Case, People's Gas Building, Chicago, Ill., is architect.

WEST CHESTER, PA.—Work has started on the construction of an addition to the power house of the West Chester Street Railway in Lenape. The new build-

ing will be equipped with a large transformer, which will be used in connection with the new high-tension system connecting all three of the electric power plants of the company at Lenape, Downingtown and Coatesville.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company is reported to be extending its electric transmission lines from Brooklyn to Glenburnie along the Brooklyn Boulevard.

BALTIMORE, MD.—Bids, it is reported, are being asked by the Consolidated Gas, Electric Light & Power Company for construction of its proposed new power house at Westport. The company is also erecting an addition to its engine house, No. 2, Spring Gardens, to cost about \$20,000.

MARLINTON, W. VA.—At an election held recently the proposal to issue \$20,000 in bonds to purchase the local electric-light plant and water-works system was carried.

MARTINSBURG, W. VA.—Plans are being considered by the Berkeley Woolen Mills for the construction of a new central power plant for its Raleigh Street works.

SOUTH CHARLESTON, W. VA.—The E. C. Klipstein & Sons Company, 644 Greenwich Street, New York, N. Y., manufacturers of chemicals, etc., has awarded contract for electric motors for buildings No. 5 to No. 11 inclusive to the Lincoln Electric Company of Cleveland, Ohio.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 3, for construction of two wood-frame quarters; one receiving building and one power house, complete with electric lighting, plumbing, etc., for all four buildings at the high-power radio station, El Cayey, P. R. Drawings and specifications (No. 2389) can be obtained on application to the bureau or to the commandant of the navy yard, New York, N. Y.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Charleston, W. Va., Schedule 1395—One 15-ton locomotive crane, Mare Island, Cal., Schedule 1396—One motor-driven radial drill, Key West, Fla., Schedule 1404—One back-geared engine lathe, one horizontal 66-in. boring and drilling machine, one 200-ton forging, hydraulic press, Fort Mifflin, Pa., Schedule 1400—One motor-driven turret 24-in. lathe, one motor-driven engine lathe, Norfolk, Va., Schedule 1397—One motor-driven centrifugal pump.

North Central States

JACKSON, MICH.—Bids will be received at the office of A. W. D. Hall, city manager, Jackson, Mich., until Aug. 29, for furnishing and installing one steam-driven vertical, centrifugal pump and one or more electrically driven deep-well horizontal pumps for the municipal water-works system. Plans and specifications may be obtained at the office of the superintendent of water works, Jackson, or at the office of Seabury G. Pollard, consulting engineer, 3422 Burch Avenue, Cincinnati, Ohio.

STURGIS, MICH.—The village of Sturgis has awarded the contract for the excavation of tailrace for a power plant on the St. Joseph River, 3 miles from Centerville, to the G. W. Bunker Company. The channel will be from 50 to 75 ft. wide and 15 ft. deep.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until Aug. 24 for construction of brick tunnel and concrete foundations for the division of light and heat. Specifications may be obtained by applying to the above office.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until Aug. 24 for furnishing motor truck or tractor and trailer equipment for the division of city hospital, Department of Public Welfare. Specifications may be obtained upon application to the office of the director of public welfare, Room 327, City Hall.

LUCASVILLE, OHIO.—Preparations are being made to establish a municipal electric-light plant in Lucasville. Alonzo Purdy is chairman of a committee appointed to purchase the machinery.

SANDUSKY, OHIO.—Plans have been prepared by George Feick & Company, architects, for a telephone exchange building to cost about \$35,000 for the Sandusky Telephone Company.

YOUNGSTOWN, OHIO.—The Mahoning & Shenango Railway & Light Company has closed a contract with the National Sand & Stone Company in the Mineral Ridge

district. About 125 hp. will be required. The National company will discard its steam plant.

HAZARD, KY.—The Kentucky Power Company is reported to be considering extending its electric transmission lines into the Letcher County coal-mining field to supply electricity for mining operations there.

SERAGENT, KY.—Plans are being considered by the Whitley-Elkhorn Coal Company for the installation of a new electric generator and auxiliary equipment and electrically operated coal-handling machinery at its local properties.

SOUTH PORTSMOUTH, KY.—Bids will be received at the United States Engineer Office, Cincinnati, Ohio, until Aug. 31, for construction of power house at dam No. 31, Ohio River. Further information may be obtained on application to the above office.

FORT WAYNE, IND.—The Fort Wayne & Indiana Traction Company, it is reported, is considering building an addition to its Spy Run power house, to cost about \$35,000.

BLOOMINGTON, ILL.—An estimate submitted to the City Council for the installation of a municipal electric-light and power plant by C. C. Williams, superintendent of the municipal water and light plant, places the cost at \$382,625. It is not expected that any definite steps will be taken to install a plant at this time.

JOLIET, ILL.—Owing to the change in the voltage in energy from 2300 to 12,000 volts taken from the new steam plant of the Public Service Company at Joliet, the Chicago & Joliet Electric Railway Company is installing transformers and lightning protection for this service in Joliet. An underground cable connection between the railway substation and new substation of the Public Service Company, now under construction, will also be provided.

ROCKFORD, ILL.—The City Council has granted the Central Union Telephone Company permission to lay conduits in a number of streets, including West State Street from Avon to Independence Avenue.

THOMSON, ILL.—Bids will be received at the office of Franklin J. Stransky, attorney of the Savanna and York drainage district, Savanna, until Sept. 6, for pumping station and appurtenances, etc., as follows: (a) For furnishing material, machinery and construction of pumping station; (b) furnishing and installing pumping machinery, electrical apparatus and auxiliaries. Alternative bids will be received on an oil engine-driven or a steam-driven plant. Plans and specifications may be obtained from the Edmund T. Perkins Engineering Company, First National Bank Building, Chicago, Ill., and Illinois State Bank Building, Quincy, Ill., and from N. D. French, secretary, Thomson, upon deposit of \$10.

MILWAUKEE, WIS.—The Wisconsin Engine & Dynamo Company of Milwaukee, recently incorporated with a capital stock of \$200,000, it is reported, will soon erect or lease a plant in Milwaukee or suburbs, for which equipment, it is said, is now being purchased. John I. Beggs, of Milwaukee, is reported interested in the company.

DES MOINES, IOWA.—The property owners on Sixth Avenue are considering presenting a petition to the City Council asking for the installation of the electrolight lighting system on Sixth Avenue as far north as School Street.

DUBUQUE, IOWA.—The Eastern Iowa Electric Company has petitioned the Board of Supervisors for a franchise to erect electric transmission lines from Dubuque to Dyersville, New Wine, Luxemburg and Holy Cross.

MCGREGOR, IOWA.—The plant and holdings of the McGregor Electric Light & Power Company are reported to have been purchased by the Mid-Continental Utilities Company of Chicago, Ill. The plants in Lancaster, Boscobel, Fennimore and Platteville, Wis., have also been taken over by the Mid-Continental company.

MANCHESTER, IOWA.—The purchase of the local electric plant of the Iowa Electric Company, to be owned and operated by the municipality, is under consideration by the City Council.

KANSAS CITY, MO.—Bids will be received by the purchasing agent of Kansas City, second floor, City Hall, until Sept. 12, for designing, construction and installing a steam turbine, reduction gear, centrifugal pumping unit having a capacity to pump 20,000,000 U. S. gallons per 24 hours, against a total combined head of 370 ft. and a steam pressure of 165 lb. per sq. in. at throttle, together with machinery, tools and appurtenances necessary, in accordance with plans and specifications on file in the office of the chief engineer of the water department. W. C. Weaver is purchasing agent and Burton Lowther is chief engineer and superintendent.

WARRENSBURG, MO.—The new street-lighting contract with the Warrensburg Light & Power Company has been ratified by the City Council. The new contract is for a period of five years and provides for the installation of an ornamental lighting system in the business section and the erection of 140 lamps in the residential districts.

ELLENDALE, N. D.—The Ellendale Electric Company is installing a 150-kw. generator directly connected to a 200-hp. Skinner uniflow engine. The company is also installing a complete steam heating plant, at a cost of about \$12,000. G. F. Phillips is manager.

WILTON, N. D.—The Washburn Lignite Coal Company contemplates changing its lighting system from direct to alternating-current system next year. W. P. Macomber is manager.

LINCOLN, NEB.—Bids will be received by the Board of Regents, Lincoln, until Sept. 1 for construction of a social science building. Separate bids to be submitted on heating, ventilating, vacuum cleaner, electric wiring, etc. The building will be 160 ft. by 220 ft., three stories and basement, and will cost about \$300,000. Proposals to be addressed to J. S. Dales, secretary board of regents, Station A, Lincoln.

LOOMIS, NEB.—The Intermountain Railway, Light & Power Company of Holdrege has decided to postpone erecting an electric service line from Holdrege to Loomis until national financial affairs are in a more settled condition. The issue of bonds, authorized at the spring election, and the village lighting and interest tax levies will be held in abeyance until work on the line is started.

WESTERN, NEB.—The installation of an electric-lighting system in Western is under consideration.

GOODLAND, KAN.—The Goodland Light & Power Company is installing a 125-hp. Muncie crude oil engine in its power plant.

LARNED, KAN.—Steps have been taken to organize a company to erect an electric transmission line between Larned and Garfield. The cost of the line is estimated between \$6,000 and \$7,000.

MILTONVALE, KAN.—The City Council is considering the disposal of the municipal electric-light plant to the Riverside Electric Light, Power & Gas Company of Abilene.

ROSSVILLE, KAN.—The local electric-light plant, owned by the R. B. Feagan Electric Company of Junction City, is reported to have been purchased by a syndicate of Colorado capitalists.

Southern States

CHARLOTTE, N. C.—The contract for electrical equipment for Camp Greene has been awarded to Tucker & Laxton of Charlotte. The cost of the work is estimated at about \$200,000, and it will require 2,000,000 lin. ft. insulated wire, 15,000 lamps, etc.

ORIENTAL, N. C.—The Town Council is considering issuing bonds for the installation of a municipal electric-light plant.

CHARLESTON, S. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 25, for construction of one shell house, one torpedo storehouse and one magazine building, including electrical work, etc. Drawings and specifications (No. 2488) may be obtained upon application to the above bureau or to the commandant of the navy yard, Charleston.

ATLANTA, GA.—The Georgia Railway & Power Company is planning to extend its line to Camp Gordon, near Chamblee, a distance of about 5 miles.

ST. CLOUD, FLA.—The City Council is considering taking over the local electric-light plant and distributing system to be owned and operated by the municipality.

MEMPHIS, TENN.—The Memphis Consolidated Gas & Electric Company and the Merchant Power Company have been consolidated under the name of the Memphis Gas & Electric Company.

ANNISTON, ALA.—The Alabama Power Company is contemplating the erection of a transmission line to Camp McClellan.

FLORENCE, ALA.—The Muscle Shoals Traction Company, it is reported, has awarded a contract to the Central Construction Company of Indianapolis, Ind., for the construction of an electric railway between Florence and Huntsville, a distance of 64 miles, with branch to Lexington, 12 miles long. E. M. Wilkens is chief engineer, and M. S. Bingham is consulting engineer. Tracey W. Pratt of Huntsville is vice-president and treasurer of the Muscle Shoals Traction Company.

FAYETTE, MISS.—The old machinery in

the municipal electric-light and power plant has been removed to temporary quarters preparatory to installing the new oil engine and other equipment for which \$17,000 in bonds was issued in June.

CLARKSVILLE, ARK.—The City Council has awarded the contract for the installation of an ornamental lighting system on Main Street, from the High School to the iron bridge, to the Wesco Supply Company of St. Louis, Mo.

FORT SMITH, ARK.—The erection of a new power house to cost about \$250,000, either on site of present power station on Arkansas River front or on Poteau River in Le Flore County, is under consideration by the Fort Smith Light & Traction Company. The present plans provide for a plant of 5000 hp. capacity; the present plant has an output of 4200 hp., which it is proposed to enlarge and improve so that the two plants will have a generating capacity of 10,000 hp. An electric transmission line will be erected to Alma to supply energy to the Citizens' Electric Company, which has franchises in Alma, Mulberry and Ozark, and also to erect a 33,000-volt transmission line to Greenwood to furnish power to the Coal District Power Company to operate the coal mines in that district.

TEXARKANA, ARK.—The Four States Lumber Company is contemplating the purchase of boilers and other power plant equipment.

DUNCAN, OKLA.—An election will be held Aug. 21 to vote on the proposal to issue \$45,000 in bonds for the installation of a municipal electric-light plant.

ERICK, OKLA.—Bonds to the amount of \$25,000 have been authorized for the installation of a municipal electric-light plant.

FREDERICK, OKLA.—The city of Frederick is contemplating installing a 250-hp. steam engine, non-condensing, and one centrifugal pump, two-stage, directly connected to motor, maximum capacity 20,000 gal. per hour against a 16-ft. lift and a 65-lb. head. One pump of same capacity, either steam plunger or turbine type, to be used as an emergency.

LAWTON, OKLA.—Franchises have been granted to John C. Keys of Lawton to supply both electricity and gas in the towns of Lawton and Temple. The company now operating an electric franchise in Lawton will erect an electric transmission line from here to Temple. It is proposed to build a pipe line from the natural gas field, 19 miles from Lawton, to both towns at once.

NEWKIRK, OKLA.—The electric plant of the Newkirk Electric Light Company, recently destroyed by a tornado, will be rebuilt.

OKLAHOMA CITY, OKLA.—The Oklahoma Gas & Electric Company, it is reported, has recently acquired the electric plants and systems in Norman, Yukon, Drumwright, Kiefer and Hennessey. Electric transmission lines are being erected to these and other communities.

PAWHUSKA, OKLA.—The purchase of equipment for oil-pumping plants is reported to be under consideration.

TEMPLE, OKLA.—At an election held recently the proposal to grant a franchise to John C. Keyes of Lawton to supply electricity and gas in Temple was carried. The municipal electric plant will be closed down. Energy to operate the local system will be transmitted from Lawton.

WOODWARD, OKLA.—The City Council has decided to call an election to submit the proposal to issue \$42,000 in bonds for the installation of a municipal electric-light plant.

DENTON, TEX.—The Board of Regents has awarded contract for electrical work in connection with the erection of girls' dormitory, dairy barn and additions to laundry and power plants to the M. Lewin Electric Company of Dallas. The cost of the entire work is estimated at about \$100,000.

TERRELL, TEX.—The property of the Terrell Electric Light Company, including the electric transmission line from Terrell to Forney, is reported to have been purchased by Fred M. Leight, Jr., of Galveston, and associates. The plant, it is understood, will be rebuilt and new machinery installed.

Pacific and Mountain States

ARLINGTON, WASH.—The Washington Coast Utilities Company is preparing to install a complete meter system in Arlington for furnishing electricity for both lamps and motors. The present flat-rate system will be discarded.

HOQUIAM, WASH.—The City Commission is negotiating with the Grays Harbor Railway & Light Company of Aberdeen and

the North Pacific Public Service Company of Bremerton for lighting the streets of the city. Both companies submitted bids for lighting the city.

NORTHPORT, WASH.—The Northport Power & Light Company, recently organized with a capital stock of \$200,000, to install an electric-light and power system in Northport, will purchase energy from the West Kootenai Power & Light Company of Rossland, B. C., connecting with its transmission lines at the boundary. The line will be erected from Bonnington Falls to Northport, a distance of 30 miles. The Northport power company will supply energy to the Northport Smelting & Refining Company. The Northport smelter, it is understood, will be operated by electricity instead of steam power. The cost of the electric system is estimated at from \$125,000 to \$150,000.

SEATTLE, WASH.—The city purchasing agent has been authorized to call for bids for meters for the light department for 1917 and 1918. About 4000 will be required.

SEATTLE, WASH.—The finance and city utility committees of the City Council are considering engaging J. L. Stannard of Portland, Ore., consulting engineer, to prepare an estimate and report of the power possibilities of Cedar River, between the existing power plant at Cedar Falls and the water-works intake at Landsburg.

TACOMA, WASH.—The City Commissioners have authorized a survey of the Mineral Lake power site. The city is considering the purchase of the power site with a view of developing the same as an auxiliary to the Nisqually plant. The proposed development would cost about \$500,000.

TACOMA, WASH.—The city of Seattle has taken a 60-day option on the Lake Cushman power site, the purchase of which has been under consideration by the City Council at various times. The option taken puts the city under no obligation to purchase and requires no deposit. The site is owned by the Mason City Power Company and is valued at \$400,000. The cost of development for a plant similar to the one at La Grand, with a 45-mile transmission line, is estimated at \$5,000,000.

ALBANY, ORE.—The proposal to issue \$250,000 in bonds for the purchase of the electric-light and power plant of the Oregon Power Company will be submitted to the voters at a special election to be held in December or at the general election in November, 1918.

HALFWAY, ORE.—The City Council has granted the Idaho Power Company of Boise a franchise to install and operate an electric-light and power system in Halfway for a period of 50 years.

HELIX, ORE.—The Town Council has signed a contract with the Pacific Light & Power Company of Portland for lighting the city for a period of five years. The Helix Milling Company will install a 100-hp. motor in its mill. A transmission line will be erected from Adams to Touchet, via Helix.

MARSHFIELD, ORE.—Preparations are being made to install new machinery at the shipbuilding plant of Kruse & Banks, including a large electric crane.

PORTLAND, ORE.—Work has been begun on the construction of a dam on the edge of Bull Run Lake to determine the possibility of storing water at the lake. It is proposed to increase the depth of the lake, thereby increasing the city water storage. The increase in the amount of water also may be a part of a municipal lighting plant project.

HANFORD, CAL.—The contract submitted by H. G. Lacey & Company for the installation of a new street-lighting system in the residential districts of the city has been approved by the City Trustees. The plans provide for the erection of 67 arc lamps.

LOS ANGELES, CAL.—Plans have been prepared by the Seventh Street Company, Union Oil Building, Los Angeles, for the construction of a reinforced concrete power house, 40 ft. by 90 ft., to be erected in the rear of 715 Olive Street, at a cost of about \$14,000.

LOS ANGELES, CAL.—Final options have been secured on property on both sides of the Los Angeles River, where the Franklin Canyon siphon crosses this stream, which will be used for an auxiliary power plant for the municipal electric-lighting and power system. The proposed power station will have a capacity of 4000 hp. Contracts have been awarded for generators and other equipment. The cost is estimated at \$125,000.

MARTINEZ, CAL.—Surveys have been completed by the Pacific Electric Metal Company for the erection of a large ferro-silicon factory near the depot at Bay Point. The plans provide for the erection of four or five concrete buildings. The electrical

capacity of the plant will be about 10,000 kw.

RICHMOND, CAL.—The American Carbon Company has contracted with the Western States Gas & Electric Company for a large amount of electrical energy to operate its proposed plant to be erected in Richmond.

SAN DIEGO, CAL.—Arrangements are being made by the A. J. Savage Munitions Company for the erection of its proposed firearms plant. Plans for the initial structures provide for the erection of two one-story buildings, each about 60 ft. by 300 ft., with woodworking plant, to cost about \$45,000. The cost of the machinery and equipment, which provides for electrical operation in all departments, is estimated at \$225,000.

SAN FRANCISCO, CAL.—Improvements are contemplated by the San Francisco-Oakland Terminal Railways to its system on Telegraph Avenue, from Broadway to Fortieth Street and College Avenue, and on College Avenue, from Broadway to the Berkeley line, at a cost of about \$143,000.

SAN JOSE, CAL.—Work will soon begin by the Peninsular Railway Company on the construction of an extension to the army cantonment at Palo Alto.

TRACY, CAL.—The directors of the West Side Irrigation District have awarded a contract to the General Electric & Machine Company of Stockton for completing power installation and furnishing seven complete pumping units, at about \$60,000.

IDAHO FALLS, IDAHO.—The Utah Power & Light Company is reconstructing three 225-kva. units in its local plant. Work will soon begin on the erection of a 11,000-volt electric transmission line (1 miles long) to serve electricity for domestic and irrigation purposes in the Fairview district.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company is contemplating the construction of a large steam heating plant in Salt Lake City, to cost several hundred thousand dollars. The company already operates three steam plants in the city.

Canada

ANYOX, B. C.—The Granby Consolidated Mining, Smelter & Power Company is contemplating increasing the output of its smelter from 2500 to 3000 tons daily. New equipment, including a furnace, two large converters and other apparatus, will be installed.

KAMLOOPS, B. C.—Improvements will be made to the power plant at the King Edward Sanitarium, including the erection of a new power house and extension to the electric plant, at a cost of about \$5,000.

WINNIPEG, MAN.—Tenders addressed to the chairman of the Board of Control will be received at the office of M. Petersen, secretary of board of control, Winnipeg, until Aug. 24 for furnishing and installing one mechanical chain-grate stoker for the municipal hospital power house on Morley Avenue. Specifications may be obtained at the office of W. P. Brereton, city engineer, 223 James Avenue.

EUGENIA, ONT.—Contract for the installation of a 4000-hp. generator and turbine at the Eugenia plant has been awarded by the Hydro-Electric Power Commission of Ontario. This additional unit will double the output of the plant.

GALT, ONT.—Plans for the erection of a hydroelectric station have been presented to the Hydro-Electric Power Commission of Ontario for approval. Bids will be asked for construction of the plant as soon as plans are approved.

HALDIMAND, ONT.—The residents of Haldimand and Cramton Townships have applied to the Hydro-Electric Power Commission of Ontario for electrical service. The petition has been presented by the Township Council of Haldimand.

Miscellaneous

CIENFUEGOS, CUBA.—The Cienfuegos, Palmira & Cruces Electric Railway & Power Company, it is reported, contemplates extending its system from Palmira to Cruces, a distance of about 10 miles.

MELBOURNE, VICTORIA, AUSTRALIA.—Tenders will be received by the director of navy contracts, Navy Office, Melbourne, Australia, until Oct. 24, for furnishing auxiliary machinery for the Flinders naval base, via Melbourne, including two electrically-driven air pumps, with complete set of spare parts; one steam-driven air pump, with complete set of spare parts;

two small circulating pumps; one large circulating pump; one large feed pump; one large feed pump, with complete set of spare parts; one small feed pump with complete set of spare parts, and one oil fuel pump with complete spare pumps. Tenders, forms and specifications are on file at Department of Trade and Commerce, Ottawa, Ont. Applications for information should refer to file No. A-1901.

SYDNEY, N. S. W., AUSTRALIA.—Tenders will be received by the director of naval contracts, care Commonwealth Navy Dockyard, Cockatoo Island, Sydney, N. S. W., Australia, until Oct. 10, for furnishing pumping plant and equipment for the Commonwealth naval dock yard, Cockatoo Island, including two main dock pumps with vertical spindle motors and control equipment; one vertical spindle motor and control

equipment, four sluice valves, with four motors and control equipment; two drainage pumps with motors and control equipment; two exhaust pumps with motors and equipment; one enclosed motor and equipment for dock caisson. Tender forms, specifications and drawings are on file at the Department of Trade and Commerce, Ottawa, Ont. Applicants for information should refer to file No. A-1901.

1,235,555. INCLOSED ELECTRIC FUSE; Robert C. Cole, Hartford, Conn. App. filed July 23, 1916. Knife-blade terminal type.

1,235,579. TIMING DEVICE; Paul M. Lincoln, Pittsburgh, Pa. App. filed Sept. 2, 1914. Improvements.

1,235,584. SYSTEM OF DISTRIBUTION; Friedrich W. Meyer, Wilkinsburg, Pa. App. filed Jan. 11, 1913. Improvement.

1,235,585. SYSTEM OF DISTRIBUTION; Friedrich W. Meyer, Wilkinsburg, Pa. App. filed Jan. 11, 1913. Regulating and assisting the induction motors in their operation, and for compensating the power factors of the systems.

1,235,592. DEVICE FOR ATTACHING CONDUCTORS TO INSULATORS; Henri Parra, Port de Capdenac par Figeac, France. App. filed Nov. 17, 1913. Improvement.

1,235,607. RECTIFYING SYSTEM; Edmund F. Sipher, Wilkinsburg, Pa. App. filed May 25, 1914. Employs a transformer wherein all portions of the secondary winding are active during each half cycle.

1,235,628. LATERAL-CHANNEL INDUCTION FURNACE; James R. Wyatt, Philadelphia, Pa. App. filed July 19, 1916. Stirs a pool by general horizontal scouring effect of a hot metal flow driven into the pool, preferably near its circumference, by motor effect and which may be introduced in a direction generally tangential thereto.

1,235,629. ELECTRICAL INDUCTION FURNACE; James R. Wyatt, Philadelphia, Pa. App. filed July 19, 1916. Provides electric melting appliances suitable for melting, refining or maintaining in molten condition metals having a relatively low melting point.

1,235,630. MULTIPHASE INDUCTION FURNACE; James R. Wyatt, Philadelphia, Pa. App. filed July 19, 1916. Distributes a plurality of heating channels in new co-operative relation to a furnace pool.

1,235,638. PROCESS FOR OBTAINING OXIDE OF TITANIUM FROM MATERIALS INCORPORATING OTHER SUBSTANCES; Louis E. Barton, Niagara Falls, N. Y. App. filed March 30, 1917. New.

1,235,684. ELECTRIC SWITCH; Jay H. Hall, Cleveland, Ohio. App. filed March 18, 1913. Single magnet or winding which has the characteristic of maintaining its contacts open, not only when the winding is not energized, but also when it is energized above a certain value.

1,235,693. KNIFE SWITCH; Harry F. Johanningmyer, St. Louis, Mo. App. filed April 21, 1916. Improvement.

1,235,699. VAPOR ELECTRIC APPARATUS; Frederick G. Keyes, East Orange, N. J. App. filed Nov. 24, 1913. Proposes to substitute for the liquid anode an anode of tungsten or some other material capable of resisting the high temperatures to which the elements of the lamp are liable to be subjected.

1,235,724. APPARATUS FOR THE ELECTROLYTIC PRODUCTION OF ZINC, COPPER OR OTHER METALS; Marcel Perreux-Lloyd, Boulogne sur Seine, France. App. filed Dec. 14, 1915. Apparatus is composed of a rectangular vessel, preferably of slate, which contains the liquid electrolyte and the electrodes.

1,235,742. SYSTEM OF CONSTANT-CURRENT DISTRIBUTION; Percy H. Thomas, Upper Montclair, N. J. App. filed Jan. 11, 1916. Provides for the neutralizing or overcoming or compensating for this characteristic of the mercury-vapor apparatus, which tends to disturb series operation.

1,235,761. ELECTRIC AIR HEATER; Carl O. Bergstrom, Boston, Mass. App. filed July 2, 1915. Portable.

1,235,796. AUTOMATIC CONTROLLING MEANS FOR ELECTRIC HEATERS; John E. Harvey, Milton, Mass. App. filed Dec. 16, 1915. Provides thermo-responsive means for opening and closing an electric circuit through the heating element.

1,235,803. DYNAMO-ELECTRIC MACHINE; Edward B. Jacobson, Pittsfield, Mass. App. filed Dec. 3, 1913. Adapted to be used for charging a storage battery and also for starting a prime mover.

1,235,818. ELECTRIC SIGN SYSTEM; Malcolm E. Launbranch, Chicago, Ill. App. filed Jan. 22, 1916. Controls the selection of the lamps so that a predetermined word or sentence may be displayed upon the sign.

Record of Electrical Patents

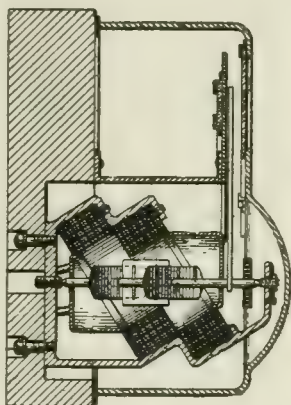
Notes on United States Patents
issued on August 7, 1917

1,235,859. AUTOMATIC ELECTRIC SWITCH; Albert Thode, Hamburg, Germany. App. filed Oct. 21, 1913. Improvements.

1,235,905. ELECTROLYTIC PROCESS OF MAKING ALKALI PERBORATES; Otto Liebknecht, Frankfurt on the Main, Germany. App. filed Jan. 6, 1916. For the electrolytic production of sodium perborate by an electrolytic process.

1,235,926. POLYPLEX TERMINAL FOR ELECTRIC LIGHT AND POWER CABLES; George P. Roux, Philadelphia, Pa. App. filed Sept. 27, 1912. May be used as a junction box and branch tap.

1,235,932. ELECTRIC CONTROL APPARATUS; William M. Scott, Tredyffrin Township, Chester County, Pa. App. filed Feb. 14, 1916. Generator may be switched into circuit or in parallel with another generator or source of current only when the voltage of the incoming generator bears a certain relation to the voltage of the generator or source of current into whose circuit it is to be switched.



1,236,114—Electrical Measuring Instrument

1,235,978. ELECTRICAL RELAY; Henry R. Holton, Chicago, Ill. App. filed Oct. 23, 1916. Employing a plurality of spring contacts engageable by a contact member, for closing a circuit through all of said contacts and to further provide an improved mounting for the said contacts.

1,235,996. ARC-LAMP ELECTRODE; William R. Mott, Lakewood, Ohio. App. filed Sept. 25, 1914. Photographic use.

1,235,999. REPAIR DEVICE FOR HIGH-VOLTAGE ELECTRIC TRANSMISSION LINES; George S. Neeley, St. Louis, Mo. App. filed April 30, 1915. Adapted to be utilized by workmen for replacing broken or damaged insulators which carry overhead electric conductors, and for effecting an immediate attachment of the line wires to the insulators, even though said wires be alive or charged with current.

1,236,001. FUSE SUPPORT; George S. Neeley, St. Louis County, Mo. App. filed May 22, 1916. High-tension distribution systems.

1,236,005. ELECTRIC MOTOR CONTROL; Ernest W. Pittman, Flushing, N. Y. App. filed March 25, 1914. Applied to a planer.

1,236,025. ELECTROLYTIC CELL; Frank G. Wheeler, Appleton, Wis. App. filed Oct. 30, 1915. Diaphragm type.

1,236,026. BUSHING FOR ELECTRIC TUBULAR INSULATION; Carl M. Wheelock, Milwaukee, Wis. App. filed June 18, 1917.

Means for securely attaching the tubing to the edges of openings such as those in cut-out boxes.

1,236,057. SEPARABLE ATTACHMENT PLUG; Charles G. Cope, Chicago, Ill. App. filed April 5, 1913. Simplifies the construction.

1,236,066. STAYBOLT TESTING DEVICE; Ethan I. Dodds, Pittsburgh, Pa. App. filed July 25, 1916. Electromagnetic means which will operate promptly to detect a broken bolt.

1,236,082. HEATING DEVICE; Harry T. Hipwell and Harry H. Hipwell, Pittsburgh, Pa. App. filed July 20, 1916. For permitting the application of light rays to the human body.

1,236,090. ELECTRIC RIVETING; Charles H. Kicklighter, Macon, Ga. App. filed Dec. 15, 1916. Provides an apparatus and method for heading rivets in cylinder seams by the use of polyphase currents.

1,236,091. ELECTRIC WELDING; Charles H. Kicklighter, Macon, Ga. App. filed Dec. 15, 1916. For making a plurality of welds simultaneously by the use of polyphase currents.

1,236,114. ELECTRICAL MEASURING INSTRUMENT; Robert Shand, Lynn, Mass. App. filed July 7, 1914. Duplex ammeter and voltmeter of the inclined-coil type.

1,236,128. RELAY; Delavergne P. Williams and John F. Williams, New York, N. Y. App. filed Jan. 25, 1917. For setting up in one circuit electric impulses derived through another circuit.

1,236,130. MEANS FOR MEASURING ELECTRICAL ENERGY; John C. Wilson, Milwaukee, Wis. App. filed Aug. 14, 1913. Provides compensating means which will enable wattmeters to give accurate readings under varying voltage conditions.

1,236,133. ELECTRIC SWITCH; Carl E. Anderson, Bridgeport, Conn. App. filed Sept. 1, 1916. Snap.

1,236,135. ELECTRIC BATTERY; Charles E. Avery, Trenton, N. J. App. filed Sept. 1, 1916. Dry.

1,236,161. PLUG; David D. Gordon, Chicago, Ill. App. filed March 6, 1916. Separable attachment.

1,236,177. RELAY; Ernest H. Jacobs, Schenectady, N. Y. App. filed Feb. 26, 1914. Time-limit relays.

1,236,188. INSULATOR; Edwin N. Lightfoot, New York, N. Y. App. filed Dec. 21, 1912. Improvements.

1,236,206. SUPPORTING MEANS FOR ARC-LAMP ELECTRODES; John C. Ohnstad, Fort Monroe, Va. App. filed July 9, 1913. Electrodes are made to burn away evenly.

1,236,210. ATTACHMENT PLUG; Paul D. Phillips, Chicago, Ill. App. filed May 12, 1913. Improves upon the construction of the threaded contacts.

1,236,248. PHONOGRAPH ATTACHMENT; Wilfred A. Atkinson, Phillipsburg, N. J. App. filed May 19, 1916. Automatic lighting.

1,236,302. IRON ATTACHMENT; Mary Hopper, San Diego, Cal. App. filed Dec. 29, 1916. Holding the electric wires out of the way of the operator.

1,236,309. DYNAMO-ELECTRIC MACHINE; Louis F. Johnson, San Gabriel, Cal. App. filed May 19, 1913. Rotor is entirely free from winding, insulated bars, or electrical fittings of any kind.

1,236,341. GIN BRUSH; Stephen D. Murray, Dallas, Tex. App. filed Sept. 5, 1914. Improvements.

1,236,357. ELECTROMAGNET CONSTRUCTION; Henry E. Reeve, New York, N. Y. App. filed April 8, 1911. Forming each head of the magnet of a washer or disk of suitable metal, preferably such as brass, and having a central opening to receive the core.

1,236,375. RELAY; Arthur H. Johnson, Epsom, England. App. filed June 4, 1914. Improvements.

1,236,379. HIGH-POTENTIAL SWITCH; Granville E. Palmer, Brookline, Mass. App. filed Feb. 16, 1917. Contact members and thermal cut-outs or fuses are immersed in a non-conducting medium.

1,236,385. RECTIFIER SYSTEM; Sidney W. Farnsworth, Pittsburgh, Pa. App. filed Feb. 5, 1914. Danger of injury to the apparatus by reason of short-circuiting within the rectifier will be avoided.

Electrical World

The consolidation of ELECTRICAL WORLD and ENGINEER and AMERICAN ELECTRICIAN

Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, AUGUST 25, 1917

No. 8

Unwelcome Shortage of Power

POWER shortage is an unusual, unwelcome and unbidden characteristic in central station operation. But in wartime, as in the farmer's dry spell, all signs fail. And in the electrical industry, as in other industries which are now speeding at top notch, consumption is racing past production, demand is exceeding supply. We have material shortage, fuel shortage, labor shortage, food shortage. Power shortage is in some communities an inescapable corollary of the others. That shortage of power makes its uninviting appearance is not strange; what is remarkable is that it has not arisen before as a more serious factor.

On top of stimulation to industries by internal prosperity and by war orders from the first Allies to accept the challenge of the German government came the entrance of our own country into the conflict. Still greater stimulation of industries connected with war was offset slightly by reduced activity on the part of luxury business. The net result was that not less power but more power was needed. The corner merchant in the same predicament can enlarge his stocks; he can move his capital more quickly. The hotel can double men in rooms and "regret" that the convention and absence of other quarters make this inconvenience necessary. But there are no straphangers for the central station.

The electrical utility is to-day wearing out its power station equipment at an excessively rapid rate because it is requiring of that equipment more work than it was designed and constructed to do. It is consuming its capital in this process. By forcing generating and boiler room equipment it is giving more in quantity of the service which the public wants, but it is depreciating property at a high rate. It cannot afford to go too far in this direction.

That the generating companies have placed orders far ahead the manufacturers offer unassailable proof. In some lines orders are on the books for delivery three years hence. This is not so simple a matter as it sounds. To order far ahead when prices are at the present high level may mean that the investment will have to be roughly twice as much as it would have amounted to for the same unit a few years ago. Would a shoe dealer order even part of his 1920 stock at prevailing prices? Yet the implied condition upon which the electrical utility progresses is that it shall be ready to meet the demands made upon it under ordinary conditions. It has to buy ahead. If the overbought condition of the market forces it to buy far ahead, it buys for delivery a long time in the future, paying the increased price due to world-wide demand and world-wide shortage.

To discourage new business goes against the grain.

It is not what we have done in the past. But when the alternative is to neglect old customers, the right answer is plain, unless, of course, the new business is a question of national defense. The first problem, however, is to make the shortage felt as little as possible, to keep it from being felt at all in industries vital to the national safety. All the other problems sink into insignificance compared with that. The first aim is to render the service; the question of how it is to be done is incidental to the main issue. Many studies are under way to increase unit productiveness of both men and material; and under the stress of present issues it is to be expected that more rigid conservation policies will be introduced. The companies will respond to the public need, although the sacrifice of non-essential uses of energy may be asked of the public as its share.

A Unique Lighting System

ANY one who has visited the Nela Park Laboratory recently has come away with a vivid and most interesting impression of the possibilities of daylight lighting. To those not familiar with the locality it may be mentioned that the works are on the top of a rather steep bluff to which the approaches are long and circuitous and exposed in winter to weather conditions that make access difficult and uncomfortable. For the convenience and comfort of the employees the difficulty was removed by constructing from the base of the rise to near its top a passage 100 yards (91.4 m.) long and rising by successive ramps and short flights of steps about 35 feet (10.6 m.). Once near the top of the bluff the way to the various buildings becomes easy and the passage does the rest.

How to light a long underground tunnel of this sort was a serious problem. Of course ordinary ceiling fixtures might have been used, but the effect is not altogether pleasant, and it was thought worth while to try an experiment with the object of giving the passage conditions of lighting as near daylight as the state of the art would permit. To this end the main passage was provided with narrow lateral air spaces reaching to the full height of the passage between the outer concrete walls and the inner walls of hollow tile. These air spaces are good in themselves as lessening the unpleasant likelihood of dampness, and are also made to serve the source of what is perhaps the best approximation of daylight lighting effect that has yet been obtained. In the inner walls of the passage were constructed thirty-two windows on each side, glazed with a rather light translucent glass transmitting light freely but preventing view of the walls outside. Just above

each of these windows was installed a 100-watt blue-glass daylight lamp in a show-window lighting reflector, so as to throw a large proportion of the light through the windows. There is in addition a smaller emergency lighting circuit with special provisions for certainty of service which are described elsewhere in our columns. The actual result is very pleasing. The passage does not convey at all the impression of being an underground tunnel, but might well be merely a covered way connecting two buildings and lighted from the sky itself. It is equally successful from the ordinary standpoint of artificial lighting, and is certainly as admirable an example of resourcefulness in meeting a somewhat difficult problem in illuminating engineering as has come to our notice.

Central Station Laboratories

THE modern city central lighting and power station has to maintain its volt, ampere and watt standards to a degree of precision which twenty years ago was regarded as the sole prerogative of the scientific laboratories of the country. The voltmeter, ammeter and wattmeter standards have to be checked and kept in reliable condition at the station, in such a manner that the portable working instruments may be recalibrated at regular intervals, by comparison therewith. In order that watt-hour meters on customers' premises can be tested in place, with satisfactory precision, a considerably higher degree of precision has to be maintained in the standard instruments at the station than in the instruments on consumers' premises.

E. P. Peck contributes a description in this week's issue of a central station laboratory in Atlanta, Ga. The description is interesting in its indication of the details through which the standardization is effected. The fundamental standard is the Weston cadmium cell. Potentiometers enable various emfs. to be measured, in terms of the known voltages of these cells, over a very wide range. All standard voltmeter and ammeter readings are checked through the potentiometers, and finally the working instruments are calibrated against the standard instruments.

The circuit arrangements in such a laboratory are conveniently systematized to a high degree, so that any particular instrument goes to its own particular table for test and is connected, through its own particular switches, in a perfectly definite way. This systematization saves a large amount of time and labor. In this respect it is just the reverse of what an experimental laboratory has to be, where, in the nature of things, nearly everything is special and directed to a new particular result. Between the purely experimental laboratory, with its absence of routine, on the one hand, and the purely standardizing central station laboratory, with its precision of routine detail, on the other hand, there are all kinds of intermediate types of electrical testing laboratories, of mixed experimental and routine equipment, depending on the particular class of work to be done. There is room for more installations of the kind described in the central stations of the country.

Booming the Electric Range

AT THE present time central stations are somewhat divided on the question of the advisability of pushing electric cooking. Some regard it as the coming great field for added load; others think it a highly desirable addition to service in normal times but of questionable value at the present costs of material and labor, inasmuch as to succeed in a cooking campaign a very low figure must be quoted. Again, it is undoubtedly the fact that the effect of electric cooking appliances on the load curve of the station varies very widely from place to place. In England, for example, where the business was vigorously pushed before the war, the cooking load ran entirely clear of the general peak. The demand from the electric ranges as caused by the habits of the London population came subsequent to the main peak at all times when the peak was of any consequence. On the other hand, in some of our South-western territory, where the commercial power and lighting loads are a less important part of the load than in the East, it is found that the cooking demand falls ahead of the main peak far enough to keep it out of the way. In certain other places there is a perceptible tendency to pile the cooking load upon the general service at a disadvantageous time. Each central station must study the habits of its own community to judge correctly of the probable effect of a considerable cooking load. That upon the whole it is a desirable addition to the service, and likely in the future to be a profitable one, seems now quite certain; but it has limitations which need study.

Until recently the cost of electric ranges was absurdly high. The designers seemed to be victims of an obsession that electric ranges must in their whole material aspects resemble coal and gas ranges, while in truth electrical cooking apparatus must, for efficient working, be designed for its own purpose and not in imitation of old-fashioned devices. When carefully and intelligently handled electric cooking is wonderfully clean and economical. It can beat out coal at anywhere near present prices over a great part of the country, and as a practical proposition it can generally beat out gas if electrical energy is sold at figures now becoming common. It is to-day possible to put in an electric cooking outfit at a figure substantially the same as the cost of a correspondingly complete and adequate coal or gas outfit. By cooking outfit we do not here mean an elaborate and expensive electric range, made in imitation of the towering and elaborately filigreed coal ranges in fashion a few years ago, but an equipment fully able to meet the cooking requirements of the family, be it large or small.

The main thing in successful utilization of electrical energy for cooking is proper instruction in its uses, and it is just regarding this point that an article we publish this week on the cooking campaign in St. Louis becomes singularly pertinent. It has been found there, as elsewhere, that apartment-house business is of great importance. This is due to the fact that the families are generally small and of various habits, so that the

diversity factor is particularly favorable, much more favorable than it would be in a staid suburban neighborhood where comparatively little entertaining is done and everybody dines at approximately the same hour. The necessary initial investment per family is likely to be smaller in an apartment house and the use of electric appliances is likely to receive a little better personal attention that it would on a large estate. But for electric cooking on a large or small scale a small amount of practical instruction is necessary to secure proper economy. It is no more difficult than cooking with a gas or coal range—in fact, rather easier—but the apparatus must be handled in its own way and not precisely in the same way as other sources of heat. In other words, a little instruction means a considerable increase in the efficiency attained, without calling for the slightest degree of technical knowledge of electricity, but only for an entirely empirical familiarity with the things to be done.

The St. Louis company therefore started in, after a brief experience, on a deliberate educational campaign. The electric company not only furnished an adequate force of demonstrators but also undertook a course of ten lectures with demonstrations on electric cooking. It even went a step further and advertised a cash payment of \$7.50 to each applicant who actually did attend all the ten lectures. The result was more than 1500 applications, which eventually simmered down to a group of over 400 who carried through the course. The effect on business was certainly electrical, aside from good immediate results. It soon became apparent that first-class modern apartments should be equipped with electrical kitchens, and the final result of the campaign was the sale of more than a thousand ranges, with half as many more likely to go in at a very early date.

What has been done in St. Louis can readily be done elsewhere, and there is a fine field for activity both in large and small companies. Aside from the positive economies that can be worked at the present cost of fuel, there is a possibility of a large business in summer resorts at remunerative prices. The summer cooking problem is a serious one, coal being often very expensive, wood inconvenient and troublesome, gas unattainable, and oil ranges a not inconsiderable fire risk. There never was a time more favorable for pushing the cooking load ahead.

Slip-Measuring Devices

IN ATTEMPTING to measure the slip of an induction motor it is necessary to observe the speed of rotation with great care, and also to observe with precision the frequency of the alternating-current supply circuit. When the slip is small these two observed quantities are nearly alike, and in subtracting one from the other to obtain the slip slight errors in either may involve large errors in the result. In fact, it is not rare to make careful observations in this way, and to find that, owing to some trifling and temporary irregularity, the speed of the induction motor comes out slightly greater than the synchronous speed of the circuit, thus making the slip appear negative, or as though the motor were a generator.

In order to avoid measuring the slip through the difference in two nearly equal speeds, various methods have been used for measuring it directly. Among these are stroboscopic methods, whereby the number of slipped revolutions may be made visible and capable of being counted in a given time.

This week's article by Milton M. Flanders describes a form of electromagnetic slip counter that is capable of being applied in succession to a number of different machines. A rotating contact on the induction-motor shaft is connected to a polarized relay, through the secondary of a potential transformer across the supply mains. The relay adjustment is such that it responds once in each slip cycle. The relay, beating slip cycles, is then connected with a clockwork-driven indicator dial, so that the needle of the dial advances one step for each slip cycle. A stop watch used with this instrument then enables the total number of slip cycles per minute to be measured with the ordinary degree of stop-watch revolution-indicator precision. When the measurement is made, the observer sees the slip cycles counted off on the dial and is able to assure himself that, by their regularity, the instrument is behaving properly.

Electromagnetic slip in an induction machine is a silent and stealthily elusive phenomenon, in which a mechanical rotor lags behind a rotating magnetic field in the stator. A slip-revolution counter of this kind translates it into visible beats and audible clicks, that restore the phenomenon to the realm of mechanically revealed quantities.

WHAT has the electrical industry done to help the government successfully to wage the war? What part is it now playing in the general war scheme? Its untiring activity in patriotic devotion to the nation's interests will be the theme of the next issue of the **ELECTRICAL WORLD**—the National Service Number. How many millions of dollars of Liberty bonds were taken up by the industry, both employer and employee? How many millions were subscribed to the Red Cross? To what extent have those engaged in the electrical profession found their way into the nation's fighting forces? These statistics have been carefully gathered for presentation in the coming issue. How the manufacturers have co-operated to furnish the government with electrical materials at the lowest prices, with quick deliveries, with-

The Coming Issues

out disrupting the industry; how the best engineering minds of the industry and central stations have helped, will also be told. In addition to presenting information about the tangible operations of the industry in the war program, there will be articles that reflect how the industry has been able to maintain a service of such supreme quality in the face of mounting costs, decreasing labor and necessity for quick action. Reports will be made on methods for obtaining economies in many directions, such as produced by fuel consumption, material utilization and interconnection of systems. In general, the National Service Number will be a record of the spirit which pervades the industry when a national crisis arises—the first to act without stint of money, labor or brains.

Features of Modern Standardizing Laboratory

The Latest Ideas for Carrying Out Varied Work with High Accuracy Are Embodied in the New Laboratory Belonging to the Georgia Railway & Power Company

BY E. P. PECK

Superintendent of Operation Georgia Railway & Power Company, Atlanta, Ga.

THE standardizing laboratory of the Georgia Railway & Power Company has recently been moved into new quarters, and advantage was taken of this to devise a flexible and convenient arrangement of benches and wiring so that a varied line of work of high accuracy might be done with speed and a minimum of trouble.

The standardizing laboratory maintains the company's precision instruments, which are called the primary standards, and makes checks and does repair work on all of the portable instruments used by the various departments. As the accuracy of all of the company's watt-hour meters is dependent on the accuracy of the portable instruments, the greatest attention is paid to the maintenance of these portable standards. It is not only a question of maintaining their accuracy for the purpose of having the bills accurate, but it is a point of pride with the company that the tests cannot be successfully disputed.

All of the portable instruments which are used on important work are checked against one of the potentiometers. These instruments, as shown in Fig. 1, are mounted on a concrete-top table in one corner of the laboratory. As accessory to the potentiometers, there are four standard current-carrying resistances, ranging from 0.1 ohm to 0.00002 ohm, providing for accurate current determinations from 0.01 amp. to 2000 amp. There are also two volt multipliers, each having 15-volt, 150-volt and 1500-volt ranges. The galvanometers, as shown, are of the lamp and scale type, each having a light screen mounted on it to shade the scale from the general room lighting.

The potentiometer shown on the left in Fig. 1 is an old Queen instrument which was purchased in 1907, making it one of the first potentiometers used for central station work in this country. The other potentiometer was made by Leeds & Northrup and has been installed recently. All of the instruments mounted on this bench have been checked either by the Bureau of Standards or the Electrical Testing Laboratories.

Reserve standard cells and standard resistances are used to check the working standards every six months, at which time the working standards are also intercompared. It might be mentioned that all of these standards have shown a high degree of reliability with the exception of one standard resistance, which had an improperly brazed connection when received from the manufacturer. After repairs had been made on this the standard became satisfactory. The standard cells are kept in regular use until the regular checks show that the cell has begun to change from its rated voltage. We have found that the Weston cadmium cell will maintain its rated voltage for several years when regularly used if it has proper care.

Switches are provided under the standard resistances,

as shown in Fig. 1, with connections arranged so that the heavy current leads and potential leads from any of the standard resistances may be connected in circuit. The single-pole switch on each standard controls the main circuit, and the double-pole switch to the left of this switch controls the potential tap circuit. Just under the heavy-current bus on this bench are two small double-pole, double-throw switches, one connected to each potentiometer. These connect either potentiome-

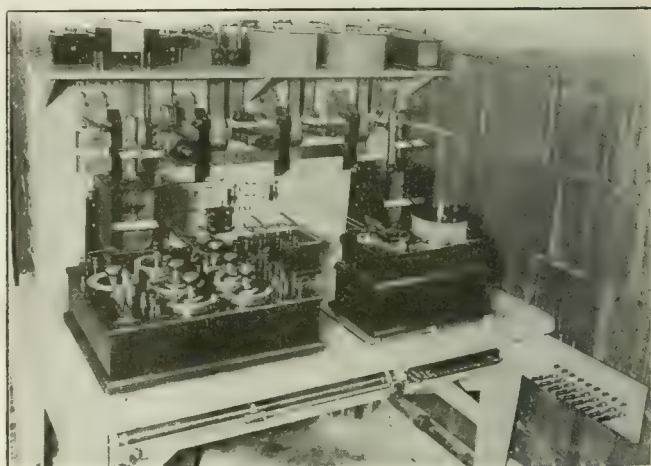


FIG. 1—BENCH CONTAINING POTENTIOMETERS, STANDARD RESISTANCE, AND VOLT MULTIPLIERS

ter to the voltage circuit used for checking voltmeters and wattmeters or to the potential taps of the standard current-carrying resistances. One potentiometer may be used for voltage work while the other is being used for current measurements, or both potentiometers may be connected in parallel to either the voltage or current circuits. The circuits of the potentiometer bench are given in Fig. 2.

Several years ago erratic results were obtained in the use of the potentiometer which it was finally found were due to stray currents leaking through the base of the potentiometer and over the insulated top into the galvanometer circuit. To prevent a recurrence of this trouble, the potentiometers, standard cells, galvanometers and auxiliary apparatus are all mounted on individual glass plates supported on small porcelain insulators which are covered with felt disks. The connections between all of the above apparatus are run in air lines, so that the possibility of leakage is reduced to a minimum.

The arrangement of benches, wiring and control apparatus was very carefully laid out to provide the maximum of convenience and to keep stray fields at a minimum. Referring to Fig. 4, it will be seen that the potentiometer bench is in the corner of the room, and facing it, at a distance of about 3 ft. (0.9 m.), is bench No. 1. This arrangement makes it possible for one man

to check either a voltmeter or an ammeter directly against the potentiometer. The tester, sitting between the two benches on a rotatable top stool, sets the current at approximately the desired value on bench No. 1, then turns to the potentiometer bench and with the

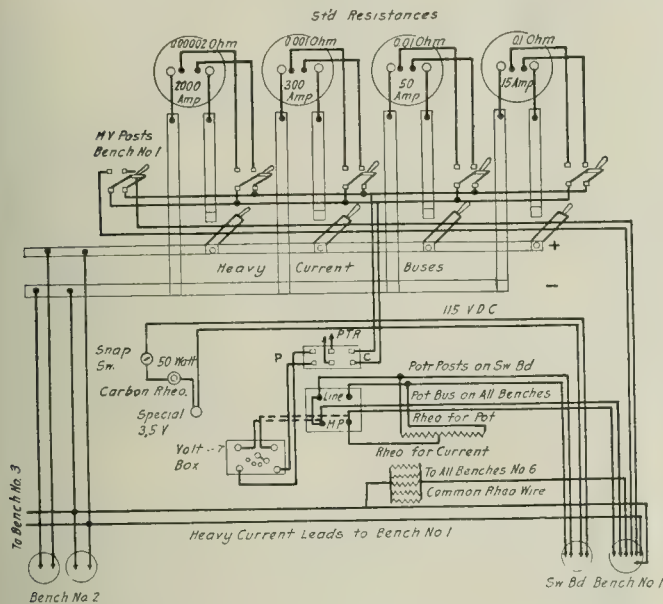


FIG. 2—WIRING DIAGRAM OF POTENTIOMETER BENCH

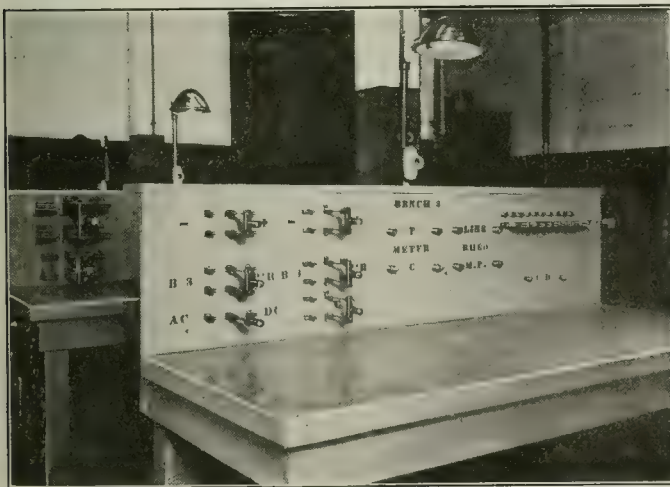
auxiliary rheostat on this bench adjusts the current to the exact value as indicated by the potentiometer. He takes a reading on the ammeter and then rechecks the potentiometer to see that the current has not changed. Checks may be made by one man in this way which are accurate within the reading error of the instrument.

The auxiliary-current rheostat on the potentiometer bench is controlled by the row of small knife switches shown in the extreme lower right-hand corner of Fig. 1. This rheostat will care for a maximum current of 50 amp., which is adjustable in 0.5-amp. steps. The

and direct currents of 200 amp., bench No. 2 of 2000 amp. and bench No. 3 of 50 amp. Moreover, bench No. 2 is not provided with reversing switches.

The bench is a very solidly constructed wood frame, on which is set a 2-in. (5.08-cm.) concrete slab with no metallic reinforcing. The switches and binding posts are mounted on the vertical back of the bench, as shown in Fig. 3. The three switches on the left control the current circuit, the bottom switch connecting the bench to either a low-voltage transformer for alternating-current supply or to the individual battery for direct-current supply. The double-throw switch above, when thrown to the right, connects the current posts of this bench through a loop to the potentiometer bench. When this switch is thrown to the left, the current circuit is limited to this bench only. The top switch of this row reverses the current on the bench post, but does not reverse the current supplied the potentiometer. The bottom switch in the row nearer the center excites the heavy current transformer. The next switch above this connects the voltage circuit to the potentiometer or to the bench individually. The top switch is a voltage-reversing switch. The row of small switches at the top right-hand corner of the bench are rheostat switches. These cut in zero temperature coefficient resistances, giving currents from 0.5 amp. to the maximum provided for that bench. Current ranges from 0.03 amp. to 0.75 amp. are obtained by a small carbon rheostat connected to the binding posts under these switches, marked "C. R." The wiring of current and potential circuits is shown in Fig. 5 and Fig. 6.

When the current circuits on any of these benches are connected to the potentiometer bench an auxiliary rheostat on the potentiometer bench is also connected in the circuit. This makes it possible to obtain the final adjustment of current at the potentiometer, regardless of which bench is being used. When the bench is used independently of the potentiometer bench, the standard meter and the tested meter are placed



FIGS. 3 AND 4—VIEW OF BENCH NO. 3, AND ARRANGEMENT OF TESTING BOARDS WITH RESPECT TO POTENTIOMETER BENCH

small carbon rheostat which is mounted just under the bench in front of the Leeds & Northrup potentiometer is in parallel with the wire rheostat. This carbon rheostat is adjustable from 0.03 amp. to 0.75 amp.

A description of bench No. 3 will be given. The other benches are practically the same except that bench No. 1 has a current capacity for both alternating

on the same bench and the control rheostats on this bench are all that are necessary.

Voltage control for voltmeters and the potential circuits of wattmeters is obtained by means of a slide-wire resistance. The wire used is "Advance," which is wound on a tube approximately 2 in. (5.08 cm.) in diameter and 30 in. (76.2 cm.) long. The whole tube is con-

nected across the supply circuit, voltage for the instrument being taken from one of the supply lines to the slide.

Attention is called to the lamps which are hung over each of the test benches. The location of these lamps,

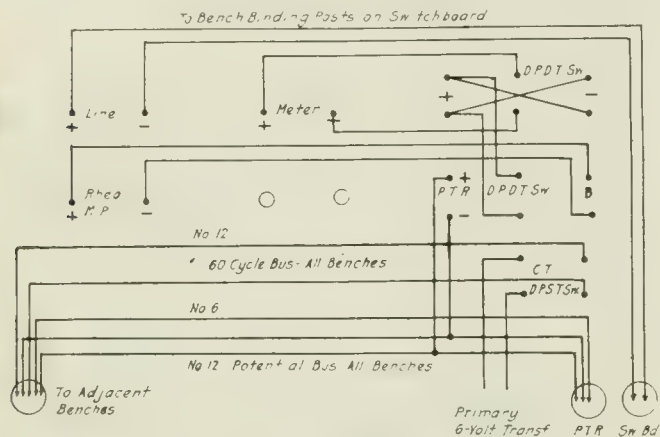


FIG. 5—WIRING OF CURRENT CIRCUITS

which was determined after some experiments were made, is such that a meter placed near the center of the bench receives excellent illumination on its scale and does not give a reflection troublesome to the tester. A socket is also connected just above the bench so that a fan or soldering iron may be connected when desired.

In Fig. 7 is shown a rear view of bench No. 2, with three 100-amp.-hr. three-cell storage batteries connected. This bench is arranged to take ten of these batteries for heavy-current tests. Bench No. 1 is arranged for two of these batteries and bench No. 3 for one battery. As by far the largest part of the checking is done on instruments under 100 amp. in range, this method of obtaining heavy current is very flexible and convenient. For charging, the batteries are slid from the platform shown onto a small truck of the same height as the platform and are hauled over to the charging platform, where all are charged in series through an adjustable resistance.

At the right of the battery is shown the 1000-amp.,

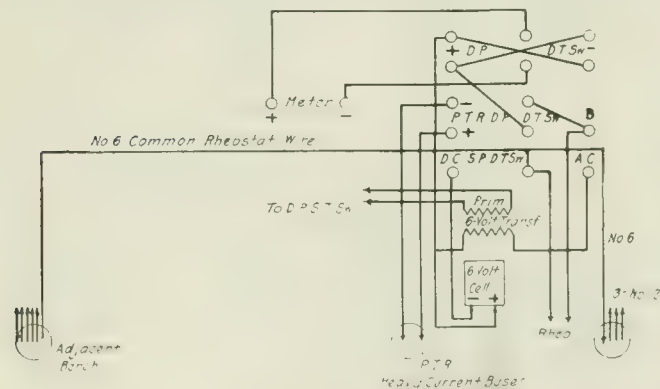


FIG. 6—WIRING OF POTENTIAL CIRCUITS

6-volt transformer which supplies the heavy alternating current for tests on this bench. Directly above this transformer is the heavy current rheostat which controls the current in 100-amp. steps from 100 amp. to 1000 amp. The finer adjustments of current are obtained by means of the small rheostat and switches as shown in Fig. 3.

The direct-current potential supply for the labora-

tory and for the meter shop on the floor below is obtained from a 300-volt battery in another room. This battery is wired to the laboratory distribution switchboard, at which point it may be connected to any or all of the benches as desired.

The scheme of voltage and current supply for the meter department is the same as that described for the laboratory; that is, each bench has its individual battery for direct current and transformer for alternating current and its individual zero temperature coefficient rheostats.

The distribution switchboard in the laboratory has a 110-220-volt connection to the Edison system, a 110-220-volt, single-phase alternating-current supply and a 220-volt, three-phase alternating-current supply from the 60-cycle distribution system. There are also connections to a 600-volt motor-driven direct-current generator and to the 300-volt potential battery. Any of these sources of supply may be connected to any of the benches or to all of the benches with the exception of the potentiometer bench.

All direct-current instruments are checked against

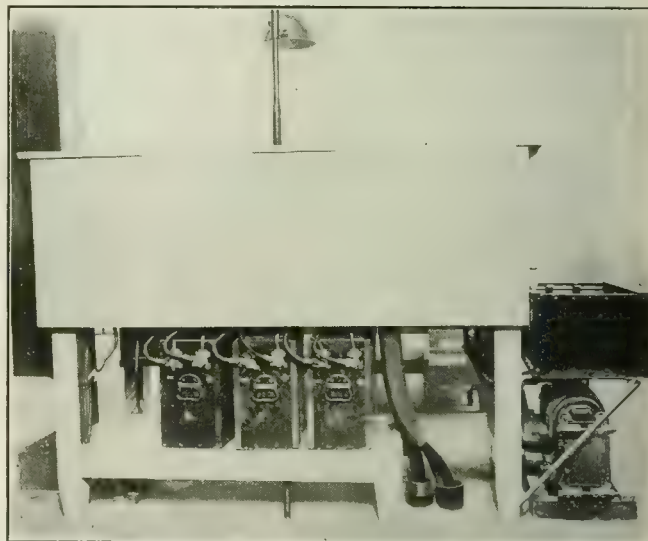


FIG. 7—METHOD OF MOUNTING TESTING BATTERIES SO THEY MAY BE TRANSPORTED BY TRUCK TO CHARGING PLATFORM

one of the potentiometers, and the alternating-current instruments are checked by means of transfer standards which were carefully tested to determine that they were accurate on both alternating and direct currents. The wattmeter used as a transfer standard is a large laboratory standard which has an even scale. This instrument is, for practical purposes, perfectly astatic. Its error due to stray fields obtained by any ordinary means is too small to be readable. Its accuracy is very high on both alternating and direct currents. The ammeter and voltmeter transfer instruments are of the same make and are also astatic. Their accuracy on both alternating and direct currents is very high. The laboratory wattmeter is frequently checked against the two potentiometers, one being used as a current standard and the other as the volt standard. When the greatest accuracy is desired the instrument is checked against the potentiometers both before and after being used as an alternating-current standard. This instrument is very permanent, however, and the second check has never shown any deviation from the first.

Good Location for Your Salesroom—How It Pays

An Array of Facts and Figures Concerning Profit That Have Been
Gathered from the Experience of Many Central Stations
in Various Sections of the United States

BY EARL E. WHITEHORNE

WHEN central station executives hire a salesman or a sales manager they measure him by a very simple standard. "Will he sell goods?" they ask themselves. "Will he make the right impression on the customer he calls on? Is he a worker or a loafer? Will he creditably represent this enterprise? Will he prove the most profitable man we could secure?" Those are the questions, and the man they pick must look right from all these angles. But did you ever sit back calmly and apply this test to the location of your office—of your store? Certainly this is no less important.

REMOTE LOCATION MEANS LOSS OF MONEY

When you stop to think of it, the maintenance of an office or a store by any central station is a selling effort. It is intended to bring closer contact with the public, more convenient intercourse, for the simple purpose of promoting better business, more sales of service and appliances. A good location, therefore, must be worth more than a poor one, just because a good location means a frontage on a busy street, where larger crowds are passing by and offering more selling opportunity. And the central station that is content to hide its office in a corner of the remote plant or keep its store on a side street, out of close touch with the shopping district, is losing money. Here is some evidence from central station men who have discovered this from actual experience in moving from a poor location to a good one. What they say is worth consideration by every manager while there is yet time to act, before the busy selling months between now and the holidays have slipped away.

About three years and a half ago, for instance, the Trumbull Public Service Company, in the little city of Warren, Ohio, moved its offices from off the side street. Read what New-Business Manager William J. Marshall has to say about it.

"Our company was located on a side street," he writes, "and our offices were small and about as unattractive as any I have ever seen. There was absolutely nothing inviting about them, and our consumers would duck into them, pay their bills and 'streak it' out as fast as they could go. They seemed to be afraid to come into the place, and wanted to get away as quickly as possible. If you spoke to them or tried to approach them in any way, they would say as few words as possible and go. I do not know that I can blame them. Had I not known that the people employed there were good, law-abiding citizens, I should have done the same thing. No appliances were sold whatever and there was no room to display them.

"We finally rented space in a new building in the very best location in the town, inducing the owners of the building to name it the Electric Block and to install a large electric sign on the roof reading 'Electric Block.' We installed the most modern equipment in the new

offices and made them as attractive as possible. We also installed an attractive showroom and show window and a complete stock of electrical appliances, and on the front of our offices erected a large 'Do it electrically' sign with 2200 10-watt lamps. Some people said we were crazy—that it was not necessary and that we would never sell out our stock of appliances, but we were sure that if we made our offices so attractive and pleasant that it was a pleasure to come into them we should soon have the crowds coming in, that we would get better acquainted and closer to them, and could in a short time work up a very nice appliance business. The result, after three years, has shown that we were right.

"Our consumers now come in without any fear of being sandbagged. They stand around and visit and seem to feel that we are real human beings. They even come in to have a little chat when they have no business to transact, and on Saturday nights one would think we were holding a small reception—people coming in to say 'hello' and talk things over or to look over our line of appliances. And in the matter of appliances our sales have increased from nothing to an average of about \$2,500 a month. Sales are increasing right along, and all appliances are sold at list and all show a good profit."

Mr. Marshall paints a graphic picture—one particularly impressive because it shows the strong conviction this experience has wrought upon him. "Attractive offices in a good location," he adds, "are bound to bring you closer to the people, and if you make the offices the show place of the town, the community will point to them with pride and feel that you are one of them and a booster for the town." No one will doubt the value to his company of such a friendly contact with the public.

EXPERIENCE OF INDIANAPOLIS COMPANY

Another similar case in a larger city has already received considerable publicity, but the facts are interesting in this comparison. The Merchants' Heat & Light Company moved its office in Indianapolis from a side street to a prominent corner in the shopping district. Before the company moved the average number of contracts taken in the office was about forty-eight a week. It never exceeded seventy-five. But when the new quarters were opened, with a big electric sign that marked the building as "The Daylight Corner," the average of contracts taken over the counter jumped at once to 160 a week, and appliance sales increased over 150 per cent. In fact, appliance sales alone are paying the entire cost of this investment in location, though the building houses all the general offices of the company. Surely such a move is justified.

But it is not only when the central station moves from a back street into the light of day that quick cash profits come. The Public Service Electric Company of

New Jersey moved its Newark office a while ago, although already it was basking in the center of the limelight. Let W. N. Halsey, the local agent, tell why this was done and what resulted. He says:

"It is true that our old building was considered one of the best locations in the city, fronting on Broad Street within one short block of the second busiest crossing in the United States. It was a store site hard to improve upon. Then again Broad Street, like Broadway, New York, was thought to have a 'good side' and a 'bad side' for trade, and we were moving off the good side to a location three blocks away and across one of the large parks. Many people shook their heads and predicted that our merchandise sales would fall off; but we had the advantage of locating in the same building with the big new trolley terminal, which is used by thousands of people daily, and also fronts on the principal street leading to the Hudson & Manhattan station, the 'tube' line to New York. In addition, we counted on the fact that Newark has become cosmopolitan, and it is no longer essential to success to have your enterprises located on the 'four corners.' The effect of this change of location is expressed by these figures better than words:

	January to June	July to December	Increase Last 6 Months Over First 6 Months	Total for Year
1915	\$8,588.19	\$17,445.58	\$8,857.39	\$26,033.77
1916	14,958.02	32,033.83	17,075.81	46,991.85
1916 over 1915..	\$6,369.83	\$14,588.25	\$8,218.42	\$20,958.08
Per cent increase	74.1	83.6	92.7	80.5

"This remarkable increase in merchandise sales has more than justified our confidence."

What could better prove that where the crowds are passing there lies the business?

PROVIDENCE IS AN ILLUMINATING INSTANCE

In the experience of the Narragansett Electric Light Company's electric shop in Providence, R. I., we have still another test of location value, for here the sales-room was moved from an upper floor down into a real store on a prominent shopping street. A. H. Alcott, manager of electric shops, gives these figures:

"Our records as far back as 1912 for appliances unfortunately do not contain the amount of business secured in dollars and cents, but for comparison we happen to have our Christmas business for 1912, when we were located on the second floor of an office building with a showroom of about 100 sq. ft. Our Christmas business that year amounted to \$2,089, but we moved to our present location in August, 1913, and from that time until Dec. 31 our sales amounted to \$8,344.82, covering just four months. Our entire business for the year of 1914 amounted to \$21,785.71, for 1915 to \$27,777.12, and for 1916 our business amounted to \$65,000, the above figures representing the sale of appliances alone.

"There is absolutely no question in our minds that our location on the street floor has been responsible to a very large extent for our increase in business, as our store is now much more accessible to our customers who wish to pay their bills there, and we are also able by keeping our windows attractive to show the merchandise which we are attempting to sell, which would have been impossible in our second-floor location, or even on a back street off one of the main highways.

We are most enthusiastic about our store on the ground floor, as we feel that it is one of the best things we ever did to increase our sales of merchandise."

PHILADELPHIA AND BOSTON SPEAK

Again, the Philadelphia Electric Company many years ago moved just one block, off a back street to the main shopping thoroughfare, and its appliance sales jumped from \$1,700 to \$17,000 for the first year. On the other hand, the Noblesville (Ind.) Heat, Light & Power Company last fall reversed the operation with the effect stated below:

"This company," writes John T. Kesler, new-business manager, "built a new office during the year 1915, and its location is not so convenient to the business section of this city as the old office had been. Our idea was to get the office building in close proximity to the power house and storeroom, which are now all on the same block, the power house being just across the alley from the back door of the office. This was done to facilitate the management, something which in a small plant like this is desirable. From that point of view, the change has been a good one, but in the matter of greater sales of appliances and the number of people coming into and passing by the office it has not been an advantage. On the contrary, fewer people pass by and come into the office than did formerly, although we now have better office facilities and showrooms."

In short, it pays to be among those present. It pays to have a place of prominence among the other merchants if you intend to carry on a merchandising business and sell appliances at retail. Many companies that operate in a large number of communities have had an opportunity to experiment, and their opinions all agree. C. E. Greenwood, superintendent of appliance department for the Edison Electric Illuminating Company of Boston, says:

"We try to be very careful in the selection of locations for our suburban stores, appreciating the value of the 'business side' of the street even in small towns. First, we consider the geographic location from the standpoint of service to a district, and then we consider the importance of merchandising locations in that center. As a rule, we have been very successful, and in the one or two towns where experience has proved that the location was not right we have made or are now making plans to change to a location where our display windows can give their full value in attracting the public to the store."

Such is the experience of central station men in all parts of the country who have been able to make a direct comparison between a good and a poor location. Good location costs more money, but it is worth it, for it pays more profits in sales and in the value of a closer contact with the people on the street. An office on a back street means opportunity wasted. For location is as profitable to the central station as it is to any other kind of business.

British Grant for Research

In the British civil service budget for 1918 a grant in aid of scientific and industrial research to the amount of \$5,000,000 is provided. The sum is to be distributed among approved industrial organizations and is to supplement the research funds of these associations.

THE PARALLEL OPERATION OF DISTRIBUTION TRANSFORMERS

The Development of a Low-Priced Reliable Protective Device for Low-Voltage Side of Network Eliminates Troubles

Many electric service companies which have tried to operate distribution transformers in parallel without success have learned that the lack of a suitable protective device for the low-tension side of the network was the principal source of trouble. To meet this situation

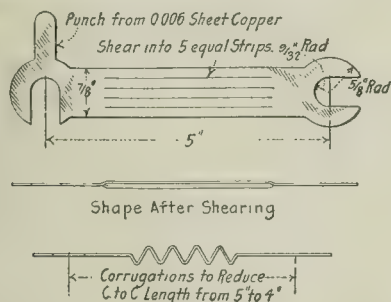


FIG. 1—FUSE MADE OF SHEET COPPER AND DESIGNED FOR OUTDOOR SERVICE

S. B. Hood, superintendent of distribution for the Northern States Power Company, Minneapolis, Minn., has had the special devices shown herewith made.

The fuse consists of a sheet of copper, the link of which is sheared lengthwise into five parallel strips (Fig. 1). Each strip has a carrying capacity of 75 amp., the total rating of the entire fuse being 375 amp. When the fuse is installed all strips except those required to carry the current in the particular case are broken out by the linemen. When the full fuse is not sufficient additional fuse links are placed one on top of the other. The construction crews are guided in the installation of these fuses by the accompanying table.

With parallel operation two types of fuse are required, one for connecting two sections of the secondary network and the other for protecting the secondary side of all transformers operated in multiple banks. To permit installing the first type Mr. Hood employs a section fuse jumper like the one shown in Fig. 2. The break in the secondary main is made by inserting a standard porce-

FUSES TO USE FOR TRANSFORMER SECONDARIES

Size of Transformer (Kw.)	Two-Wire, 110-Volt	Three-Wire, 110/220-Volt
3 and 5	1 strip	1 strip
7½ and 10	2 strips	2 strips
15	4 strips	3 strips
20	5 strips (1 fuse)	4 strips
25	1 full fuse plus 2 strips	1 full fuse (5 strips)
30	1 full fuse plus 3 strips	1 full fuse plus 1 strip
40	1 full fuse plus 4 strips	1 full fuse plus 2 strips
50	2 full fuses	1 full fuse plus 3 strips

lain strain insulator. The jumper arms are made of 0.75-in. (1.9-cm.) cast brass, and are attached to the line by means of clamps fastened with two 3/8-in. by 1-in. (9.5-mm. by 2.54-cm.) sherardized cap screws. The fuse is held in place between the jumper arms by cast-brass wing screws which permit quick renewal.

For protecting the transformer secondaries the fuses are mounted on holders designed for pole mounting. The

holder consists of a base of 1-in. (2.54-cm.) ebony asbestos lumber to which is bolted a galvanized-iron strap for fastening to the pole. A center clamp is used for rigidly supporting the neutral lead, which, of course, is not fused at any point but is solidly grounded to the water system at numerous points throughout the various networks. The fuse terminals for the outer wires on the secondary block consist of standard sherardized steel cap screws with recessed nuts in which the terminal wires are laid, the wires being bent into eyes to fit the recessed nut. The wires are held in position by hexagon nuts. Finally the fuse is clamped to this hexagon nut by a brass wing nut.

Experience has shown that after these fuses are in-

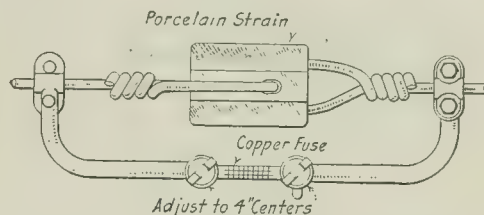


FIG. 2—JUMPER ARM AND METHOD OF INSTALLING SECTION FUSE

stalled it is possible to obtain as reliable operation and close regulation as with any direct-current network. The Northern States Power Company uses a standard size of 4000-2300/220-110-volt transformer for each section of the network, varying the spacing of the transformers to suit the load conditions. Operation of a network of the older type with a large number of transformers of various sizes in it is believed to be a treacherous undertaking. The company also operates the primary main in interconnected rings, never allowing more than a single transformer unit to be connected to any branch outside the ring system. This practice is essential in order to avoid a general blow-out following the breaking of a primary. If the ring system is properly worked out, the secondary leads by-pass the load around the break.

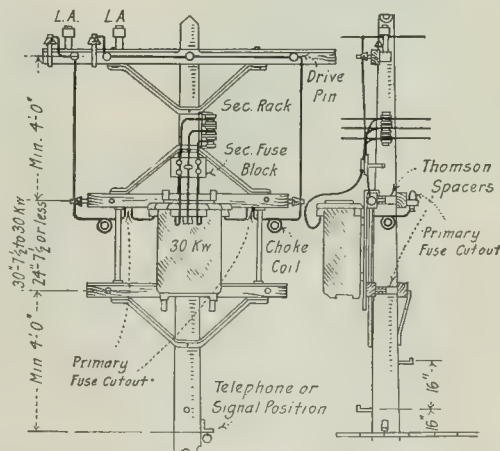


FIG. 3—METHOD OF INSTALLING FUSE BLOCKS ON TRANSFORMER POLES

Fuse cost is not the ruling factor in a problem of this sort, where reliability of operation and the maintenance of good regulation are to be balanced against cost. Nevertheless, it may be interesting that the cost of these fuses is 7 cents each and the cost of the holders is \$2.25 each.

Success Follows Educational Sales Methods

Observations on the Electric Range Business as Seen by a Company
Which for a Long Time Proceeded Cautiously and Is
Now Driving Range Sales at Full Speed

NINETY per cent of electric range sales at St. Louis, excluding apartment-house sales, are over-the-counter business. People walk into the Union Electric Light & Power Company's store and say, "I want to look at an electric range." After that the transaction is a straight merchandising proposition. Not many ranges are sold to customers on their first call, because it is generally necessary for the member of the family who makes this call to consult with the wife or the husband, as the case may be, before the deal is closed. Strangely enough, a large percentage of those who call to "look at" a range are men. But regardless of details it is a fact that the individual range sale business at St. Louis is becoming a merchandising business. This fact is the more striking when it is known that there are at present only approximately 2 per cent of the residential electricity customers in the city cooking electrically. Several factors, it is believed, have co-operated to bring about this condition. They are, it is thought, in the order of their importance, the apartment-house business, the electric cooking school, and the "cook-by-wire" advertising.

Apartment-house business has contributed to the electric cooking education of the St. Louis public in a large measure, because the first installations have been much talked about. Apartment-house dwellers as a class are lovers of leisure; they entertain and take more part

in the social life of the city than the home dwellers as a general rule. For this reason they are an ideal class through which to spread the electric cooking idea by word of mouth; and it is quite generally believed that word-of-mouth advertising is most effective.

The effect of the electric cooking school has been practically of the same nature. A comfortable majority of the electric cooking school class which was just graduated and a like proportion of another which is just starting are from the great middle class of the city's inhabitants, the wives of home owners and of other well-paid employees. The electric cooking school is something new. It is, therefore, a live topic of conversation among these students in their respective circles of acquaintance.

Advertising in newspapers and on billboards has helped to associate the name of the Union Electric Light & Power Company with the interest created by word-of-mouth advertising. Moreover, printed advertising has been effective in definitely convincing the public that electric cooking is not a luxury but is a really economical method. Copy giving averages of actual monthly bills for families of different sizes has helped bring this about.

Briefly, the foregoing states the favorable electric range situation at St. Louis and gives what are thought to be the fundamental causes contributing to the estab-



TWO VIEWS OF APARTMENT BUILDING WHERE 144 SUITES HAVE ELECTRIC RANGES, AND HOW THE ELECTRIC COMPANY HELPS THE BUILDER TO GET TENANTS

lishment of this situation. A short history of the company's campaign utilizing these principles is also of interest.

The Union company started selling ranges during "Electrical Prosperity Week" in 1915. Before that it had done some experimental work and had placed a few ranges. During that week in 1915 it sold thirty-six

removed and all money refunded except the charge for energy actually used. An initial payment of one-tenth of the range price was asked and the balance could be paid in twelve payments. The payment of one-tenth down restrained people who had no intention of buying from imposing on the company. Salesmen's commissions were paid only after the forty-five-day period had elapsed.

The two big features of the business in 1917 have been the electric cooking school and the apartment-house sales. The school was inaugurated primarily to educate the company's salespeople and demonstrators and a large number of St. Louis housewives. As the result of two 6-in. by 10-in. (15.24-cm. by 25.4-cm.) newspaper advertisements announcing the school, a significant feature of which was the offer of \$7.50 to each person who satisfactorily completed the course, 1089 applications for the electric cooking course were secured. The advertising campaign was discontinued immediately, but in response to a very small advertisement calling a meeting of the applicants more than 1500 women besieged the appointed place. It was, of course, impossible to handle such numbers, but ten classes of forty-eight women each were formed to run for ten weeks, as indicated in the proposition reproduced herewith. Each class comes two hours a day once a week. There are two classes each weekday except on Mondays and Saturdays.

The terms of the school, as contained in the advertisements, were as follows:

1. Course of ten lectures conducted by Margaret M. Williams Winn.
2. We pay \$7.50 cash to those who attend all ten lectures.
3. A diploma signed by Mrs. Winn will be awarded those who attain the required degree of efficiency.
4. If these graduates are ever without a position we will suggest their names to persons who want to employ a competent cook or domestic and call upon us to assist them, as

A Free Cooking School For St. Louis Domestic

**Madam, Send Your Cook—We'll
Pay Her \$7.50 for Her Time**

The Electric Company has now arranged to teach "Better Cooking."

Lessons will be given in the form of lectures, with demonstrations. Equipment has been provided so that those attending the classes actually can cook the various dishes under an expert's direct supervision.

To each St. Louis cook, domestic or maid who takes the complete course of 10 lectures we will pay \$7.50 for her time in attending the school.

That means \$7.50 for a few odd hours on different days.

If you are a mistress, it is to your advantage to urge your domestic to attend. You are privileged to come yourself if you like.

If you are in some family's employ, don't miss this opportunity to develop your talents for cooking. Hundreds will enroll and earn this money. Resolve right now to be among the first.

Why We Make This Unusual Offer

Cooking electrically is today accepted in 3000 cities as the superior method of preparing food. We want all those employed in St. Louis kitchens to know more about it.

We want them to learn how easy, how simple it is to use an electric range. We want you to see how it saves you work and how much more delicious it makes the meals.

Hundreds of electric ranges are in daily use in St. Louis. More are being installed each week. To be valuable nowadays, a cook must be up-to-date.

This Expert Will Teach You —Enroll NOW!

Mrs. Margaret M. Williams Winn, the domestic science authority until recently in charge of the St. Louis School of Housekeeping, with her corps of trained assistants, will conduct our "Cooking School." She will cook many foods in many ways. And she will use only an electric range.

The school starts March 14th—but don't wait for that. Thousands will want to take this course and earn \$7.50. You must let us know before the classes are all filled.

Come, write or telephone NOW and give us your name.

Electricity is Cheap in St. Louis

The Electric Company

UNION ELECTRIC, Main Office—15th and Locust

The Terms Are These:

1. Course of 10 lectures conducted by Margaret M. Williams Winn.
2. We pay \$7.50 cash to those attending ten lectures.
3. A diploma signed by Mrs. Winn will be given at the completion of the course to those who acquire the required degree of efficiency.
4. The names of those who prove to be the best cooks and are given diplomas will be kept on file. This enables us to supply the names of our graduates when, as often happens, we are called upon by those seeking a competent domestic. The company, however, will not act as an employment bureau.
5. The school will be held on the tenth floor of the Union Electric Building, Twelfth and Locust streets.
6. Classes are limited to 25 persons. When all the classes are filled no more can enter.
7. White caps and aprons will be furnished free of charge to all who attend.

AFTER TWO INSERTIONS OF ADVERTISEMENT 1089 APPLICATIONS FOR ENROLLMENT WERE SECURED

ranges. Those thirty-six ranges were carefully watched, and more were sold from time to time, until, on Jan. 1, 1917, the company had about 400 ranges installed on its lines. One of the strongest factors in the sale of the 400 ranges was the company's 120-ft. by 20-ft. (36.58-m. by 6.1-m.) cooking exhibit at the Household Show, at which three range manufacturers assisted in conducting an educational demonstration employing a total of about ten cooks, ten salesmen and a large force of servants. Fifty-two ranges were sold during that week and several hundred prospective customers were discovered. Its experience with these 400 ranges convinced the company that it should go after range load with all possible force.

As a part of the educational plan an electric range sales department was organized. It consists of three salesmen, one saleswoman and demonstrator, and three women who are primarily demonstrators. Working in co-operation with this sales organization is the cooking school force. The terms of the company's range proposition to the public were that the company would sell a range at list price installed and at the end of forty-five days, if it did not perform as promised, it would be

UNION ELECTRIC LIGHT & POWER CO. ST. LOUIS

Training School of Domestic Science

THIS IS TO CERTIFY THAT

Has completed, with credit, the full course of Instruction and Practice, as taught in our Electric Range Department School; is familiar with Modern Electric Cookery and the operation of Electric Ranges.

*In Testimony Whereof, the undersigned have affixed their signatures
this _____ day of _____ 1917.*

EVERY GRADUATE GETS A DIPLOMA

often happens. But the Electric Company does not conduct an employment bureau.

5. The school will be held on the tenth floor of the Union Electric Building, Twelfth and Locust Streets.

6. Classes are limited to twenty-five persons. When all the classes are filled no more can enter.

7. White caps and aprons will be furnished free.

The members of the first group of classes have just

been graduated and have received diplomas. Of the original 480 members, 417 finished the course and 407 were graduated. At the final sessions several questions were put to the classes to determine the effect of the educational effort. Only two of the 480, it developed, knew anything about electric cooking before the school was announced. There was only praise—absolutely no criticism—of the method of conducting the school in spite of the fact that discipline had been purposely made very strict. A question as to how many could conscientiously recommend the electric range brought a ringing cheer. Sixty prospective customers were turned in by the students, and among the sixty it was found that forty ladies had turned in their own names. The full effect of the school is well shown in the letter reproduced below. The second group of classes is now going through the school. When those composing it have completed the course there may be a change in the general plan of operating the school.

The company's success at securing apartment-house business is attributed to its plan of going after it. C. E. Michel, manager office sales department, by talking to real estate people, learned that apartments, to rent easily nowadays, must have "all the frills." He himself took the electric cooking idea to the largest and most progressive speculative builder in the city and sold it as a "new apartment-house frill." The result speaks for itself.

The company to date has sold 1080 ranges. Of these 252 are installed in apartment houses; 442 are sold but not yet installed. In addition to this the company has practically closed orders for 520 more ranges. Practically all of these will go into apartment houses.

Broadly speaking, the company is convinced that the electric range is the most important merchandising and service development in which it is engaged. It appears to be comparable with the beginning of incidental power service for day load inaugurated by the early electric light companies.

This is what a student wrote to the company after completing the course:

St. Louis, Mo., June 19, 1917.

Union Electric Light & Power Company,
Twelfth and Locust Streets, St. Louis, Mo.
Attention Mr. C. E. Michel.

GENTLEMEN—Since the free cooking class of which I had the privilege of being a member has been completed, I have been wishing to express my appreciation in a more tangible way than just thinking about it.

The experience was a very wonderful one for me. In fact, I have been using an old gas stove for all my cooking, and to become acquainted with the modern electric appliances was a revelation indeed. As soon as there is the least possibility I will surely exchange the old for the newer way, and will lose no opportunity of telling all my friends of the advantages of the electric. Even though at first, until I became acquainted with the stoves, I was very much afraid of them—primarily, I suppose, because I couldn't see a flame.

The lessons were not only interesting but were very practical—I have been using the recipes daily—and the teachers made it a delight to attend.

The last, and perhaps the greatest surprise of all, was the check so kindly handed to us. The privilege which the Union Electric Light & Power Company has granted so many women of St. Louis will have a wide influence if it touches each one as deeply as it did me. It took me out of my kitchen into a bigger world, and I want you to know that I have very much appreciated the uplift.

Very respectfully,

THE AGING OF RUBBER INSULATING COMPOUNDS

Data on About 250 Laboratory Tests Which Are Quite Representative of Results Secured Throughout Investigation.

As pointed out in the Aug. 18 issue of the *ELECTRICAL WORLD*, the Underwriters' Laboratories has been conducting a series of tests bearing on the life of the rubber insulating compounds employed on wires and cables. A complete record of the results of the tests is beyond the scope of this article, but a tabulation of the test results obtained during the six months' period ended July 1, 1917, has been completed and a partial summary of the tests is given in the accompanying table. This table includes the data of about 250 tests, and is quite representative of the character of the results obtained throughout the investigation. Data on tests for permanent set are not given, as the work has shown that this property is not materially affected by three years' aging.

The "percentage loss" figures are possibly not absolutely correct. Owing to changes and improvements in

AGING OF RUBBER INSULATION

AVERAGE TENSILE STRENGTH, LBS. PER SQ. IN.		Per Cent Loss in Tensile Strength in Three Years	AVERAGE ELONGATION, INCHES		Per Cent Loss in Elongation in Three Years
New	Three Years Old		New	Three Years Old	
673	647	3.8	7.7	6.8	12.1
673	580	13.8	7.1	5.7	20.0
655	647	1.2	6.5	4.7	28.0
650	532	18.1	6.9	6.0	13.7
649	624	3.9	6.8	5.6	18.1
602	505	16.2	6.9	5.9	14.9
552	503	8.7	6.6	5.5	16.8
533	517	3.0	7.2	5.8	19.6
531	538	*1.3	7.2	5.9	18.3
521	501	3.7	6.2	5.6	10.2
498	486	2.6	6.6	5.1	22.3
497	415	16.5	6.8	5.4	21.2

*Indicates gain in tensile strength.

An average of about 450 tests conducted during the last six months shows losses of 10 per cent for tensile strength and 18.2 per cent for elongation.

test methods and apparatus made in three years, the results may not be exactly comparable, but it is considered that they are quite representative of the performance of samples after three years' aging. In connection with the work, samples showing excessive deterioration have been traced in regard to their original performance in the chemical tests, in case such tests have been made. In a large percentage of these cases the sum of the percentages of acetone, chloroform and alcoholic potash extracts, total sulphur and ash have been found to exceed the specified total of 80 per cent. It may also be mentioned that the converse has in general been found to hold good, as most samples showing super-standard qualities in the chemical tests performed favorably in this work. Many of the samples are to be tested after another year of aging.

Make-and-Break Contact

To overcome the expense of platinum contact members in spark coils Horace V. Taylor of Pittsburgh, Pa., suggests replacing at least one of the contact members with tungsten. The combinations silver tungsten and platinum silver are made the subject of patents No. 1,232,624 and No. 1,232,625.

Apparent Sunlight for Underground Passage

Daylight Lamps with Reflectors Throw Light Through Windows
of Translucent Glass of High Transmission Efficiency—
How a Solution for New Problems Was Found

AN unusual underground passageway has been constructed through a hill on which the laboratory and office buildings of the National Lamp Works are situated at Cleveland. The purpose of the passage is to provide a safe and comfortable approach to the top of the hill in addition to an outdoor stairs, the latter having proved unsatisfactory during the bad weather which sometimes prevails on the shore of Lake Erie at that point. As soon as it was decided to build the passage it was learned that while the desirable characteristics for such a structure are well known there is no established method of accomplishing the desired ends.

For instance, it was considered very necessary that the passageway be dry and be well lighted. On account

impression that a visitor frequently receives in passing through such a long tunnel.

As the first step in determining what sort of lighting would best accomplish these effects, a quarter-scale cardboard model was built and several schemes of lighting it were tried. It was decided as the result of this rough investigation that lighting which would simulate daylight in color and distribution would be the most desirable. Such a lighting scheme, it was believed, would lessen the sense of being underground. While it was not the intention to convey the impression of an up-ground passageway, the simulation of daylight is so complete that many visitors are deceived.

All of the lighting-circuit leads are run in conduit laid in the air ducts between the walls. At each of the thirty-two windows a branch is taken off one of the three-wire No. 8 lines to serve a 100-watt, 110-volt blue-glass daylight lamp installed in a show-window lighting reflector. The type of three-wire circuit which is used was selected so that the line drop could be taken care of by installing lower-voltage lamps of a single rating for the entire length. The glass used in the window panes is a translucent glass known as "cynite," that is high in transmission efficiency but is sufficiently scattering in its refraction not to reveal any of the details of the wall behind it.

From Fig. 1 it will be noticed that uniform illumination is not provided. This was in order that the alternating lights and shadows might break up the long passageway and make it seem shorter. In placing the windows locations were selected which would allow adequate lighting of the 4 per cent ramps and five runs of stairs, which are laid out with eight steps to the run. The plan of placing the windows opposite one another was considered better than staggering them, since the latter arrangement would have given the subway a zigzag effect.

Of equal importance with the consideration of effect of the lighting came that of its reliability, for darkness in such a long, narrow passage at rush hours would create an extremely dangerous condition. Solution of the reliability problem was reached by installing an emergency lighting circuit carrying six 15-watt tungsten lamps, which operate continuously on the central station lighting circuit as long as energy remains on the lines. Should this power source fail, a relay which is retained in position only by the central station energy would, actuated by gravity, fall and connect the emergency circuit to a storage battery ordinarily used in the laboratory for testing work.

The main lighting circuits are arranged for either manual or automatic control as desired. There are door switches at both entrances to the subway arranged so that pushing the door inward turns on the thirty-two daylight lamps whenever the control mechanism is set for automatic operation. The same action sets a time switch in action so that it will turn the lights out in four minutes. A person can walk through the subway



FIG. 1—THOUGH UNDERGROUND, THE LIGHT IN THIS PASSAGEWAY APPARENTLY IS SUNLIGHT

of the fact that the subway, as it is called, is 312.92 ft. (97.9 m.) long, and on account of the further fact that it rises 34.22 ft. (11 m.) in that distance, the problem assumed more than ordinary proportions.

Keeping the walls free from condensate so that the subway would always be dry proved comparatively simple; but not so the lighting. The primary object to be attained by the lighting was twofold. It should remove that dingy atmosphere which is present in almost all underground passages, and it should enhance the appearance of the interior, eliminating the "rat-hole"

in from one and one-half to two minutes. Should another person enter the passage before the end of any four-minute period for which the lamps are lighted the

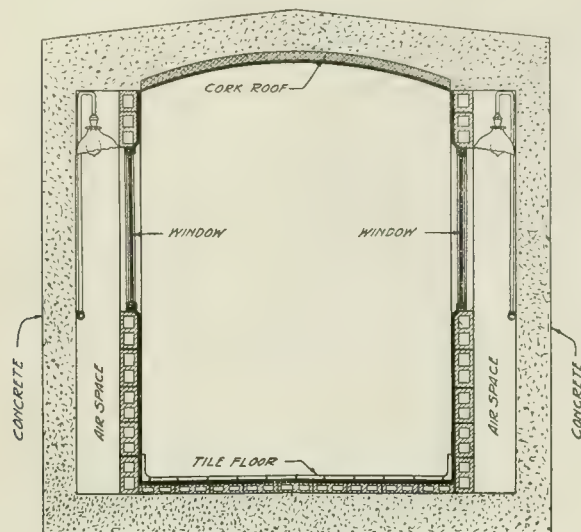


FIG. 2—CROSS-SECTION THROUGH SUBWAY SHOWING POSITION OF CONDUIT LINES AND LAMPS

time switch would be automatically set back to its starting point.

These automatic operations are all performed on a panelboard, the essential elements of which are a standard remote-control switch, a clock mechanism connected to the subway door switches, a relay for the emergency lighting, a small three-pole knife switch for cutting out automatic operation and substituting manual control, a pilot lamp in the emergency circuit, and a push-button in the door circuit which can be used in testing at the board. The arrangement of these parts in the circuit is given in Fig. 3.

The automatic system will properly take care of the lighting for all ordinary traffic in the subway. It has been found, however, that, at least during the win-

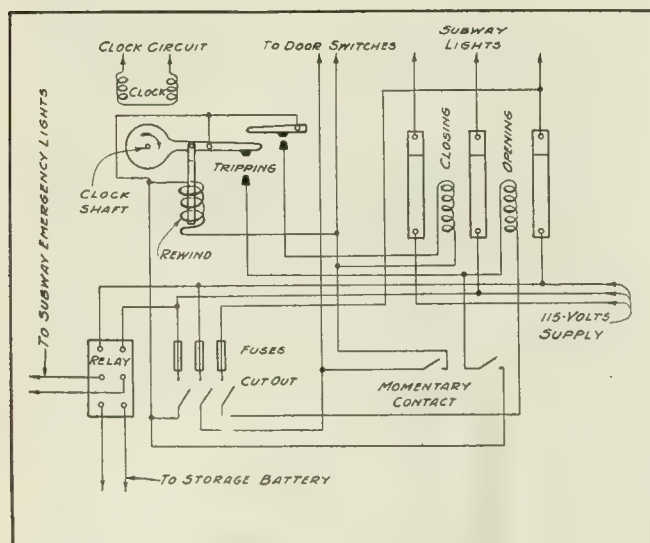


FIG. 3—DIAGRAM OF CONNECTIONS FOR APPARATUS ON THE AUTOMATIC CONTROL PANELBOARD

ter months, the automatic system keeps the lights on continuously through the greater part of the day on account of the frequency with which the subway is used. Therefore it has been considered advisable to

disconnect the automatic mechanism during the busy hours of the day. This can be done by a watchman on his regular rounds and it saves the wear on the mechanism. The automatic system is most useful in taking care of the lighting after the busy hours are over and during the hours and days of infrequent traffic.

The entire work of the design was done by Evan J. Edwards of the laboratory's engineering staff. His original solution of the engineering problems recounted here is of special interest because so far as it is known the problems are entirely without precedent.

ACCURATE METHOD OF MEASURING MOTOR SLIP

Contactor on Motor Shaft Connected with Relays So that Slip Is Automatically Recorded with Exactitude

BY MILTON M. FLANDERS

If the speed of a motor is taken with an ordinary speed counter, an error of one-half of 1 per cent is not unusual. With a machine operating at 900 r.p.m. and having a slip of 45 r.p.m. this would mean an error of 4.5 r.p.m. Expressed in terms of slip, this error would become 10 per cent, and usually the error would be greater. Tachometers, especially the hand type, if constructed for any great range, are difficult to read and

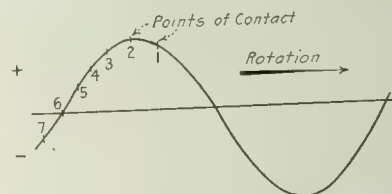


FIG. 1—MOVEMENT OF POINTS OF CONTACT ON WAVE WITH MOTOR RUNNING AT LESS THAN SYNCHRONOUS SPEED

usually unreliable for work approaching precision. Therefore it may be seen that some special method is required for obtaining slip accurately.

A device which does not have the foregoing objection has been developed by the writer. From several years' experience with this device in varied forms it has been found to yield very accurate results. The principle on which the apparatus operates is as follows: If the shaft of the motor under test is arranged to rotate a contactor at the same speed as itself, completing a circuit once during each revolution, and this circuit be connected to a source of the same frequency as the motor supply, it is evident that at synchronous speed any device in the contactor circuit would be energized once for each revolution. It is also evident that the circuit would be subjected to an unidirectional pulsating voltage, the direction and magnitude of which would depend on the point of the alternating-current wave at which the contact was made. If the motor runs at less than synchronous speed, the point of contact, instead of being at the same point of the wave for each revolution, would be a little farther back for each succeeding contact, as shown in Fig. 1. As the motor continues to slip, the voltage applied to the contactor circuit will rise to a maximum in one direction, fall gradually to zero, rise again to a maximum in the reverse direction, and again fall to zero for each cycle slip of the contactor, and consequently of the rotor.

If a single stroke bell is connected in the contactor circuit, every alternation slip will produce a stroke, the hammer returning to the off position at each zero point. If this bell is a polarized bell, one stroke will be eliminated and the bell will strike once for each cycle slip, since each alternate impulse is reversed in polarity. For high slip any attempt to count the strokes of the

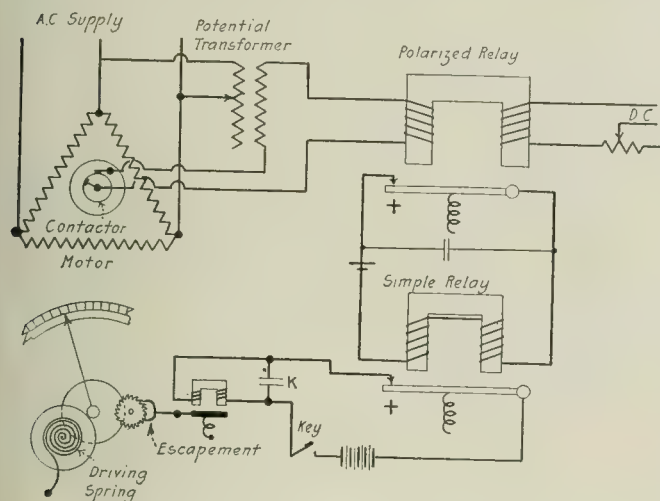


FIG. 2—DIAGRAM OF DEVICE FOR MEASURING SLIP

bell is useless, and the device in this form is very far from satisfactory.

The completed instrument, as shown in Fig. 2, consists of a small potential transformer with adjustable taps, giving a constant secondary voltage for several standard motor voltages. The contactor may be of the speed-counter type, shown in Fig. 3, or may be mounted on the motor. In the latter case, rubber tips do not give satisfaction, and a better way is to drill a $\frac{1}{8}$ -in. (3.18 mm.) hole in the shaft center and insert the end of the contactor spindle, which has been tapered to fit tightly enough to prevent slipping. This contactor has its brushes connected in series with the secondary winding of the potential transformer and a relay consisting of two windings on a common core, one of which is excited by the contactor circuit, the other from a direct-current source. When the current in the contactor circuit is in one direction, the flux from each winding neutralizes the other and no attraction of the armature occurs. When the polarity in the contactor circuit is reversed the two fluxes aid one another and a very positive attraction occurs. This relay is provided with an ordinary armature and secondary contacts.

In the secondary circuit of this relay is a simple

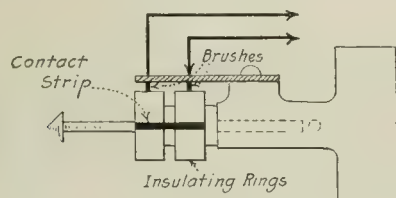


FIG. 3—SPEED-COUNTER TYPE OF CONTACTOR

relay operated by one or two dry cells. Its function is to relieve the delicate polar relay just described of the heavy duty required to operate the recorder. This relay is not necessary but makes closer adjustment and higher speed possible. These relays are mounted in a case with the potential transformer at any convenient

place. Leading from this case are two pairs of wires, one pair leading to the contactor and the other to the recorder from the secondary circuit of the simple relay. This circuit is energized by several dry cells as may be required.

The recorder consists of a clock train driven by a coiled spring and controlled by an escapement. The ratio of the gearing is such that the indicator hand makes one complete revolution for 100 strokes of the escapement lever. The indicator dial has 100 equal divisions. The escapement lever is held to one side by a strong hairspring and has an armature attached which, when attracted by electromagnets, will allow the escapement wheel to move one tooth. The electromagnets are connected in the secondary circuit of the simple relay, which circuit may also be closed by a key.

With these arrangements every cycle slip will cause the polar relay to operate once, which in turn energizes the simple relay and moves the indicator one division. In actual use the stop of a stop watch and the key are closed simultaneously and the slip taken for one minute. With reasonable care an accuracy of one-half of 1 per cent may be obtained. The synchronous speed of the machine is determined from the reading of a standard frequency indicator.

If the slip is desired in r.p.m. a convenient method is to divide the cycles/slip by the pairs of poles of the induction machine. It is evident that the slip may be recorded equally well for either over or under synchronous speeds within large limits. The apparatus described has been used to measure slips up to 550 cycles per minute without trouble. To permit high-speed operation all arcing points on the relays must be bridged by condensers to permit close adjustment without arcing across the gap.

VENTILATED BASE FOR USE WITH NITROGEN LAMPS

Base Is Separated from Neck of Bulb by a Space
Which Is Used for Purpose of Ventilating
the Lamp Base

The temperature to which the base of nitrogen lamps is heated is in some cases sufficiently high to take the temper from the spring contacts and other parts of the base and its connecting socket. In consequence John H. Dale of New York City has brought out in patent No. 1,231,335 a means for separating the base from the neck of the bulb by a space or chamber, the base being supported upon the lamp bulb in such a manner that the heat of the bulb cannot be transmitted directly by conduction to any material extent to the lamp base. This space is then used to ventilate the lamp base. The lamp base proper is supported upon the lamp by means of a skirt which is similar to the one used in the existing forms of nitrogen lamps and which is secured to the upper end of the neck by an annular ring of cement. The lamp base proper also comprises a skirt, which has secured to it by means of the glass insulation the usual screw plug.

Ventilating openings are provided in the skirt near its connection to the screw plug, the openings in the ring and skirt being spaced but a slight distance apart so that a circular row of holes is provided in each instance.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

OVERCOMING TROUBLE WITH REVERSE-CURRENT RELAYS

Burning of Fiber Pieces Holding Tripping Contacts Remedied by Using Low-Voltage Release Trip Coils Operated by Gravity

BY J. R. BALDWIN

Reverse-current relays on the circuit breakers of rotary converters in a Southern station were giving trouble owing to the burning of the fiber pieces holding the tripping contacts. The circuit breakers were tripped by shunt trip coils, an auxiliary contact being placed on the breaker to open the circuit. A slight kick in the voltage would cause the contacts on the relay to close, but they would open before the shunt-trip coil worked. This would draw an arc due to the inductive effect of the coil and it would hang on until the fiber burned up.

The trouble was remedied by using low-voltage release trip coils operated by gravity. The circuit is not opened on this type of relay, but a coil of low resistance is short-circuited by the relay contacts, the coil being in series with a high resistance.

MAST ARM FOR SERIES STREET-LIGHTING UNITS

Replaces Center-Span Suspension as Used for Carbon Arc Lamps—Pole Not Required on Opposite Side of Street

Where Mazda C series units of 400 cp. or 600 cp. have replaced inclosed carbon arcs for street lighting,

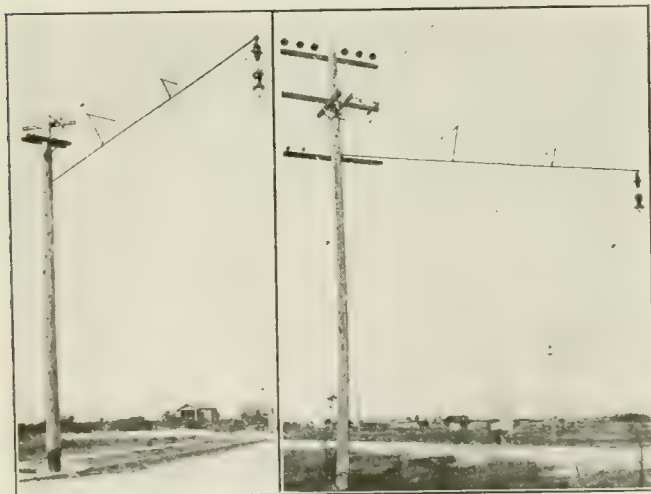


FIG. 1—TWO INSTALLATIONS USING MAST ARM

it is no longer necessary that the lamp be suspended in the exact center of the street intersection, particularly in residence districts. Center-span suspension, while having many undeniable advantages, is nevertheless objectionable, owing to the poles and guys required

on the corner opposite to the line pole, as in soft ground it is necessary not only to have the span pole but to hold it with one anchor guy and one stub guy.

On streets having sidewalks 12 ft. (3.7 m.) or more wide with full radius curves at the corners a rather long mast arm is required to throw the lamp out beyond trees or other obstructions on both streets. To solve this problem the San Diego Consolidated Gas &

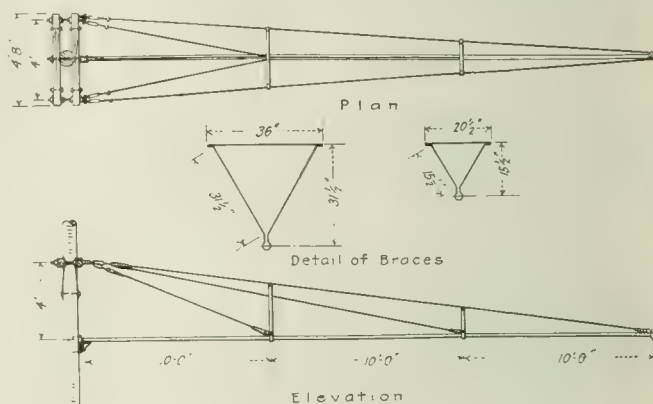


FIG. 2—DETAILS OF MAST-ARM CONSTRUCTION

Electric Company has adopted as a standard for city service a mast arm 30 ft. (9.1 m.) in length. As will be seen from the accompanying illustration, the mast arm is of simple construction and of such materials that, except the pulley castings at the two ends, it may be fabricated entirely in the company shops. The use of turnbuckles on all guys permits perfect leveling in the field.

A 600-cp. series compensator lamp unit, including absolute cut-out, weighs 60.5 lb. (27.4 kg.). The mast arm is capable of sustaining 110 lb. (49.9 kg.) before bowing at any point and much more before failure.

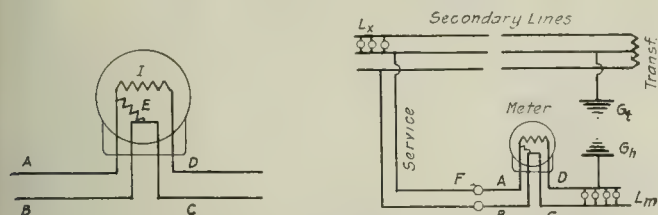
In installing the mast arm the brace arm is usually attached to the pole directly under the primary line arm and the pole plate under the secondary line arm. A duplex feed is used, specified as No. 8 (19 No. 20) duplex 3/64-in. (1.19-mm.) new N. E. C. rubber insulation with braided weatherproof single braid over all.

METER CONNECTIONS FOR DISTRIBUTION CIRCUITS

Right and Wrong Way of Connecting Two-Wire Meters to Three-Wire Grounded Neutral Circuits Outlined

Assuming the usual three-wire 110-220-volt secondary distribution system with grounded neutral, it is not generally recognized that there is a right way and a wrong way, almost as common, of connecting up the ordinary two-wire 110-volt consumers' meter to such a system. Referring to Fig. 1, wire A, which leads to and through the current coil of the meter, should never be connected

to the neutral or grounded wire of the transformer secondaries if the workman desires to give the best kind of service to his company. If such a connection should be made as is shown in Fig. 2, and the fuse F should become loosened or blown, it is apparent that an accidental or intentional ground on wire D of the house wiring would supply the load without the regis-



FIGS. 1 AND 2—INTERNAL CONNECTIONS OF SINGLE-PHASE METER; CONDITIONS THAT CAUSE WRONG REGISTRATION

tration of the meter. Such a condition can always be prevented by connecting wire A of the line side of the meter to the phase side or ungrounded side of the service wires.

A further study of Fig. 2 shows that, although the fuse F may be intact, the two grounds, G_t and G_h act as a shunt across the current coil of the meter, and as such supply a part of the load unmeasured by the meter, depending for its magnitude on the resistance relations of the grounds and of the neutral secondary wire. This undesirable condition might go on for years.

Again, if conditions are right, although there might be no load on the meter shown, energy from the transformer ground, back through the house ground and the meter, might help to feed some other load entirely separate from the meter load L_m , as load L_x , thereby running the meter backward, a condition which is particularly common in buildings having a three-wire service but two-wire meters for separate offices. The latter condition, the writer knows, is a constant source of mystery to more than one meterman who ought to understand it. The conditions described suggest other interesting variations, but the important point is this: If this matter, simple as it is, has anything to do with net revenue, it deserves more widely distributed attention among central station metermen.

REBUILDING A FEEDER BOARD WITHOUT STOPPING SERVICE

Temporary Service Panel Was Connected to Circuits While Corresponding Feeder Panels Were Being Reconstructed

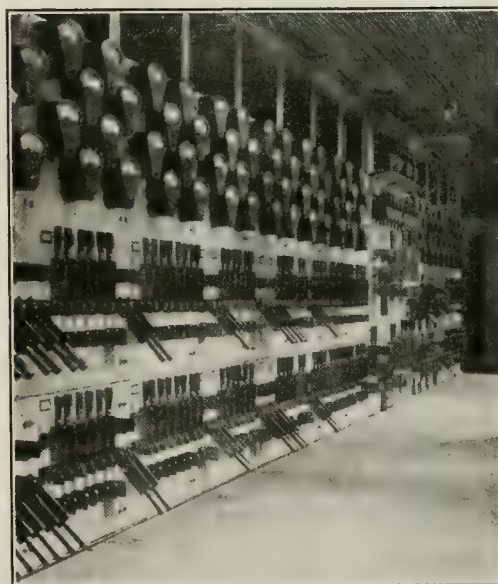
Reconstruction of an Edison three-wire feeder board to provide for double the number of circuits formerly handled was recently made necessary in Station C of the Pacific Gas & Electric Company. Since the circuits controlled could not be de-energized for the entire period required for reconstruction, the work was done without interrupting service at all, this being accomplished by the use of a temporary panel.

The original board consisted of twenty-one 3-ft. by 7½-ft. (91.4-cm. by 228-cm.) marble panels, each one consisting of two sections—28 in. (73 cm.) and 62 in. (157 cm.) high respectively. All of the switches (two double-throw single-pole knife switches to each positive and negative circuit) and the ammeters (one for the positive and one for the negative circuit) were installed

on the upper or larger panel, the lower one being left blank and serving only to give a finished appearance to the board. The positive meters were arranged along the top of the board and the negative meters just below. As two sets of negative and positive busbars arranged in one horizontal plane were used, and all of the switches were in one horizontal row, considerable copper had to be used for jumpers between the busbars and switch lugs.

To provide for the new circuit it was decided to install the new switches on the lower blank panel and regroup the meters on the upper panels to allow for those required for the new circuits. The latter operation was accomplished without disfiguring the panels by inverting the upper panel, plugging the old holes with plaster of paris and drilling new holes as required. The ammeters covered most of the plugged holes. To avoid the use of excessive amounts of copper, all of the switches on the upper panel were used as positive switches and those on the lower panel as negative switches. This required a rearrangement of the busbars. Instead of using four busbars in one horizontal plane as before, one busbar was supported back of each row of switch lugs, thus requiring only short jumpers and making the back of the board more accessible. This arrangement utilized the entire space of the panels giving four feeders to a 3-ft. (91.4-cm.) panel, which before accommodated only two circuits. Furthermore, a more orderly arrangement of switches was secured.

To accomplish reconstruction without cutting out a single feeder, a temporary two-feeder panel was installed and the two feeders from the first panel of the board were connected with it by jumpers. This arrangement cleared one complete panel so that it could be taken down, redrilled and put back in place according to the



ARRANGEMENT OF APPARATUS ON FEEDER BOARD AFTER CAPACITY WAS DOUBLED

rearranged plan. Since the capacity of each panel was doubled by the arrangement, the temporary panel was required only while the first unit was being rebuilt. Thereafter the additional capacity gained by the revised connections took care of each additional unit as it in turn was reconstructed.

The necessity of making the change without inter-

fering with the service made the work consume much more time than would have been ordinarily required. However, the complete reconstruction of the connections was effected in about ten months by one journeyman and a helper. The satisfaction attendant upon the use of the rearranged board is such that the company has adopted this panel arrangement as standard.

ESTIMATED COST OF A
14.5-MILE TELEPHONE LINE

Total and Unit Cost of Equipment, Delivery, Freight and Placing Given in Tabulated Form
by New England Company

A comprehensive estimate of the cost of a telephone line as a part of a 66,000-volt transmission service was recently prepared by the Fall River (Mass.) Electric

the time to cut up, these boilers gave out at midnight.

There was no chance to repair them before daylight came with its morning load. The only hope was to get the new battery into service. M. H. Frank, the company's operating superintendent, remembering an old 150-ft. by 8-ft. (45.72-m. by 2.43-m.) steel stack that the company intended to let down and dispose of, took out a crew, cut the stack guys and allowed the steel stack to fall as gently as could be with speed imperative. Only about 20 ft. (6.09 m.) of the steel stack was crushed, and this was straightened enough for practical purposes by jacks placed inside. This steel stack was then hoisted to the position the breeching should occupy and was temporarily connected to the boilers and the stack. The fires, which had already been started under the boilers, were then built up and the boilers were placed on the line in time to pick up the morning load.

DETAILS OF ESTIMATED COST OF TELEPHONE LINE

	Amount Required,	PURCHASE		DELIVERY		FREIGHT		PLACING		Weight Data, Lb.
		Unit % Ft.	Total	Unit % Lb.	Total	Unit (100 Lb.)	Total	Unit	Total	
¼-in. seven-strand steel wire, ft.	165,186	\$0.0925	\$1,530.00	\$0.30	\$49.56	\$0.35	\$57.82	\$6.50 per 1000 ft.	\$1,073.71	16,519
No. 2117 insulators	323	0.3876	125.30	0.30	7.85	0.35	9.16	*		2,616.3
No. 9007 Lee pins	309	0.45	139.05	0.30	4.63	0.35	5.41	0.30 ea.	92.70	1,545
No. 1142 insulators	646	1.09	704.14	0.30	27.13	0.35	31.65	0.15 ea.	96.90	9,044
M-218 clamps	617	0.756	466.45	0.30	7.40	0.35	8.64	†		463
No. 5365 hooks	617	0.31	191.27	0.30	1.39	0.35	1.53	‡		2,468
¼-in. splicing sleeves	70	0.135	9.45	0.30	0.15	0.35	0.40	§		50
Transformers, 5-kw.	3	48.00	144.00		3.08		3.50	\$7.00	21.00	
Lightning arresters	3	25.00	75.00		0.22		0.25	¶		
Test blocks	8	30.00	240.00		0.66		0.75	\$6.00	48.00	
Instruments	2	17.50	35.00		1.00		0.30		70.00	
Total			\$3,659.66		\$103.07		\$119.41		\$1,402.31	

*Included with pins. †Included with insulators. ‡Included with wire. §Included with transformers.

Light Company, which has petitioned the Gas and Electric Light Commission for authority to build a two-circuit steel-tower line from Fall River to the Rhode Island boundary. The estimate was made by engineers of the Turners Falls Power & Electric Company, who have had extended experience in line construction in the Connecticut River valley. The proposed transmission line is 14.5 miles (23.3 km.) in length, and its total cost, including a 1300-ft. (396-m.) span across the Taunton River, is estimated at \$294,305. It is planned to install 75-ft. (22.9-m.) Aermotor steel towers spaced 600 ft. (182.9-m.) apart, using two ¼-in. (6.35-mm.) seven-strand steel telephone wires. The total cost of the telephone portion of the line is put at \$5,284.45.

HOME-MADE BREECHINGS
ERECTED IN RECORD TIME

How an Old Steel Stack Was Used as a Temporary Breeching to Save a Complete Failure of Lighting and Heating Service

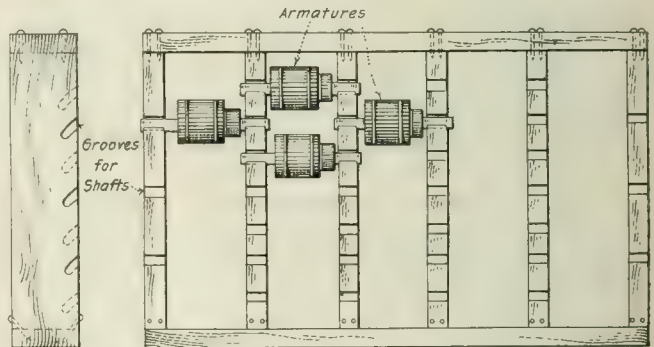
When the Galesburg (Ill.) Railway, Lighting & Power Company was rebuilding its station the work had reached a point where only the failure of a new breeching to arrive prevented a new battery of boilers being fired up. The settings were dry and the concrete stack was completed. Meanwhile the operating force was engaged in "coaxing" a set of old boilers to produce enough steam to supply electric and steam-heating service. Selecting the coldest night of the winter as

SIMPLE ARMATURE RACK

Made of Slotted Planks and Designed to Facilitate the Inspection of Armatures

BY FRANK HARAZIM

Scarred commutators and broken armature wires are often caused by allowing the armatures to be scattered about the workbench after repairs are made. This trouble can be avoided by using a rack which can be



constructed from wood as shown in the illustration. The size of the rack will depend upon the length and diameter of the armatures. Three slots are cut in the first and last boards of the rack, and the others contain seven. By keeping armatures in this manner the workbench can be kept more orderly, the armatures may be readily inspected, and there need be no worry about their being misplaced or injured.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat

PLAN FOR PROMOTING
SALES WITH BONUSES

How the Minneapolis General Electric Company Successfully Worked Out a Salary and Bonus System for Paying Salesmen

A few years ago the sales department of the Minneapolis General Electric Company, organized on the straight salary basis, was running along smoothly with an established force. Then one of the salesmen, who was getting \$165 per month, suddenly left the company's employ. His action was responsible for the institution of a bonus system in the company's sales department, for it was decided to give his salary to the men already in the department in the shape of bonuses in the hope that this would stimulate sales.

In the beginning those who were working out the plan took the sales records of all the men in the department over a period of several years. From these records it was found that if an arbitrary value for points was assumed the average man's sales ranged between 2000 points and 5000 points per month. The assumed value, based on a value of forty points for securing a wiring contract in an old house already on the company's line, established a basis from which to figure. The number of points to be credited to a salesman for securing other kinds of business was figured in relation to house-wiring in such a manner that the salesman could not afford to go after business that would come in by itself and would be encouraged to go after business that carried a profit to the company. The same plan was used in arriving at values of points for various items in the commercial lighting business and in the small power business. The result of these calculations is given in the table herewith, which sets forth the number of points credited to each class of business.

With the point system established, it was then necessary to lay down the rules under which the bonus would be given to the salesman. It was decided that the amount of bonus which should be allotted to a salesman should be in direct proportion to the amount by which he reduced his own net sales expense for any certain month over the same month in the preceding year. For instance, if in March, 1916, a certain salesman had a record of 2000 points and his total sales expense was \$100, then his sales expense per point would be 5 cents. Then, at the end of March, 1917, if he made a record of 4000 points and his sales expense remained at \$100, the cost of his business per point would be 2.5 cents. He would then have reduced his cost of doing business by the amount of 2.5 cents per point, and his bonus for March, 1917, would be 2.5 cents times 4000, the total number of points, or \$100. The salesman's total sales expense in each instance was taken as meaning his salary plus his expenses. Expenses were interpreted as being all expense items except such things as civic and commercial club dues and

such other items as the company wishes to pay to help promote civic spirit. The equity of the plan was at once apparent to the salesmen, who were in reality given the amount they saved the company.

The plan also works the other way, however, in that a salesman can lose money. He always gets his salary, but if he shows a loss in points which entitles him to a loss of his bonus he must make up the loss in bonus before he can be credited with a cash bonus. Furthermore, a salesman must increase his volume of business before he can be credited with a cash bonus.

Suppose, for example, that in April, 1916, a salesman had a record of 1500 points at a cost of 5 cents per

NUMBER OF POINTS FOR BONUS SYSTEM

RESIDENCE BUSINESS		Number of Points
Class of Business:		
A. Old house, reconnection contract.....		1
B. New house, new service on extension.....		2
C. New house, new service on line.....		5
D. Old house, new wiring on extension, Ratio 1/2.....		10
E. Old house, new wiring on extension, Ratio 1.....		20
F. Old house, new wiring on line.....		40
COMMERCIAL LIGHT		
G. Old building, reconnection contract, per \$100 revenue per year.....		4
H. New building, new service on extension, per \$100 revenue per year.....		8
I. New building, new service on line, per \$100 revenue per year.....		20
J. Old building, new wiring on extension, per \$100 revenue per year.....		40
K. Additional on meter per \$100 revenue per year:		
1. Expansion.....		20
2. Displacement.....		50
L. Old building, new wiring on line, per \$100 revenue per year.....		100
COMMERCIAL POWER		
H. New power on extension per \$100 per year.....		8
I. New power on line per \$100 per year.....		20
K. New power, additional:		
1. Expansion.....		20
2. Displacement.....		50
M. Change of name contract (any class of business).....		5

point, and then in April, 1917, he again made a record of 1500 points, but reduced his sales expense to 4 cents a point. This would apparently entitle him to a bonus of \$15, but a bonus gained in this manner is good only to apply against a bonus deficit and cannot be collected as a cash bonus.

An important feature of the plan is the reserve fund which has been worked out in connection with the system. Before a salesman can get any bonus he must have a credit of \$25 in the reserve fund. After that he can collect every month a bonus amounting to \$10 plus 50 per cent of the balance which he may earn. The primary purpose of the reserve is to provide ample credit to absorb any deficit which a salesman may contract in an off month. The secondary reason for the

reserve is that it provides an accumulation toward the purchase of an automobile. The salesmen are heartily in favor of this plan, because each of them wants a car. To buy the machine it is not necessary for a salesman to wait until his reserve reaches the amount of the purchase price, \$382, for the company will buy the car after the salesman's reserve has reached a reasonable amount and will then assist him in paying for it by deducting \$10 from his salary and \$10 from the bonus which he earns each month.

It is the experience of the Minneapolis company that the last named feature of this plan, which helps the salesmen get cars of their own, is a highly desirable one. It has been found that the salesman with a car cannot only make more money for himself, but can be of greater service to the company.

TACTFUL NOTIFICATION OF RATE ADVANCE TO PATRONS

How a Large Syndicate Informed Its Customers that
Increases Were Necessary Because
of Higher Costs

Quite frequently public service corporations send out to their customers very formal notices, advising them of changes in service regulations or other matters pertaining to the supply of electrical energy, which have

IT is the earnest desire of this company to render at all times the best possible service at a fair price.

We realize that companies such as ours are absolutely dependent for their success upon the established high quality of the service they render and upon the good will of the public they serve.

Of late, owing to the steadily increasing cost of everything entering into operation and construction—the same as with your own cost of living—costs for rendering good service have steadily mounted upward, until we have been forced to announce to our customers that beginning September first, it will be necessary to make a SERVICE CHARGE OF FIFTY CENTS per month in addition to the amount charged for gas used.

The high cost of living has affected us, far more than it has the average household or business, but even at that, government census figures show that gas and electricity are practically the only things entering into the cost of living that have actually decreased in the past ten years.

During its long period of service, this company has been as liberal as possible in giving voluntary rate reductions thus saving our customers many thousand of dollars. It now asks the indulgence of the public for the necessity of making this nominal service charge which will, in the aggregate tide over the company during the temporary period of excessive production costs.

FORM OF RATE INCREASE NOTIFICATION

anything but a human appeal. These notices are usually cold and matter of fact, written in a commandeering and authoritative strain and serve many times to arouse animosity against the utility. Especially is this so if advances in rates are announced. In such cases diplomacy of a high order should be employed if friction is to be kept down to a minimum. The accompanying illustration is a reproduction of a notice sent out by one of the syndicates operating from New York which might serve as a model for other utilities, unless something as good or better has already been sent out. It has the advantages of brevity and kindness without disguising in any degree its purpose.

POLICE FORCE HIRED TO TURN OUT SIGNS

New Jersey Property Pays 25 Cents a Sign and
Finds It More Economical Than Hiring
a Special Patrol

The method employed by the Commonwealth Electric Company of Summit, N. J., for rendering service to electric sign customers by turning off their signs at the proper time is inexpensive and full of suggestion. It has been found that to employ patrolmen for the sole purpose of looking after electric signs was very costly. In Summit the company pays the police department of the municipality 25 cents per month per sign for turning off signs at the proper time. This is much cheaper than the cost of hiring a patrolman for this work. The signs have outside boxes, locked, with one master key fitting all. All that the policeman has to do is to unlock the box and turn off the switch. For turning on these lights the company employs a man, who also notes lamp outages, which he immediately remedies. The company uses a flat rate for lamps for sign purposes based on the number of lamps required.

ELECTRIC WATER HEATING WITH RANGE INSTALLATION

Outline of Practice Followed by Southern California
Company and Which Has Met with Considerable
Approval on Part of Customers

In a paper read before a meeting of the employees of the enlarged Southern California Edison Company, Los Angeles, Charles H. Coulter made the following remarks regarding electric water heating:

Heating water is a phase of our business that has received little consideration from central stations up to the present time, because of the opinion that it would be necessary to give a decidedly low rate to obtain this business. At the present time we have two styles of water heaters to offer the prospective consumer—the circulating type of 3 kw. to 4 kw. rating and the submerged-tank type, a heater taking from 800 watts to 1500 watts.

It is my opinion that serious consideration should be given the type of heater that we recommend for sale. The circulating type has its advantages, and the installation of this heater through the farming districts may not seriously interfere with our service and may call for only a slight increase in our transformer expense. This heater gives the consumer the advantage of being able to heat and draw from the top of the tank just as little hot water as desired. It is fast—within twenty minutes one may have sufficient water for a bath. It may be quickly installed. Care must be exercised, however, in not trapping the hot water when the discharge is placed on the top of the tank. We have found it advisable to enter the tank on the side as near the top as possible. Nearly all tanks used for domestic hot water are tapped, so that the discharge outlet may be connected in this way.

For insulation—a very important part of any satisfactory hot-water system, and particularly so where electricity is used—we have been using "Cel-o-cel." In almost every new home you will find the water tank has been boxed. We have taken advantage of this condition by closing the lower end of the space and boxing the tank with this insulator.

The circulating type may be easily cleaned when the efficiency of the heater is affected by scale. This type has the advantages of low initial cost, of being easily cleaned when affected by scale and of giving the consumer the privilege of heating as little water as needed, thereby keeping the cost of this necessity to the figure he is willing to pay, and the disadvantage of causing our company a lot of

trouble if promiscuously installed within the more thickly populated districts.

The submerged type gives hot water at all hours at any degree desired. The thermostatic control is reliable, and the element of one particular heater of this type is so constructed that trouble caused from scale may be easily taken care of. The use of the submerged-type low-water wattage heater in conjunction with an electric range gives the consumer an installation to-day that will eventually be used as widely as gas at the present time.

Within the Van Nuys district we have installed twenty-seven heaters, and I can conscientiously say that we have not had one complaint caused by a high bill brought about by the use of the heater. In a number of instances we had numerous and serious complaints caused by high bills where a range was installed and a water heater not used. Because we believed that these consumers were heating considerable water on the outside elements of the electric ranges, we recommended the installation of a heater. After the installation of the water heaters the consumers are, without one exception, satisfied with their ranges.

PREVENTION OF FOOD WASTE BY MEANS OF DEHYDRATION

Opportunity for Central Stations to Serve the Nation
by Showing Customers How Electric Fans Can
Be Used to Dry Vegetables and Fruits

Prevention of food waste is now the national slogan, and the electric lighting utilities have it in their power to further this propaganda. The opportunity lies

longer period. Now is an opportunity to point out to customers having fans how the fans can be used to dehydrate vegetables and thereby serve the nation. It might be pointed out that a strenuous campaign in this direction by the central station companies might derive a profitable reward from the energy consumed by the fans.

The Society for Electrical Development has recently issued a pamphlet describing the electric fan process for drying fruit and vegetables and showing the central stations typical advertisements for promoting this work. Considerable interest is being aroused by a window display of the Glenwood Light & Water Company of Glenwood Springs, Col., in which fruit and vegetables are dried by an electric fan. Four racks made of light wood with wire mesh bottoms are set up in front of a 10-in (25.4-cm.) Westinghouse fan. Each rack is large enough for 6 quarts (5.6 l.) of material. A watt-hour meter indicates the exact cost for each run. In an advertisement in the local papers the company asks housewives to bring their fruits and vegetables and have them dried free of charge. Reference is made to Farmer's Bulletin No. 841, which describes the process.

PLAN FOR APPORTIONMENT OF LINE COST TO CUSTOMERS

In Cases Where Construction Investment Is Not
Justified Customers Are So Assessed That
Each Pays for Part of Line He Uses

In its construction of distribution lines which will serve only isolated consumers, the Louisville Gas & Electric Company, as is customary where prospective business would not justify construction investments, requires the customers to defray construction costs of this new work. Where only one customer is involved the plan is simple, but where others are interested this company has worked out a plan for apportionment of the costs which is proving satisfactory to the customers.

An instance of this kind recently came to the attention of a representative of the ELECTRICAL WORLD. The line was extended out into a district occupied by country homes of well-to-do people living at some distance from their neighbors. Six of them wanted service that entailed nearly 2 miles (3.2 km.) of wire construction, about a fifth of which reached the place of the first customer. Instead of assessing each customer a sixth of the whole cost, the Louisville company charged the nearest consumer only one-sixth of the cost of the construction to him. The next five each paid an equal amount plus one-fifth of the cost from that point to reach the second man, and so on until the sixth man paid his one-sixth of the cost to the first man, one-fifth of the second step, one-fourth of the third step, one-third of the fourth, one-half of the fifth, and the whole of the last division. In this way each customer paid for the line he actually uses an amount equal to that paid by all others who use that same part of the line. Where the line goes beyond a customer he does not participate in paying for the part he does not use.

This plan has recommended itself to the customers concerned and has become the established practice of the Louisville company.

Drying Fruits and Vegetables



A New Use for the Electric FAN

Outlining a Campaign for
Selling Electric Fans and
Building Up the Fan Load

The U. S. Department of Agriculture, Bulletin No. 841, says:

"It has been found that many sliced vegetables and fruits placed in long trays 3 by 1 foot and stacked in two tiers end to end before an Electric Fan can be dried to the requisite dryness within 24 hours. Some require much less time. For instance, sliced string beans and shredded sweet potatoes will dry before a fan running at a moderate speed within a few hours. In many cities the Electric Fan will cost not more than one-fourth of a cent an hour to run. The Fan should be placed close to the stacks of trays, and they should not be filled so full that the air can not pass freely through them. The Fan method has a marked advantage in that product keeps cool owing to evaporation while it is being dried, thus tending to retain the color and eliminate spoilage."

Write to the Division of Publications, Dept. of Agriculture, Washington, D. C. and you will receive a complete copy of this Bulletin, No. 841, free.

ADVERTISING ONE OF THE ELECTRIC FAN'S VARIED USES

through dehydration by means of the electric fan. The electric fan is purchased as a rule only for use in the hot summer months, although it is well known in the industry that its range of operation covers a much

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

DETERMINING PHASE-LAG IN CURRENT TRANSFORMERS

Methods Described That Are Simple to Carry Out and Capable of Giving Required Results Rapidly Under Commercial Conditions

THE importance of determining the exact ratio of transformation of current transformers and the phase-lag introduced by their insertion between the main circuit and the windings of meters had led a number of experimenters to develop a variety of meth-

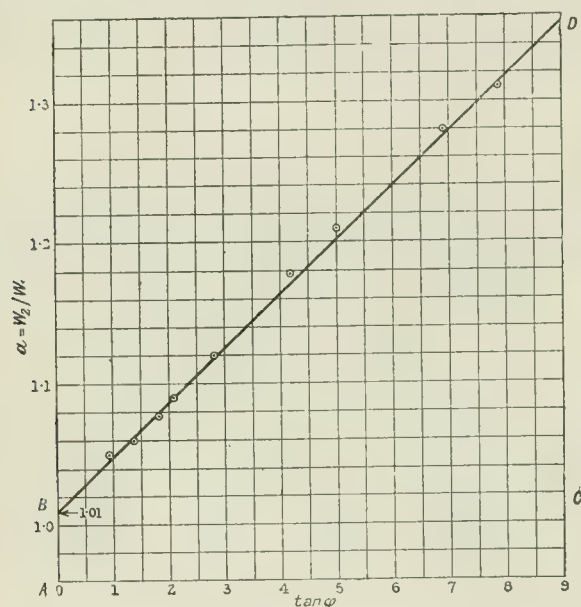


FIG. 1—RELATION OF TANGENT OF PHASE ANGLE TO RATIO BETWEEN WATTMETER READINGS

ods of measurement of these quantities. A. J. Makower and A. Wust in the July 13 issue of the London *Electrician* describe methods that are simple to carry out and capable of giving the required results rapidly under commercial conditions.

If two wattmeters, W_1 and W_2 , the latter with a transformer, are connected with their shunt coils in parallel across the terminals of an alternator, A_1 , whose voltage is E , and with their secondaries so as to carry the currents I_1 and I_2 supplied by the coupled alternators A_1 and A_2 , the readings of the instruments are given by the equations

$$W_1 = EI_1 \cos \varphi \quad (1)$$

$$W_2 = EI_2 \cos (\varphi + \delta) \quad (2)$$

where I_1 and I_2 are the primary and secondary currents of the transformer T under test and δ is the angle of lag introduced by it. The angle φ between the voltage E and the current I_1 can be varied at will by altering the coupling angle between the alternators by means of the adjustable coupling B . If the ratio of transformation of the transformer is given by $\lambda = I_2/I_1$, and the

ratio of the wattmeter readings by $a = W_2/W_1$, it follows that

$$a = \lambda (\cos \delta - \sin \delta \tan \varphi) \quad (3)$$

If any two points a_1 and a_2 are taken at angles φ_1 and φ_2 from the curve given by $a = f(\varphi)$, it can be shown that

$$\tan \delta = \frac{a_1 - a_2}{a_2 \tan \varphi_1 - a_1 \tan \varphi_2} \quad (4)$$

The value of δ can be calculated from equation (4), taking several pairs of values, and the value of λ is then obtainable by substituting in equation (3) the mean value obtained for δ .

This method was applied to a pair of similar current-transformers of a commercial type, whose rating was 75/3.5 amp. at 25/125 cycles. Transformers T_1 and T_2 were connected back to back in the position occupied by the transformer T . By this arrangement wattmeters W_1 and W_2 of the same range could be used.

If the nominal ratio of transformation of each of the transformers be called t , the nominal ratio of the combination will be $t/t = 1$. The actual ratios of trans-

formation are λt and $-\lambda$, giving an actual combined

ratio of transformation of λ^2 , which we will call Λ . If the angle of lag introduced by each transformer is δ , the angle of lag introduced by the combination may be written as $\Delta = 2\delta$.

The observed curve $a = f(\varphi)$ is plotted in Fig. 2.

From this curve Δ and Λ can be calculated as explained above, using equations (3) and (4), but it is

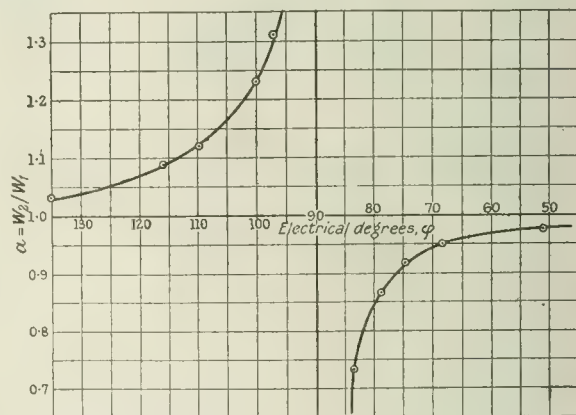


FIG. 2—OBSERVATIONS MADE WITH TWO COMMERCIAL CURRENT TRANSFORMERS

preferable to obtain these quantities graphically by plotting the curve $a = f(\tan \varphi)$. This is shown in Fig. 1, from which we see that $AB = \Lambda \cos \Delta$ and $-\tan CBD = \Lambda \sin \Delta$. Inserting the particular values we have

$$\Lambda \cos \Delta = 1.01,$$

$$\Lambda \sin \Delta = -0.0383,$$

whence

$$\Delta = -2^{\circ}10' \text{ and } \Lambda = 0.983,$$

giving

$$\delta = -1^{\circ}5' \text{ and } \lambda = 0.993.$$

While the forms of the curves obtained are of general interest, their determination involves considerable time and careful calibration of the two wattmeters in order to get correct values of the quantity a . The tests can be greatly simplified if the value of δ alone is sought and the wattmeters are used only as zero reading instruments.

Installations, Systems and Appliances

An Electrical Method of Hardening Steel.—A method known as the Wild-Barfield process, which has recently been developed and put into practical use, is described. The process, in so far as it involves the heating of the steel up to a certain point, and quenching it, entails no departure from accepted practice. Its chief claim to distinction may be said to lie in the manner in which the attainment of the correct temperature from which to quench the steel is judged. The furnace consists of a cylindrical vessel of heat-insulating material, containing a lining of special composition. Within the lining there is embedded an electrical heating coil, which in use is supplied with direct current. The temperature inside the furnace may reach 850 to 870 deg. C., and is measured by means of a thermocouple. It is not of material importance, however, what precisely the furnace temperature is so long as it is above the temperature from which the steel to be hardened should be quenched. This temperature is that of the decalcescence point of the steel in question, and varies from steel to steel. It may be said, however, in general to be round about 750 deg. C. The procedure then is simply to suspend the gage or other body within the furnace until it reaches the decalcescence point, and thereupon to remove and quench it. The chief novelty of the process lies in the means adopted for determining when the steel reaches its decalcescence point. These means take advantage of the known phenomenon that steel ceases to be magnetic at and above the decalcescence point. The heating coil, embedded in the furnace lining, behaves as a solenoid and radiates magnetic flux. As is well known, the magnetic flux from a solenoid is increased by inserting within the coil a core of magnetic metal such as steel or iron. In the ordinary case the coil of an electromagnet is wound closely around the metallic core. In the present instance the core is the gage or other body to be hardened, and is separated from the coil by an intervening space—filled with liquid salt—and the inclosing furnace lining. This reduces but does not wholly suppress the influence of the core as regards the increase of the magnetic flux from the solenoid heating coil.—London *Engineering*, July 27, 1917.

Theoretical Consideration of the Ventilation of Substations and Transformer Houses.—T. H. WOOD.—Although this subject is a highly important factor in the design of substations it does not always receive the consideration which it deserves, especially as the results obtained by theory agree so well with the conditions that are sure to be found in well-designed substations. Between the two modes of ventilation (mechanical and natural) it is impossible to fix any hard and fast rule, as each has its own particular advantages, and

local conditions must always be the deciding factor. Natural ventilation has the great advantage of utilizing the heat derived from the energy losses of the plant, so that the running cost is nil and the initial cost of the louver ventilators is not excessive. A common form of construction is to have them about 2 ft. (0.6 m.) high, running the length of the roof. The disadvantage of the louver type is that it is not easy to vary the ventilating area, so that on light load in winter the substation gets very cold. This can be remedied to a certain extent by employing a double row of windows, made to open and close as desired and arranged in the form of a roof lantern, thereby serving the double purpose of lighting the center of the building and providing space for a propeller fan fitted in a circular hole near the roof, the chief advantage being the much-reduced ventilating area required. If it is fitted in the gable end, it can often be made to assist in the architectural design of the building, but the running cost must not be overlooked. The author also gives calculations which take into account only the total plant which is likely to be running at one time and at its rated capacity.—London *Elec. Review*, July 20, 1917.

Generation, Transmission and Distribution

The Use of Waste Gases for Steam Generation.—JOHN B. C. KERSHAW.—In view of the industrial struggles ahead and the existing need for utilizing fuel resources to the greatest possible extent, the author has made a study of the progress and records of the last few years, in order to show what economies are possible by aid of waste-heat boilers. He points out that the heat carried away in waste gases may exist either as "sensible heat," *i.e.*, heat measurable by the thermometer and due to the failure to extract from the gases the whole of the heat generated by the combustion of the fuel, or as "potential heat," *i.e.*, heat represented by chemical energy, due to the incomplete oxidation of the combustible matter and to the presence of hydrogen and carbonic oxide in the escaping gases. In the latter case, the author says, some form of burner and combustion chamber, with means for regulating the air supply, is necessary, whereas when the waste gases carry only "sensible" heat and combustion is completed, the addition of a boiler only is required to save some portion of wasted heat. He further points out that in the earlier installations of waste-heat boilers the natural chimney draft was relied upon to overcome the increased resistance due to the passage of the gases through the flues of the boiler. In many cases the boiler was erected directly above the furnace, so as to minimize the losses from this cause. This plan was never entirely satisfactory, and in modern installations artificial draft is always employed. In this way the draft of the original apparatus or furnace is increased rather than lessened by the installation of the waste heat boilers, and the use of the fans also enables much higher gas velocities to be attained over the water-cooled plates of the boiler, and increases considerably the rate of heat transmission and therefore the efficiency of the whole plant. As regards the practical value of waste heat boilers it is possible with a modern plant to reduce the heat of the waste gases to 500 deg. Fahr. (260 deg. C.). Any furnace, therefore, which is allowing gases to pass away above this temperature may be provided with the necessary plant for recovering the waste heat, although

as a general rule it only pays to recover the heat when the gases are carrying 200 deg. or 300 deg. Fahr. (93.3 deg. or 148.9 deg. C.) of surplus heat up the chimney. Practical examples of waste-heat utilization for steam generation are drawn from the United Kingdom, Belgium, Germany and the United States, examples being selected in which the data of test results are the most reliable and up to date.—*London Engineering*, July 20, 1917.

Electric Steel Furnaces.—E. KILBURN SCOTT.—In this article the author describes the various types of furnaces used in England, specially emphasizing a description of the Greaves-Etchells furnace. He also points out that very soon there will be fifty electric furnaces at once in the Sheffield district and the output of the field will be at the rate of 200,000 tons (181,400 t.) per annum.—*London Elec. Review*, July 13, 1917.

Units, Measurements and Instruments

Testing of Magneto Magnets.—J. D. MORGAN.—The author in this article points out that the testing of the permanent magnets used in ignition magnetos, though apparently a simple matter, presents difficulties of both a scientific and a practical nature. He describes a magnetic balance suited to practical conditions of testing and related in its action as nearly as possible to the duty which the magnet is required to perform.—*London Engineering*, July 13, 1917.

Miscellaneous

Hydroelectric Energy in Spain.—According to recent statistics, the hydroelectric energy available in Spain amounts to 5,000,000 kw. There are in being 110 great hydroelectric installations, which produce a total of 280,000 kw., and a large number of small manufactories, of which the production is 500,000 kw. The reserve power of the 110 large installations is about 1,000,000 kw. Many factories use water as motive power without transforming it into electricity. In Catalonia the weaving industry uses power equivalent to about 200,000 kw., of which half is used directly. The rivers which have their source in the Pyrenees and traverse Catalonia could furnish more than 1,000,000 kw., but the concessions granted amount to only 600,000 kw. The unused water-power should be a factor in the industrial development of Spain.—*L'Industrie Elec.*, July 25, 1917.

Book Review

ELECTRICAL METERS. Second edition. By Cyril M. Jansky. Prepared in the extension division of the University of Wisconsin. New York: McGraw-Hill Book Company, Inc. 416 pages, 315 illustrations. Price, \$3 net.

Though the title may give the impression that this book deals only with what is popularly understood by the term "meters"—namely, those of the integrating kind—it includes also quite a treatise on what are generally termed measuring instruments, that is, those which indicate but do not integrate, though this portion is chiefly introductory to the other in being devoted more particularly to those types of indicating instruments which are used in the integrating ones. As a book on integrating meters it therefore is complete in itself and treats quite thoroughly of a subject which

is generally only a mere chapter in books of broader scope; it is, in fact, believed to be the only book devoted entirely to this subject. The author has wisely made it still more complete in itself by including a well-written chapter on those of the fundamental principles of electricity and magnetism which are involved in an intelligent understanding of meters, including a good brief discussion of terms, units, laws, alternating currents and induction. The main part of the book is devoted to a description, with numerous well-chosen illustrations, of the various typical American meters used in practice, and to a considerable extent to the method of testing them, including a chapter on the errors and their causes. It treats not only of watt-hour and ampere-hour meters of the integrating types, but also of many forms of indicating meters, including those for measuring volts, amperes, power, phase and frequency, as also recording and demand meters and instrument transformers, making the treatise one which covers the subject with considerable completeness. The explanations are in simple and easily understood terms, accompanied by numerous diagrams, and there is very little of the higher mathematics. The author, in the capacity of a teacher, has made a specialty of familiarizing himself with this class of instruments and with testing them; he is therefore well qualified in this branch and gives the reader the advantages of his own apparently very extended experience, especially in meter testing. The book is therefore not one of the "shears and paste" variety. During the four years since the first edition appeared many new developments have been made, hence much new material has been added and obsolescent matter has been cut out. The chapter on the errors of instruments has been largely rewritten and information on the influence of frequency and wave form has been added, as also a whole chapter on instrument transformers. Among minor features which might be criticised, mention may be made of the fact that the author refers to Ohm's law before he describes it; that when he describes it he does not put it into its more usual form, $I = E/R$; that he does not lay sufficient stress on valence in connection with Faraday's law; that the energy of water is better represented by pounds and feet than by cubic feet and feet; that an emf. is not always produced by a change of linkages of magnetic flux; that a kilowatt-hour is not necessarily 1000 watts for one hour, etc. But these slips are not likely seriously to confuse the average reader. A more definite distinction between direct-current and alternating-current instruments would have increased the reference value of the book, though it is true that the two kinds overlap. The book, which is complete in itself, is a useful one, is well and intelligently prepared, showing a familiarity with the subject, and is said to be the only one devoted entirely to this branch of applied electricity.

Books Received

ELECTRICAL MACHINERY. By Terrell Croft. New York: McGraw-Hill Book Company, Inc. 318 pages, 302 illustrations. Price, \$2 net.

STANDARD TABLE OF ELECTROCHEMICAL EQUIVALENTS AND THEIR DERIVATIVES. By Carl Hering and Frederick H. Getman. New York: D. Van Nostrand Company. 130 pages, illustrated. Price, \$2.

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

WISCONSIN PURCHASE

BY INSULL INTERESTS

John I. Beggs Advises Electrical World of New Holding Company in Which Mr. Insull and Associates Acquire Stock

A telegram from John I. Beggs, president Wisconsin Power, Heat & Light Company, was received in answer to an inquiry by the ELECTRICAL WORLD. It did not reach New York until after the issue of last week had gone to press. The telegram supplements the article in that issue, page 315, in regard to the transaction by which Samuel Insull and associates acquire an interest in properties developed by Mr. Beggs. The message is as follows:

Have not sold any electrical properties or stocks. Insull and associates have bought large interest in additional stock issue Central Utilities Securities Corporation, which is a holding company controlling certain hydroelectric and public utilities in Wisconsin and which has acquired recently large oil interests in Illinois. I retain my entire interest in the company and continue as a director thereof. The properties in the Fox River Valley controlled by me are not included or involved or in any way affected by these negotiations, the ownership, administration and management of them remaining in my hands.

SPECIALIZATION IN ARMY

SAVES MEN AND MATERIALS

Captain Capart Calls Attention to Necessity of Employing Each Soldier of Industrial Training in His Own Trade

Supplementing the interview published in the ELECTRICAL WORLD of Aug. 11, 1917, page 271, Capt. Gustave P. Capart of the general staff of General Pétain, who is now in the United States as a member of the French scientific commission, writes to call attention to several special points which should be of great interest to American engineers. Captain Capart says:

The first of the points to which I refer is the necessity which has been encountered by all of the belligerent armies of establishing the separate identities of the forces in the trenches and those to the rear.

The first of these army service corps, of course, are in contact with the enemy, and the others must prepare defensive works and provide with munitions and supplies their comrades in the trenches by means of railroads, roads, automobiles and all other methods of transport. They must repair the means of transport, maintain machine shops, operate water-supply systems, etc.

The second point, and one which it is of the greatest importance that American engineers shall grasp, as they will, since it coincides with their every-day experience in civil life, is the indispensability of specialization in the army. In order to attain the greatest human efficiency and thereby the greatest efficiency in material and the least loss in human life it is necessary that in so far as may be possible each soldier of industrial training be employed in his own trade. This makes it possible to organize entire and individualized regiments of electricians, of foresters, of concrete

workers, etc., who become available for active duty very quickly, as their military training may be extremely limited.

By thus pushing to the limit that intense specialization the necessity for which is being realized more and more in Europe the United States will be able to lend prompt and efficacious aid to her allies. That the American authorities are working in this general direction is shown by the formation of railway regiments which are already in France and the foresters' regiments now in course of organization. It is not only in the forces to the rear that this specialization is noted; the actual fighting forces are divided into sections of bombers, machine-gun operators, trench-mortar operators, etc. The public is already familiar with the highly specialized airplane service, which may be pointed to as an example.

Finally, I should like to call your attention to the fact that the game of war cannot be learned once for all. Each soldier of whatever corps must serve actively, have a period of rest and a period of training in special schools in the newer phases of the ever-changing business of war. The engineer in civil life finds it necessary to read constantly, to converse with his fellow engineers, see new developments, etc., in order to keep up to date. War is the greatest enterprise ever undertaken, and no one is permitted to go to sleep on the job. The mentally "dead one" becomes so literally if not sooner discarded.

LOW-RATE ENERGY CASE

OF CALIFORNIA COMPANIES

Pacific Electro Metals Hearing Before Railroad Commission Involves Questions of Cost and Rate Making

The investigation which the California Railroad Commission is making on its own initiative into the rates which three San Francisco power companies are quoting the Pacific Electro Metals Company occupied four full days last week and involved long processes of direct and cross-examination. Among those called to the stand were Mortimer Fleishhacker, president Great Western Power Company; John A. Britton, vice-president and general manager Pacific Gas & Electric Company, and H. F. Jackson, president Sierra & San Francisco Power Company, as well as engineers and rate experts of these companies. A statement of the case appeared in the ELECTRICAL WORLD for July 28, page 175.

The most essential points of the case have not been reached, but a formidable collection of statistics has been prepared and there is general agreement on the importance of the rate-making principles involved. After examination of the power company officials the commission will present the results of its study. This will be accompanied by a map showing transmission lines of the State and suggesting means of combination to cut down cost of service, reduce steam standby charges and conserve power resources generally.

Meanwhile construction is actively under way on the Pacific Electro Metals plant at Bay Point. One of the structures is partly completed and concrete footings for several others have been poured.

PRESIDENT WILSON FIXES COAL PRICES

The following scale of prices is prescribed for bituminous coal at the mine in the several producing districts. It is provisional only. It is subject to reconsideration when the whole method of administering the fuel supplies of the country shall have been satisfactorily organized and put into operation.

Subsequent measures will have as their object a fair and equitable control of the distribution of the supply and of the prices, not only at the mines, but also in the hands of the middlemen and the retailers.

The prices provisionally fixed here are fixed by my authority under the provisions of the recent act of Congress regarding administration of the food supply of the country, which also conferred upon the Executive control of the fuel supply. They are based upon the actual cost of production and are deemed to be not only fair and just, but liberal as well. Under them the industry should nowhere lack stimulation.—*From the President's Statement.*

The prices prescribed, being on f. o. b. mine basis for tons of 2000 lb., follow:

	Run of Mine	Pre- pared Sizing	Slack or Screen- ing
Pennsylvania	\$2.00	\$2.25	\$1.75
Maryland	2.00	2.25	1.75
West Virginia	2.00	2.25	1.75
West Virginia (New River)	2.15	2.40	1.90
Virginia	2.00	2.25	1.75
Ohio (thick vein)	2.00	2.25	1.75
Ohio (thin vein)	2.35	2.60	2.10
Kentucky	1.95	2.20	1.70
Kentucky (Jellico)	2.40	2.65	2.15
Alabama (big seam)	1.90	2.15	1.65
Alabama (Pratt, Jaeger and Corona) ..	2.15	2.40	1.90
Alabama (Cahaba and Black Creek) ..	2.40	2.65	2.15
Tennessee (eastern)	2.30	2.55	2.05
Tennessee (Jellico)	2.40	2.65	2.15
Indiana	1.95	2.20	1.70
Illinois	1.95	2.20	1.70
Illinois (third vein)	2.40	2.65	2.15
Arkansas	2.65	2.90	2.40
Iowa	2.70	2.95	2.45
Kansas	2.55	2.80	2.30
Missouri	2.70	2.95	2.45
Oklahoma	3.05	3.30	2.80
Texas	2.65	2.90	2.40
Colorado	2.45	2.70	2.20
Montana	2.70	2.95	2.45
New Mexico	2.40	2.65	2.15
Wyoming	2.50	2.75	2.25
Utah	2.60	2.85	2.35
Washington	3.25	3.50	3.00

MORE SERVICE FROM THE FREIGHT CARS

Intensive Car Loading and Increase in Number of Miles Hauled Contribute Toward a Better Showing

Fairfax Harrison, chairman of the Railroads' War Board, authorizes the following:

With an increase in equipment of only 3 per cent, the railroads of this country rendered nearly 26 per cent more freight service in June than in the same month last year.

Both the railroad men and the shippers are to be congratulated on the zeal and skill with which they have carried out the requests of the Railroads' War Board "to make one car do the work of two." Intensive loading has increased the number of cars available to meet the demands of the government and the shipping public by many thousands. Prompt loading and unloading of cars and the efforts which the railroad employees are making to keep cars out of the repair shops have also done much to help.

IMPROVEMENT COMES IN CONDITIONS OF COAL SUPPLY

Coal Production Committee of Council of National Defense Says, However, That Production Does Not Meet Increased Requirements

An appeal to coal operators and miners issued by the coal production committee of the Advisory Council of National Defense, and signed by F. S. Peabody, chairman, and William Green, secretary, says in part:

The coal production has been increasing sufficiently to warrant the belief that there will be an adequate supply of coal to meet the requirements of consumers in the United States. The bituminous coal loaded at the mines in May was 24 per cent more than in May a year ago and 12 per cent more than in April of this year. In June, 1917, the increase was 26 per cent above the output of June, 1916. This means that in June, 1917, a new record was established, with a production of nearly 47,000,000 tons (42,300,000 t.) of bituminous coal. This gratifying record was even exceeded in July. Yet not enough coal is being mined to meet the increased requirements, estimated at 10,000,000 tons (9,000,000 t.) annually, which will be necessary to supply the growing needs of our allies, for the bunkering of fleets which will transport our troops and supplies to France, and for Cuba and South America.

Though the production of coal throughout the country is now seriously handicapped by the inadequacy of transportation facilities, yet we call attention to the fact that, owing to the co-operation and the splendid efforts of the executive railway committee of the Council of National Defense, much progress has been made in supplying cars to the mines, resulting in the material increase in production for the month of May over that of April. There is, of course, still room for improvement, but we have every assurance that the regulations now being put into effect by the railroads, the putting into service of many new cars and the increase of motive power as a result of the curtailment in passenger service will make for a continued improvement in car supply.

It is not the intention of this committee to seek arbitrarily to restrict the normal activities of operators or miners, but we are interested, as the whole nation must be, in maintaining uninterrupted operation in the coal-mining industry and in securing at all times the maximum production of coal. This committee, representing the coal operators and miners, renders great service in promoting good will and harmony in the coal industry and in co-operating for the purpose of bringing about the adjustment of differences between operators and miners to the end that production may be increased.

The present co-operation between those actively engaged in the conduct of the coal industry will prevent the putting into effect of any extreme or arbitrary policy which would interfere with the freedom of action of the coal operators and coal miners of the country. In the judgment of the committee the problems affecting this industry can be more effectively solved and the interest of our nation and the public more properly protected by the men who, from the nature of their business and occupation, are essentially qualified to deal with them. It is necessary that a proper degree of voluntary restraint be exercised to the end that not only the maximum production be obtained, but that the public may be able to rest secure in the knowledge that its interest will be safeguarded.

Ernest Haughton and Wife Killed in Automobile Accident

Ernest Haughton, manager of the Chicago Bryan-Marsh division of the National Lamp Works, was killed, with Mrs. Haughton, Wednesday night, Aug. 22, while driving by automobile from Association Island to Paul Smith's in the Adirondacks. According to obtainable meager reports, none of the children was injured.

SOUTHERN CENTRAL STATION MEN DISCUSS RANGE SALES

Peculiar Selling Problems of Virginia and Carolina Companies Threshed Out in Meeting Held in Richmond

Because the colored servant adds peculiar difficulties to the electric range sales problem in the Southeastern States, fifty central station men from that section gathered at the Hotel Jefferson, Richmond, Va., on Aug. 17, to exchange experiences and arrange for closer co-operation in the development of this class of business. The meeting was called by a committee headed by A. H. Grimsley, general manager Virginia Western Power Company, Clifton Forge, Va. The program was as follows:

"The Basis of a Cooking Rate," P. L. Miles, Hughes Electric Heating Company, Chicago.

"Selling Electric Ranges in Small Southern Towns," E. G. Couch, Carolina Power & Light Company, Raleigh, N. C.

"Demonstrating the Range in the Customer's Kitchen," Mrs. P. L. Miles.

"Selling One Hundred Ranges in a Town of Two Thousand," C. E. Romy, local manager Carolina Gas & Electric Company, Darlington, S. C.

"Developing Customers," William Lancaster, Western Electric Company, Richmond.

"Selling the Range to Yourself," Frank B. Rae, Jr., *Electrical Merchandising*, New York.

In addition to the formal program, H. W. Alexander, Society of Electrical Development, New York, and C. A. McGee, Consolidated Gas, Electric Light & Power Company, Baltimore, made brief addresses.

COLORED SERVANTS NO SERIOUS OBSTACLE

The colored servant constitutes an exaggerated and largely imaginary obstacle to range sales, according to Mr. Couch. He declared that these servants are being taught to operate electric ranges successfully and economically in the towns which his company serves. The most effective means he has found for accomplishing this education is a course of lessons which, when completed, entitles the cook to a diploma elaborately engraved and embellished with a large gold seal and red ribbon. The servants are very proud of these diplomas, which are framed and hung in the kitchens to the envy of less fortunate servants of the community.

A rate of 1¼ cents per kilowatt-hour for water heating was advocated by Mr. Grimsley, who had submitted such a rate to the utilities commissions of Virginia and West Virginia. By experiments extending over a period of more than two years, his company established the fact that the average family in the South can have an ample supply of warm and hot water at an expenditure of from 175 kw.-hr. to 225 kw.-hr. per month. He recommended the use of a three-point type of heater, the maximum consumption of which is 750 watts and the minimum 167 watts. By leaving the low heat on through the night, a 40-gal. (151.4-l.) insulated boiler is kept always warm and requires only an occasional "boost" on the high heat to give as much hot water as is required. A double-throw switch prevents the water heater from being used at the same time as the electric range, and a clause in the customer's contract prohibits its use during the evening peak.

In justifying this rate to the utilities commissions, Mr. Grimsley advanced the argument that 1¼ cents constituted a secondary rate. Energy for water heating

is supplied only in connection with electric cooking, for which he makes a rate of \$1 per kilowatt of demand and 3 cents per kilowatt-hour.

Several of those attending the meeting expressed themselves as being "on the fence" in the matter of making a cooking rate. Those who had experience claimed that because of the diversity factor of this load, its tendency not to add more than 10 per cent to the station peak and its undoubted advantage in filling load valleys, the business justified a rate of approximately 3 cents and that such a rate would net a profit equal to or greater than ordinary lighting business after a reasonable degree of range saturation is secured.

Mr. Miles closed the meeting with a complete outline of electric range selling campaign methods which had proved successful in meeting conditions in the South.

Upon invitation of W. H. Hall, manager, the new building of the Western Electric Company was visited and a buffet luncheon served.

HIGHER COST AND RATE PROBLEM IN HYNDMAN, PA.

President Margraff Feels Injustice of Present Fuel Prices and Danger to Industries and Economic Conditions

John D. Margraff, president and general manager of the Hyndman (Pa.) Electric Light, Heat & Power Company, writes in reply to an inquiry from the ELECTRICAL WORLD that the proposed increase in rates of his company does not begin to cover the additional cost "due to the inflated and unfair prices of coal." Mr. Margraff adds that the indications are that miners received an advance in wages of about 60 per cent, while the price of coal was advanced over 300 per cent. Nor is there any indication that coal operators had their overhead charges increased, for they are operating practically on the same scale with the same machinery which they used when coal was selling at \$1 per ton at the mines. The present quotation is \$3.50 per ton for run-of-mine coal at the mine.

SMALL INDUSTRIES WILL BE AFFECTED

Mr. Margraff says that the country is filled with numerous small industries which are the very sinew of the nation, and that with coal at \$3 to \$5 per ton they cannot exist but will have to discontinue, because fuel is too high compared with the prices which they are receiving for their own products.

It is the belief of Mr. Margraff that present conditions, if continued, will breed fuel famine and discontent in the coming winter.

In notifying the public that the Pennsylvania Public Service Commission had been asked to approve an advance, the Hyndman company said:

Below we give you an approximate estimate of the increased cost of operation which we believe will readily convince you that the advance asked for is very small as compared to the added cost of material and is justifiable on our part:

Coal (which is our basic expense) advanced over 200 per cent, copper 40 per cent, material for repairs 50 per cent, and wages of employees advanced 20 per cent.

The above will give you a fair idea of the increased cost of operation; the advance applied for does not begin to compare with the added cost of material.

SHORTAGE OF POWER RAISES A PROBLEM

Rochester Company Affected by Labor and Material Shortage and Decrease in Niagara Service—
Kansas City Situation

Shortage of power is reported in various cities. Arrangements are being made to lessen the resulting inconvenience as much as possible and to increase capacity so as to take care of the enormously increased demands for energy for industrial purposes. Statements in regard to the situation in Rochester, N. Y., and Kansas City, Mo., are published herewith.

REASONS FOR ROCHESTER DIFFICULTIES

James T. Hutchings, vice-president and general manager Rochester Railway & Light Company, issued the following statement on Aug. 10:

The various statements which have appeared in the papers in regard to the failure of power on Thursday morning for an hour and twenty minutes and the slight interruption in power supplied to certain lines of the street railway company at about 5 o'clock in the afternoon were in detail correct, but did not give a complete statement of the situation and all which led up to it.

The demand for power not only for the street railway but also for manufacturing purposes in Rochester has been very excessive, owing to the tremendous industrial activities brought on us by the war and particularly since the entrance of this country. The Railway & Light Company management appreciated fully the possibility of this demand and more than a year ago entered into contracts for materials and supplies such as boilers, stokers, turbines and rotary converters to place it in a position to fulfill this demand.

For the past twelve years and until April 1, 1917, the Railway & Light Company was purchasing approximately 8000 hp. from the Niagara, Lockport & Ontario Power Company, whose transmission line extends from Niagara Falls to Syracuse and whose system has been further extended to the Salmon River development. Owing to the excessive demand for power in the Province of Ontario, the Niagara, Lockport & Ontario Power Company's supply from Niagara Falls has been somewhat reduced, and, while it has added materially to its steam plant at Lyons, owing to the cutting down of its power from the falls and the greatly increased demand for power on its system it was found that it would be impossible for it to continue to furnish to the Railway & Light Company the 8000 hp. previously supplied.

The company has, however, agreed with the lighting company to maintain its tie line connection with us from Mortimer, and it was due to the use of this connection and the company's courtesy that the interruption on Thursday was not of longer duration.

The lighting company had expected to have its new hydraulic development at the lower falls completed by July 1, but delays in receiving material and scarcity of labor have held this up and it probably will be well into October before this new development is put in operation. Two new boilers of 6000 kw. capacity ordered for the No. 3 steam power plant, which were promised us in sufficient time so that they should have been in operation on Aug. 1, have been delayed, and it probably will be the middle of September before these are installed.

It has been necessary to purchase materials over as broad a territory as from Michigan to Connecticut in order to get any satisfactory promise of delivery. It further has been necessary to keep two of our men on the road visiting the various manufacturing plants and insisting upon the pushing forward of the work and, after the material is placed on the cars, to have it followed up personally by one of our men to see that it is not delayed at the various freight terminals. Never have we been in so unsatisfactory a position as at the present time, because of the conditions which have been brought about by the tremendous industrial activities caused by the war.

With the arrangements we have been able to make for emergency use of power from the Niagara, Lockport & Ontario Power Company and the expected arrival of materials which will be installed with the greatest possible speed, we confidently expect to satisfy the demands for power of both the railway and our various manufacturing plants in Rochester. The demand, however, will be excessive until the new apparatus and the new hydraulic plant at the lower falls are put in operation.

Short interruptions may occur, but we wish to assure the public that everything possible which can be done by human means to avoid such annoying interruptions as occurred on Thursday will be done, and we expect to maintain our service equal to the former satisfactory standard. Should we, through unforeseen circumstances, however, be unable for short periods to supply power we shall expect to receive the same hearty co-operation as in the past.

The Kansas City Light & Power Company has secured the co-operation of large power users in the Kansas City district, whereby loads will be distributed through the night and energy conserved pending the installation of equipment adequate for handling the business. The consumers were called into conference with officials of the company and appointed a committee of their engineers to meet with the company engineers and analyze the situation. The engineers collected data on the available energy and on needs of the consumers and arranged a schedule of distributing the load. Large plants will put on night forces to relieve the day peak loads and still use their equipment for the employment of electrical energy.

R. L. Redpath, manager of the American Radiator Company at Kansas City, was chairman of the consumers' committee. The plants represented included the Kansas City Bolt & Nut Company, the Kansas City Structural Steel Company, milling companies and similar institutions.

CAUSE OF THE SHORTAGE IN KANSAS CITY

The production of electrical energy in Kansas City has fallen short of needs from two causes—the large increase in the requirements of the Kansas City Railways Company and the inability of the Kansas City Light & Power Company to secure additional equipment for its plants ordered six, twelve and eighteen months ago. During the past few weeks there have been times when the electric cars have failed, and the supply of energy to general consumers has also failed because of the breaking down of equipment under excessive load.

The Kansas City Railways Company, with large capacity, has been under contract to give the Kansas City Light & Power Company its surplus energy. The Kansas City Light & Power Company has two plants with a maximum rating around 16,000 kw. The railway company has been delivering around 16,000 kw. to the light company. The increased business this summer has prevented the overhauling of equipment in both plants, and new equipment could not be secured. The result has been the absolute necessity of cleaning out boilers and making repairs, sometimes brought about by actual breakdowns. Therefore service has suffered.

The light company put into service on Aug. 8 a unit of 1500 kw. received recently and another 1500 unit the middle of the month. By Oct. 1, it is hoped, further increases in capacity can be attained, perhaps providing a total of about 26,000 kw., not counting reserve,

which will handle the business fairly well. The company will then have installed about 21,500 kw. of new equipment.

The company is spending about \$1,500,000 on its Central Avenue plant and on its Baltimore Avenue heating plant, sources of electrical energy. This is admittedly temporary installation, pending the suitable time for beginning work on its permanent large power plant.

The Kansas City Light & Power Company recently paid \$250,000 for 25 acres close to Kansas City on the Missouri River as a site for its permanent power plant. Building plans are ready, but no negotiations for equipment or construction will be begun until present unsettled conditions are improved.

ANNUAL TEACHERS' COURSE AT THE WESTINGHOUSE WORKS

Twenty-four Men from Different Engineering Schools
in This Country, Canada and Japan at
East Pittsburgh Plant

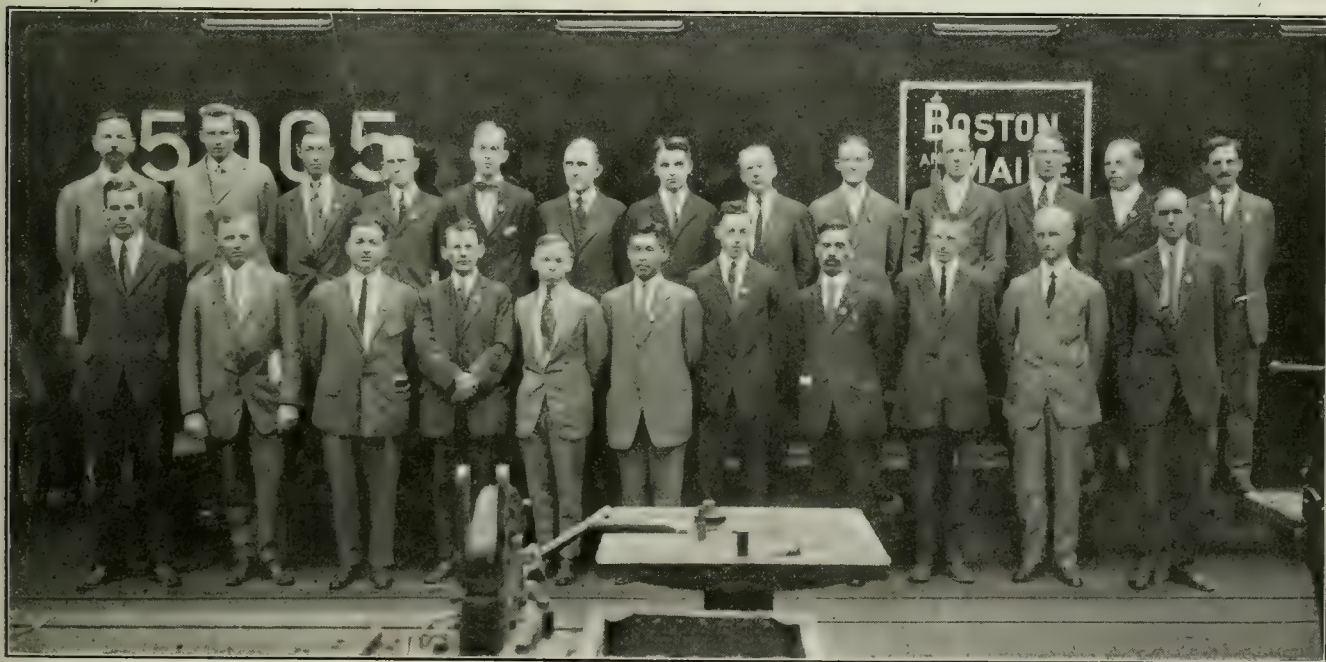
For several years past from fifteen to thirty engineering teachers have spent part of the summer vacation at the East Pittsburgh works of the Westinghouse Electric & Manufacturing Company in getting acquainted not only with the apparatus manufactured by

tunity to become acquainted with the latest developments in electrical power apparatus, with shop methods in use in large manufacturing concerns, and to meet and exchange ideas on teaching subjects with other engineering teachers of experience. Since the Westinghouse company draws men from engineering schools, it is of advantage to it that students may know not only of the opportunities open but of methods of working efficiently in its organization.

As shown by the accompanying illustration, the following are in attendance at this summer's course:

Top row (left to right)—J. F. Wilson, Queens University; R. S. Ferguson, Throop Institute; W. A. Dart, Clarkson College; P. Cloke, Clarkson College of Technology; A. M. Holcomb, Case School; F. H. McClain, Ottawa University; H. H. Higbie, University of Michigan; H. C. Bartholomew, Iowa State College; A. S. Langsdorf, Washington University; M. M. Cory, Michigan Agricultural College; R. Beach, Norwich University; C. E. Magnusson, University of Washington, and T. C. MacKay, University of Washington.

Lower row (left to right)—C. W. Ricker, Massachusetts Institute of Technology; W. B. Kouwenhoven, Johns Hopkins University; D. P. Savant, University of Missouri; H. A. Weiss, Georgia School of Technology; H. A. Brown, University of Arkansas; G. Shimizu, Kyoto Imperial University; G. D. Robinson, Pennsylvania State College; H. Mori, Kyushu Imperial Univer-



AMERICAN, CANADIAN AND JAPANESE ENGINEERING TEACHERS AT EAST PITTSBURGH

this company, but also with its engineering designers, commercial engineers and works executives. This year there are twenty-four men from seventeen different states and from Canada and Japan, representing twenty-three different engineering schools.

Most of their time is spent on actual work, either on assembly or test floor or in the engineering offices, but part of the time is given up to a series of meetings, which include inspection and discussion of apparatus being manufactured, talks on engineering opportunities and requirements, discussions of teaching problems, excursions to other plants and social meetings.

This course gives engineering teachers an oppor-

sity; C. A. Biorkman, Kansas State Agricultural College; F. T. Dargan, Clemson College, and R. C. Disque, University of Wisconsin.

Higher Steam-Heat Rates Asked in Indiana

There will be a hearing before the Indiana Public Service Commission on Aug. 30 and 31 upon separate petitions filed by the Indianapolis Light & Heat Company, the Merchants' Heat & Light Company and many other companies for authority to increase heating rates because of the great increases in the price of fuel and other things essential to the heating business.

NEW POWER CONSTRUCTION OF THE ATLANTA COMPANY

War-Time Industrial Demands Force Georgia Railway & Power Company to Increase Generating Capacity—\$2,500,000 Note Issue

The Georgia Railway & Power Company, Atlanta, has petitioned the Georgia Railroad Commission for authority to issue \$2,500,000 in notes for new development projects. The securities are to be 6 per cent two-and-one-half-year collateral notes, dated Aug. 1, 1917, and redeemable in amount not less than \$500,000 on Aug. 1, 1918, or thereafter.

It is proposed to install a sixth unit at the Tallulah Falls plant consisting of one 12,000-kw., 514-r.p.m., 6600-volt vertical generator, complete with waterwheel, penstocks and switches, and three 4000-kva., 6600/110,000-volt, single-phase, 60-cycle transformers. This will give an additional plant capacity of 30,000,000 kw.-hr. per year. A new storage basin is contemplated at Burton Lake, above the present Mathis Lake. This storage is equivalent to 40,000,000 kw.-hr. per year.

A further development is being considered on the Tugaloo River below the junction of the Tallulah and Chattooga Rivers, about 2 miles (3.2 km.) below the present Tallulah Falls power house. The dam will be of cyclopean-type masonry with 138-ft. (42-m.) head. The probable equipment will include four 12,000-kw., 6600-volt, three-phase, 60-cycle units and six 8000-kva., 6600/110,000-volt, single-phase, 60-cycle transformers of two banks, including switches and outdoor steel station. The output of this plant is expected to be 116,000,000 kw.-hr. per year.

War-time construction has been forced on the company by exceedingly heavy industrial power demands.

ELECTRICAL CONTRACTORS' MEETING IN GEORGIA

Resolution Pledges Loyalty to the Government and Support in Its Course—Norton Frierson Elected President

The convention of the Georgia Electrical Contractors' Association, held at Tybu Island, Georgia, was called to order at noon on Aug. 13, by the president, J. M. Clayton, Atlanta. E. H. Grim, sales manager of the General Electric Company, Atlanta, made an address on "Co-operation."

In the annual report of the president Mr. Clayton spoke at length on co-operation and the duty of the electrical contractors toward the government, especially at this time. He said further that the association was on the eve of an era of great usefulness, as is illustrated by its rapid growth.

The following resolution, presented by President Clayton, was adopted unanimously:

Whereas our government is now actively engaged in warring for the preservation of democratic institutions and ideals and in that fight needs the active support, either moral or physical, of all who love their country, therefore be it

Resolved by the Electrical Contractors' Association of Georgia that we at this time renew our pledges of loyalty to our country and the cause for which she is struggling, and that we offer our best efforts in support of our government.

The annual report of the treasurer showed that the association was in a healthy financial condition.

New by-laws were presented by a committee composed of T. H. McKinny, Hunter Hogue and C. B. McGaukey, all of Atlanta, and adopted unanimously. Alfred L. Brill, Augusta, was elected to membership.

A banquet was held in the evening at the Tybu Hotel; and a number of talks were made.

The nominating committee, composed of H. J. Von Weller, C. F. Ludwig and F. J. Frie, presented the following nominations: President, Norton Frierson, Savannah; first vice-president, Joel H. Weir, Athens; second vice-president, Derando Levy, Columbus; treasurer, Gadsen Russell, Atlanta; secretary, Dan Carey, Atlanta. The nominees were elected unanimously, and the following directors were appointed: F. M. Byrne, F. J. Frie, J. H. McNeil, K. D. White, C. B. McGaukey, J. M. Clayton, H. E. Lowe, H. J. Von Weller, C. F. Ludwig, Sylvester Byck. The executive committee is composed of C. F. Ludwig, chairman; Joel H. Weir, J. M. Clayton, C. B. McGaukey, and Norton Frierson and Dan Carey, ex officio.

R. M. Walker, Atlanta, was elected national director and will represent the association at the convention of the National Association of Electrical Contractors to be held in New Orleans in October.

BUFFALO COMPANY BONDS OFFERED TO CUSTOMERS

Convertible Debentures Can Be Bought by Them
on the Installment Plan if They Desire—
Dividend Rate Is Raised

The Buffalo General Electric Company is offering an opportunity to customers to share in the profits and have a voice in the management. Letters have been sent to customers offering them the first opportunity to buy the new five-year 6 per cent convertible debenture bonds, dated Aug. 1, 1917. In order to interest as many customers as possible the company has issued bonds in denominations of \$100, \$500 and \$1,000. Charles R. Huntley, the president of the company, in his letter to customers, says:

"After Aug. 1, 1919, you will have the privilege of exchanging your bonds for stock, obtaining one share of stock for every \$100 in bonds. This stock under war conditions is selling at \$103 per share, and under normal conditions has sold above \$110 per share, and is now paying dividends at the rate of 7 per cent.

"An opportunity is also given to pay for bonds under an installment plan through the Buffalo Trust Company, the company's financial agent."

The Buffalo General Electric Company increased its dividend rate from 6 to 7 per cent with the last quarterly payment, which was $1\frac{3}{4}$ per cent instead of the usual $1\frac{1}{2}$ per cent. In commenting upon the increased rate, Mr. Huntley said:

"The dividend increase within two years after the broad reduction in meter rates reflects exceptional credit on the management of the company and represents, not only a healthy growth in business, but also economies and efficiency in administration to offset the general increase in costs of all machinery and equipment."

NEW LAMP CONTRACTS FOR CENTRAL STATIONS

Committee of National Electric Light Association
Issues Information Concerning Agreements
Offered by the Manufacturers

The lamp committee of the National Electric Light Association, of which Frank W. Smith is chairman, has sent to member companies a circular regarding new forms of lamp contracts. It says in part:

In the report of your committee for the current year announcement was made of a new form of contract then in contemplation by the lamp manufacturers, and it was stated that the committee would bring directly to the attention of the member companies at a later date detailed information with reference to this subject.

Contracts which are now offered are in the form of alternative agency agreements known as Forms CB and CA, the former being used where the total annual lamp requirements of a central station amount to over \$7,500 and the latter being used where the lamp requirements are under \$7,500 for a year.

The contracts provide for delivery to the central station on consignment of incandescent lamps which may be disposed of under the following conditions:

1. Under the Form CB only the sale of lamps through dealers (CBA agents) who hold appointment through the central station company.

2. The sale of lamps directly to customers of the central station company at standard prices.

3. The supplying of lamps by central station companies to their customers through free renewal, without charge, through some service arrangement involving a charge, or the sale of lamps at a price that shall not be greater than an amount equal to the manufacturer's prevailing list price less all discounts.

It will be seen that under this new form of contract central station companies are appointed as agents for the manufacturers for the sale of large incandescent lamps (miniature excluded), i.e., standard types and sizes of Mazda and Gem lamps, and that under this arrangement the lamp stock is consigned by the manufacturer and paid for as sold by the central station company.

All lamps so distributed are subject to the basic percentage varying in accordance with the net value of lamps sold during the agreement period. In addition to this compensation percentage there is a 5 per cent compensation for prompt monthly report of sales and cash payment therefor. This compensation may be taken on all monthly returns to the manufacturer, provided that sales reports are rendered and accounts settled in cash by the tenth of the following month.

Central stations eligible to Form CB appointments (central stations purchasing lamps to the amount of \$7,500 a year) are privileged to appoint local dealers as their agents, and on the lamps sold by these agents an additional compensation of 5 per cent from the list is allowed. Form CA agents (central stations purchasing lamps in an amount less than \$7,500 a year) are not privileged to appoint local distributors as their agents, and the additional 5 per cent compensation from list referred to above does not therefore apply.

Central stations adopting either the CB or CA agency appointment and who distribute lamps to customers without cost (free renewals), or who distribute lamps to their own consumers at some service charge or at cost (manufacturer's list price less all discounts), receive on lamps so distributed an additional 5 per cent from the list.

The manufacturers have issued descriptive pamphlets in the nature of instructions, one for Form CB agents (central stations purchasing annually more than \$7,500) and the other for Form CA agents (central stations whose annual purchases are less than \$7,500). These pamphlets describe the conditions and requirements of the new forms of agreement and are set forth in considerable detail.

Form CB member companies (central stations purchasing lamps to the amount of \$7,500 a year) will have to decide whether it will be more profitable or satisfactory to sell lamps directly to customers at standard prices or to have

them distributed to its customers through dealers, or they may do both.

Form CA member companies (central stations purchasing lamps in an amount less than \$7,500 a year) are not privileged to appoint dealers as their agents and therefore are limited to their own efforts in the sale of lamps.

It will be apparent that only those central stations that sell lamps to consumers above net cost and below established prices and desire to continue the practice are eliminated from the list of those who can be served under the agency forms of agreement.

It is suggested that for full and complete information you consult the manufacturer serving you or your territory. The committee, of course, will be glad to be helpful in any way possible.

HEARINGS ON THE INDIANA RATE CASES

Applications of Individual Companies for Authority
to Add a War Surcharge of 30 per Cent
Under Consideration

A three-day hearing on the petitions of electric companies for permission to add a surcharge of 30 per cent in rates to customers was begun on Monday afternoon, Aug. 20, before the Indiana Public Service Commission.

After general matters relating to the consolidated hearing had been handled, the petition of the Browne-Mills Electric Company of North Manchester was taken up. The city of North Manchester was represented among the protestants. Other petitions to be considered during the day were from the Batesville Electric Light & Power Company, the Madison Light & Railway Company and the Oakland City Light & Power Company.

The hearing on Tuesday centered on the petitions of the Rockport Water Works Company, the Owensville Light Company and the Boonville Electric Light & Power Company.

The petitions of the Martinsville Gas & Electric Company, the Indiana Utilities Company and the Wabash Valley Electric Company were heard at the Wednesday meeting.

The original petition was in the name of the Indiana Electric Light Association, and nearly all of the electric companies in the State joined. The commission decided that the right of the association to petition on behalf of its various members was questionable, and ruled that each company seeking war relief should file a separate petition. In complying with the commission's ruling about one-half of the companies included in the original petition filed separate applications, and the others apparently dropped out, or have not yet decided what course to follow. Among the companies which failed to refile surcharge petitions was the Interstate Public Service Company, which furnishes electric service to many Indiana cities and towns. A hearing has been held on the petitions of the Indianapolis Light & Heat Company and the Merchants' Heat & Light Company, Indianapolis, as reported in last week's issue of the ELECTRICAL WORLD.

Several electric companies which were petitioning the commission for authority to add surcharges to service bills because of war price increases announced on Aug. 22 their withdrawal of the petitions following the promulgation of coal prices by President Wilson. The commission did not announce what action it would take on the petitions of companies already heard.

A. I. E. E. COMMITTEES ARE APPOINTED FOR NEW YEAR

Work of Patent Committee and Committee on Development of Water Power Now in Engineering Council

The first meeting of the board of directors of the American Institute of Electrical Engineers for the administrative year beginning on Aug. 1, 1917, was held at the headquarters, New York, on Aug. 14. There were present President E. W. Rice, Jr., Past-president John J. Carty, Vice-presidents B. A. Behrend, L. T. Robinson and A. S. McAllister, Managers F. B. Jewett, William A. Del Mar, John B. Taylor, C. E. Skinner, Charles Robbins, N. A. Carle, E. H. Martindale and Walter A. Hall, Treasurer George A. Hamilton and Secretary F. L. Hutchinson.

President Rice announced the appointment in part of the committees for the administrative year. The chairmen of the committees appointed are:

Finance, N. A. Carle, Newark, N. J.
Board of examiners, A. S. McAllister, New York.
Editing, W. I. Slichter, New York.
Meetings and papers, L. T. Robinson, Schenectady, N. Y.
Sections, Walter A. Hall, West Lynn, Mass.
Student branches, P. H. Daggett, Chapel Hill, N. C.
Code, Farley Osgood, Newark, N. J.
Standards, C. A. Adams, Cambridge, Mass.
Headquarters, N. A. Carle, Newark, N. J.
Code of principles of professional conduct, George F. Sever, New York.
Transmission and distribution, L. E. Imlay, Niagara Falls, N. Y.
Lighting and illumination, Edward P. Hyde, Cleveland.
Telegraphy and telephony, L. F. Morehouse, New York.
Electrochemistry and electrometallurgy, F. A. J. Fitzgerald, Niagara Falls, N. Y.
Power stations, Philip Torchio, New York.
Marine, H. A. Hornor, Philadelphia.
Industrial and domestic power, E. H. Martindale, Cleveland.
Electrical machinery, Alexander M. Gray, Ithaca, N. Y.
Instruments and measurements, S. G. Rhodes, New York.
Protective devices, D. W. Roper, Chicago.
Mines, H. H. Clark, Pittsburgh.

The patent committee and the committee on the development of water power were not reappointed, as it was felt that the functions of these two committees now come properly within the scope of the newly organized Engineering Council.

Guido Semenza was reappointed local honorary secretary for Italy for the two years ending July 31, 1919.

In accordance with the by-laws of the Edison medal committee, the board elected from its membership John J. Carty, B. A. Behrend and A. S. McAllister to serve on the committee for two years, and L. T. Robinson to serve for one year to fill the unexpired term of a retiring member of the board of directors.

Upon recommendation of the board of examiners seven students were ordered enrolled, eighty-eight applicants were elected to the grade of associate, six applicants were elected to the grade of member, nineteen applicants were transferred to the grade of member, and two applicants were transferred to the grade of fellow.

The program of Institute meetings for the coming year was discussed. It was voted to hold the October meeting in Philadelphia on Oct. 8, and the November meeting in New York on Nov. 9. Final decision regarding the rest of the program was deferred until the October meeting.

TECHNICAL STUDENTS ARE NOT EXEMPT FROM DRAFT

Secretary of War Baker, Upon Re-examination of the Statute, Finds that Exemptions Are Limited Specifically

Recently a letter was issued by P. P. Claxton, commissioner of the Bureau of Education of the Department of the Interior, stating that the War Department believed that students in technical schools and colleges who are within the age limits of the selective draft should be treated in the same manner as workers in industries which are devoted to the manufacture of war materials, and that under this ruling presidents of colleges and technical schools might properly urge the district exemption boards to exempt students in their institutions who give promise of special aptitude for the technical and scientific professions until these students have finished their courses. It was stated in the letter that institutional officers would be expected to exercise due caution and not claim exemption for students whose success in technical careers is open to doubt and that each case should be considered by the district exemption board on its own merits, students in technical schools not being exempt as a class.

Subsequently Mr. Claxton was informed by Secretary of War Baker that there is no legal basis for such exemption. Mr. Claxton has therefore given notice that his first letter should be disregarded.

Upon re-examination of the statute Secretary Baker found that the exemptions are limited to persons engaged in industry, including agriculture, and that there is not the slightest statutory warrant for exemptions based upon the importance of preserving continuity of instruction to young men in scientific or other schools and courses.

Mr. Baker expressed deep regret that this error on his part had arisen, and that misunderstanding had been caused to those who are engaged in conducting these valuable scientific educational institutions.

LIGHT SERVICE OFFERED TO CITY OF SPRINGFIELD, ILL.

After Municipal Authorities Turn Off Street Lamps at Midnight Local Company Proposes to Furnish Necessary Energy

The municipal light department of Springfield, Ill., has ordered that all street lights be extinguished at midnight, alleging that the financial condition of the city necessitated this action.

A. D. Mackie, vice-president and general manager Springfield Gas & Electric Company, stating that the service of the associated railway company had been jeopardized by the abandonment of service, therefore made the following proposal to the city authorities:

In order to eliminate as far as possible any danger arising from such condition of unlighted streets, this company offers to make the necessary connections between its power plant and the city's street lighting switchboard, and furnish the necessary electric energy to light all of the city's street lamps after midnight. For the electric energy so furnished this company will accept the rate now being charged the city by its own lighting department for such service.

Inasmuch as the commissioners announce that the city is without credit, this company will extend credit for the payment for such service until the city is in funds.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Validity of Commission's Order in Rate Discrimination.—An order of the Corporation Commission requiring that natural gas be furnished to the board of education of the city of Guthrie for heating the public schools at a rate different and less than that charged to other consumers is not, by reason of the discrimination in favor of the public schools alone, invalid, the Supreme Court of Oklahoma held (166 P. 128). By law jurisdiction is conferred upon the Corporation Commission over all public utilities, with the power to fix and establish rates and prescribe rules, requirements and regulations affecting their services and operation and the management and conduct of their business, and under the powers thus conferred the commission is vested with authority to make all valid and lawful orders prescribing rates which the State, in the exercise of its sovereign capacity, has the power to prescribe or make.

Valid Contract for Service Enforceable.—In the case of Wackenhut vs. Empire Gas & Electric Company (166 N. Y. S. 29) the Supreme Court in Cayuga County, New York, held that a gas and electric company which entered into a contract with the mayor of a city to furnish service at certain rates in consideration of his dismissing a suit against the company, and which furnished service at those rates for a number of years, was thereafter estopped from denying the validity of the contract on the ground that it was ultra vires as to the city. In December, 1905, the Mayor of the city of Auburn filed a petition with the Commission of Gas and Electricity requesting it to fix the illuminating power, purity, pressure and price of gas in that city. Hearings were had before the commission, and all the evidence on the part of the petitioner had been furnished and an adjournment was taken to permit the Auburn Gas Company to furnish its evidence. During that adjournment representatives of the gas company and the city had various negotiations which culminated in a contract dated July 9, 1906. The defendant has since merged and taken over the properties, franchises, etc., of the Auburn Gas Company, and carried out the terms of the contract until on or about Aug. 1, 1910, since which time it has refused to furnish service in accordance with the contract which it had signed. The defendant declined to be bound by the terms of the agreement, claiming that the contract is illegal because made in perpetuity, also that it is ultra vires and void because neither the Mayor nor the city of

Auburn had any authority to make it, and finally, because it was not a party to the contract, which was made by its predecessor. It was the conclusion of the court that the defendant is estopped from questioning the validity of the contract, which was made at its solicitation, which it has acted upon, and from which it has derived substantial benefits, and that it is valid and enforceable, at least during defendant's corporate existence, unless the terms of the contract, in so far as they attempt to fix the price at which gas should be furnished, should be superseded by rates fixed by the Public Service Commission, but until the determination of that question by said commission the contract is enforceable during the term of the defendant company's corporate existence.

Los Angeles Denied Right to Order Private Company to Discontinue Service.—In an action recently instituted by the Los Angeles Gas & Electric Corporation against the city of Los Angeles, Federal Judge Bledsoe has handed down a decision declaring that the city of Los Angeles exceeded its police powers in attempting to compel the private company to relocate parts of its system in order that the municipal street-lighting system might be properly constructed. The suit was filed when the City Council passed an ordinance providing that upon the proper notice to the private company poles and other property in the public streets of said city should be removed or relocated when necessary to provide for proper construction of the city's municipal street-lighting system. Upon seeking to enforce this ordinance and to compel the private corporation to relocate certain wires and cross-arms on one of the public streets of said city, the corporation sought by injunction to restrain the operation of the ordinance. A preliminary injunction was issued by the court and incidentally in due course the preliminary injunction was made final, the court declaring the ordinance null and void, upon the ground that it was not a proper exercise of the police power of said city and upon the further ground that there appeared to be no necessity for the regulation provided for in said ordinance. In commenting on the issue brought up for adjudication by the suit, Judge Bledsoe said: "I am in entire harmony with a plan of municipal improvement such as has been projected in the city of Los Angeles and as is here under consideration. I am, however, also firmly of the belief that until the city, by purchase, appeal to eminent domain, or otherwise, has lawfully and properly and justly eliminated competition it must meet its competitors as any other private agency would be compelled to meet them and must stand with them in the same relation to the law and let its success be measured by its ability satisfactorily to serve the public rather than by its power through the exertion of public functions to occupy a position of supremacy in the field which it deliberately has chosen to invade."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Department Change in Pennsylvania Commission.—The Pennsylvania Public Service Commission has consolidated its bureaus of engineering and rates and tariffs into one division, to be known as the department of engineering, rates and tariffs, under the general direction of Herbert C. Hoover, chief engineer of the commission.

Duplication of Facilities Denied in Arizona.—The Arizona State Corporation Commission has refused to grant the application of Sanguinetti & Uwing of Yuma for authority to install a duplicate electric light and power system for Yuma. Service is being obtained from the Yuma Light, Gas & Water Company, which obtains its energy from a California hydroelectric transmission system. The commission says: "A duplication of facilities resulting in unnecessary investments is certain to react against the consumer in the end, for the consuming public must bear the burden of maintaining two institutions where one would suffice."

Savannah Rates Again Under Consideration.—The Georgia Railroad Commission is to give a hearing to a petition from the Savannah Electric Company for permission to make a new and lower rate for electric power in wholesale quantities. The average rate which the company proposes to put in force is 8½ mills per kilowatt-hour, a reduction of about 15 per cent for electric power in large quantities. The Savannah Lighting Company has filed a protest against the granting of this rate, desiring that the higher rate now charged be retained. It is said this company will fight the reduction. The reason the commission has to pass on the new and lower rate is because it is a departure from the percentage rates which the commission has laid down.

Hearings on Regulatory Legislation in New York.—The New York Public Service Commission, First District, will continue on Sept. 17 hearings begun last week under the novel plan for "drafting legislation in the open." It is the purpose of the commission to obtain a thorough hearing of amendments proposed to the statutes under which it works, both as to such amendments desired by it and as to such as are proposed by corporations and individuals. At the first hearing last week proposals were made that all water companies, either municipal or private, within the State should be placed under the jurisdiction of one or the other of the two commissions. A bill was also proposed by which reparation of overpayments by consumers of gas and electric energy would be possible.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Denver Bonds Legal for Savings Banks.—The Denver Gas & Electric Light Company first and refunding mortgage 5 per cent sinking fund bonds have been legalized for savings bank investment in Maine and New Hampshire. This is in accordance with recent acts of the Legislatures.

Electric Fan Serves as Pulmotor.—The other day a worker employed at an East St. Louis (Ill.) industrial plant was overcome by ammonia fumes. In the absence of a pulmotor an electric fan was used to force a current of air into his mouth and nostrils. The treatment was effective and the man was restored to consciousness.

Nebraska Power Company Offers Stock.—The Nebraska Power Company, Omaha, is offering a limited amount of 7 per cent preferred stock at par to employees and patrons. The stock may be bought by an initial payment of \$10 and subsequent payments of \$10 per month per share with 6 per cent interest on the partial payments. This company acquired recently the Omaha Electric Light & Power Company.

Rate Settlement in Idaho.—The controversy between the City Council of Sandpoint, Idaho, and the Northern Idaho & Montana Power Company over lighting rates, which has been under way since last May, has been terminated. The rate for arc lights has been reduced from \$72 per year to \$60, and residence lighting from 15 cents per kilowatt-hour to 12 cents for the remaining two years of the contract. The street-lighting rate will date from May 1, and the residence rate from Sept. 1.

Jovian Order Asks Names of Members Who Are Now in Service of Uncle Sam.—As reported previously in these columns, the Jovian Order has adopted the policy of suspending payment of dues for the period of enlistment of Jovians who enter military service. The order is encountering some difficulty in obtaining the names of such members. It therefore requests that Jovians who enlist inform the Jovian central office, Syndicate Trust Building, St. Louis, so that proper records may be made. It also requests that those who know of Jovians in the service advise the central office.

Undeveloped Water Power Resources in Inland Empire.—At a recent luncheon of the Spokane (Wash.) Chamber of Commerce Carl F. Uhden, chief engineer Washington Water Power Company, gave an illustrated lecture on the water-power resources of the Inland Empire. There are about 250,000 hp. now developed, according to Mr. Uhden, and

at least 2,000,000 hp. undeveloped in the territory. The cost of furnishing the power is estimated at \$25 per year per horsepower for manufacturing purposes. The views included the power plants of the company in Spokane with 15,000 hp. capacity, the Long Lake plant with 45,000 hp. capacity, and the Little Falls plant with 36,000 hp. capacity.

Jovian State Fair Exhibit.—The outstanding feature of the exhibit which will be managed by the Minneapolis Jovian League at the Minneapolis State Fair, Sept. 3 to 8, will be an immense relief map of the properties of the Northern States Power Company, showing transmission lines, cities, rivers, waterfalls, etc. Apparatus on the map which measures 32 ft. by 34 ft. (9.7 m. by 10.3 m.) will be entirely electrically operated. The general plan of the league's participation in the State Fair is that the league has rented an entire building and has resold exhibit space to electrical jobbers, dealers, contractors and the central station company. Norman O'Neil was appointed general manager of the Jovian exhibit.

Purchases of Stock by Baltimore Consumers.—On June 30, 1917, a total of 2332 consumers of the Consolidated Gas, Electric Light & Power Company of Baltimore were purchasing 15,177 shares of stock. The total subscription price is \$1,721,034. Of the total, seventy-one consumers had completed payments for 345 shares. When consumers complete payments President Herbert A. Wagner sends them a letter saying, in part: "The price at the time you accepted the offer was \$106.50. Since then the subscription price has been increased from time to time, and subsequent subscribers are acquiring shares at the higher prices, but as these mature later the benefit of enhanced market value points to results comparing favorably with those secured to the earlier subscribers. The company is in a much stronger position than at any time in its history because of higher earnings, notwithstanding the lower rates charged for gas and electricity. The following statement shows exactly how your stock was paid for: Subscription price (ten shares), \$1.065; cash payments actually made by you, \$983.05; balance, \$81.95; allowance by company made up of: interest at 6 per cent allowed on your payments, including adjustment of dividend accrued on stock at date of final payment, \$50.70, and your proportion of amount received from sale of stockholders' rights to subscribe for new securities issued by the company in November, 1916, \$31.25, or a total for the two items of \$81.95. You have thus already received a return of \$8.19 per share on your investment on the basis of the original price, or \$16.69 per share based on a market price of \$115. At the time of your subscription the dividend rate was 7 per cent. This has recently been increased to 8 per cent. You will therefore from now on receive a dividend of \$8 per share per year, paid at the rate of \$2 every three months, and at the same time profit by the increasing market value of the stock."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Alabama Association Meets in October.—The Alabama Light and Traction Association will hold its next meeting in Birmingham, Ala., on Oct. 23.

Kansas Public Service Association.—This association will hold its annual meeting at Salina, Kan., Oct. 19 and 20. W. W. Austin, Cottonwood Falls, Kan., is secretary.

International Association of Municipal Electricians.—The annual convention of this association will be held on Sept. 11 to 14 inclusive at Niagara Falls, N. Y. Clarence R. George is secretary.

Contractors to Hold Annual Convention in New Orleans.—The annual convention of the National Electrical Contractors' Association will be held on Oct. 10 to 13 at New Orleans, La. H. C. Brown, Utica, N. Y., is secretary of this association.

Paducah Company Employees Organize Club.—The High Tension Club has been organized by employees of the Paducah Light & Power Company of Paducah, Ky., to promote co-operation and general efficiency. H. A. Barbero is president and Frank M. Swift secretary.

Georgia Electrical Contractors' Association.—Ways in which electrical contractors and engineers can render valuable service to the United States government in the present emergency was the subject for discussion at the recent meeting of the Georgia Electrical Contractors' Association in the Winecoff Hotel, Atlanta, Ga.

Oregon Association of Electrical Contractors and Dealers.—The next annual convention of the Oregon Association of Electrical Contractors and Dealers will be held in Eugene, Ore., Sept. 17 and 18. At the last convention, held in Portland, there were about 200 dealers and contractors present, and while the local dealers do not expect as many to be present at the convention to be held in Eugene, they look for an attendance of from 100 to 150 to discuss trade problems.

American Electrochemical Society.—The next meeting of the American Electrochemical Society will be held at Pittsburgh, Pa., Oct. 3 to 6. Prof. J. W. Richards, Lehigh University, Bethlehem, Pa., is secretary. One of the features of this meeting will be a session devoted to the application of electrochemistry and electric furnaces to the manufacture of war supplies and munitions. An address by Alex Dow, president of the Detroit Edison Company, on "Production of Steam from Coal," will be another of the features of this meeting.

W. B. McSpadden has been appointed new-business manager of the City Light & Water Company, Amarillo, Tex., succeeding C. B. Buck in that position.

B. J. Crahan, who for the last eight years has been superintendent of the Joplin (Mo.) Gas Company, has been promoted to the management of the Port Huron (Mich.) Gas & Electric Company.

Andrew W. Rogers has been elected president of the Beverly Gas & Electric Light Company of Beverly, Mass., succeeding the late Sidney W. Winslow, who was president of the company for twenty-seven years.

David H. Cronheim has been appointed general sales manager of the Alabama Power Company, Birmingham, Ala., to succeed Theodore Swann. Mr. Cronheim has been assistant sales manager under Mr. Swann.

Walter B. Purse, formerly superintendent of construction of the Savannah Electric Company, Savannah, Ga., is now manager of the Griffin Lighting Company of Griffin, Ga. Mr. Purse will also be directing head of the water, sewerage and drainage commission of Griffin.

Jameson L. Finney has become superintendent of the Rumford Falls (Me.) Light & Power Company branch at Dixfield and East Peru. Mr. Finney has been employed with the electric light company at Bethel and for several years was with the Oxford Electric Company.

Stacy C. Richmond of New York City has been elected president of the Niagara Falls Power Company, the Niagara Junction Railway Company and the Niagara Development Company to fill the post left by Edward A. Wickes, resigned. Mr. Richmond has been a member of the boards of the allied companies for many years.

R. E. Carlson, who was formerly a member of the firm of Hoppin & Company, engineers, Peoria, Ill., has severed his connection with that organization in order to inspect the material produced for the government by the Nash Motors Company, Kenosha, Wis. Mr. Carlson recently received a commission as captain in the ordnance department.

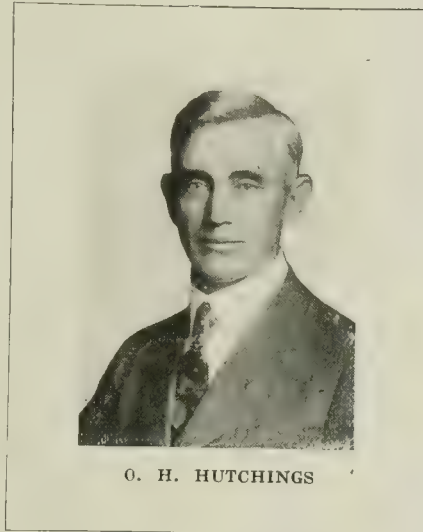
Howard Walker, who has had many years' experience in the operation and construction of public utilities, has become identified with the Interstate Electric Corporation. He is also president and general manager of the Palestine (Tex.) Ice Company, the Palestine Water Works Company and the Jacksonville (Tex.) Electric & Ice Company.

Theodore Swann, who has been sales manager of the Alabama Power Company for the past three years, has resigned to become president and general manager of the Southern Manganese Corporation. The Southern Manganese Corporation is now operating six electric furnaces in the production of ferromanganese. The works are in Anniston, Ala., and the general office is in Birmingham, Ala.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

Orie H. Hutchings, associate general manager and engineer of the Dayton Power & Light Company, was recently elected president of the Ohio Electric Light Association. Mr. Hutchings has been identified with the electric lighting and power industry since 1892, at which time he entered the service of the Dayton Electric Light Company, a predecessor of the Dayton Power & Light Company. After successfully filling several positions of less respon-



O. H. HUTCHINGS

sibility, he was made superintendent in 1907. With the further development of the company, which included the acquisition of several operating companies in places surrounding Dayton, he was promoted to the position of general superintendent and engineer, this promotion occurring in 1912. In July, 1915, he was promoted to his present position. Mr. Hutchings has been active in the work of the Ohio Electric Light Association for a number of years and has served on several important committees during this time. He is also identified with the National Electric Light Association, the American Institute of Electrical Engineers, and is an active member of the Dayton Engineers' Club.

J. F. Usener, formerly chief engineer of the Houston Electric Company, has been made chief engineer of the Galveston-Houston Interurban Company. He succeeds Charles Learmouth, who has been sent to El Paso to become chief engineer of the El Paso Electric Company. Mr. Usener has been with the Houston Electric Company ever since the system was electrified, and until recently was in charge of the power plant. He will now have charge

of the plants at League City, La Marque, South Houston and Sampsen Street.

C. H. Holway has been transferred to Schenectady as engineer and inspector in that territory for the Underwriters' Laboratories.

C. B. Buck has been appointed new-business manager of the Durham (N. C.) Traction Company. Mr. Buck was new-business manager at Amarillo, Tex.

Harry Hollis, who has been electrical engineer with the Reading Transit Company, has resigned to become associated with the Bethlehem Steel Company, Lebanon.

H. C. Mathey, formerly assistant engineer for the Underwriters' Laboratories, recently resigned his position to become laboratory superintendent for the Okonite Company.

R. B. Shepard, who heretofore has represented the Underwriters' Laboratories at Schenectady, has been appointed assistant electrical engineer at the New York office of the Laboratories.

E. P. Slack, formerly assistant electrical engineer at the New York office of the Underwriters' Laboratories, has been appointed assistant engineer in charge of factory inspections and label service at this office.

Francis L. O'Bryan, well known as a designer of electric semaphore signals and electrical engineer of the Boston & Worcester Street Railway, has joined the purchasing department of the Edison Electric Illuminating Company of Boston, Mass.

A. B. Cheadle, who has had charge of the legal department of W. S. Barstow & Company, operators of public utilities, has become associated with the General Engineering & Management Corporation and is in charge of the legal department. The General Engineering & Management Corporation acts as engineer and manager for the subsidiary operating companies of both the Interstate Electric Corporation and the Commonwealth Light & Power Company.

Robert W. Adams was elected president of the Providence (R. I.) Engineering Society at its recent annual meeting. Mr. Adams was graduated from the Worcester Polytechnic Institute in 1904 and received the degree of electrical engineer in 1908. He has been connected with the General Electric Company for the last nine years and is at present manager of the Providence office. He is an active member of the Rhode Island Council of Defense and other civic organizations.

Obituary

Dr. R. M. Parks, formerly professor of chemistry in Louisville (Ky.) schools and city gas and electrical inspector since the office was created four years ago, died recently from cancer at his home in Louisville. Successive operations, one involving amputation of the right leg, failed to give relief.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

EVIL EFFECTS CAUSED BY PRICE PROTECTION ORDERS

Not Many Manufacturers Comply with Jobbers' Resolution Calling for Discontinuance of Former Practice

Dissatisfaction has been expressed quite frequently of late over the attitude of manufacturers in continuing to announce increases in prices long in advance. Distributors generally prefer now to have these announcements simultaneously with the advance. In fact, the Electrical Supply Jobbers' Association, at its May meeting at Hot Springs, adopted the following resolution:

"Resolved, That it is the sense of this association that the interests of all concerned would be better served if protection orders or contracts were not accepted by manufacturers, and, further, if information regarding price advance were not given before the advance becomes effective."

This resolution was not without effect, because a number of manufacturers at once took steps to adopt the suggestion. However, the practice is by no means universal. It is thought, perhaps, that the majority of manufacturers do not believe that the distributors really wish to do away with price protection orders, because before the war the jobbers were very eager to know about coming price advances before they took effect.

There seems little doubt, however, now that the jobbers fully realize the evil effect that such a condition makes. For instance, a good many months ago the trade was tipped off concerning a coming advance in flexible metallic armored conductor, and as a result loaded up. The natural effect followed. A buyer to-day can go into the market and get almost any quotation on this material. Most of the quotations, it will be found, are less than the material can be purchased for direct from the manufacturers in carload lots. Those distributors who laid in a normal or slightly more than normal stock find now that they must compete with this over-stock that was purchased at rock-bottom prices.

Besides, those who purchased this abnormal stock found, to their sorrow, that they had tied up quantities of money for some time. Their credit was impaired, therefore, to that extent.

A far greater misfortune, however, is the effect the situation is having on the market in general. It is difficult to convince these distributors that although they laid in stocks at very low prices they should charge current market prices—prices that would show a satisfactory profit over present-day manufacturers' quotations. On the other hand, if no advances had been announced ahead of time the distributors naturally would stick to current market quotations. When prices begin to tumble, of course, these unwise distributors will realize their mistake, but then it may be too late.

Not only has this situation been acute as regards armored conductor, but also concerning sockets, switches, plugs, receptacles and similar brass goods, and as to certain heating appliances, principally flatirons.

Just a few weeks ago, when dry batteries advanced, one prominent manufacturer held back any announcement until the advance actually took effect. Some competitors, however, followed the older method of tipping the trade off in advance. Naturally the effect desired by the one who held back was lost.

From the manufacturers' standpoint, of course, there can be almost no logical excuse. Factories are loaded up with work and are not even able on the whole to come near normal deliveries. Business is being turned away right along, because the goods cannot be turned out fast enough.

Consequently, there is no need for business stimulation. In fact, if the jobbers were loaded up to too great an extent, such a policy might act as a boomerang, leaving the manufacturers high and dry when they had finished turning out the goods ordered under the bait of low price.

ELECTRICAL EXPORTS FOR MAY AMOUNT TO \$4,588,711

Foreign Trade for First Five Months of Current Year Reached Total of \$23,000,000, in Comparison with \$14,000,000 for First Five Months of 1916

During the month of May last electrical merchandise was exported from the United States totaling \$4,588,711 in value, or considerably over \$1,000,000 more than was exported during May, 1916. This brings the total for the first five months of 1917 up to \$22,968,062, in comparison with \$14,216,086 for the first five months of 1916. Based on the figures of the first five months of the current year, the electrical exports for 1917 should be in the neighborhood of \$55,000,000.

Although the total exports for May were roughly \$600,000 under the record of March last, the falling off was principally in items of a miscellaneous nature. To a large degree this can be attributed to import regulations of foreign countries on a number of items not necessities. However, during the month of May last records were set in the export of fans and again in the export of metal-filament lamps. The export of fans during that month amounted to \$67,000, which is but a slight increase over the previous record, while the export of lamps amounted to \$345,000, which is roughly \$130,000 more than the record established in April.

Figures for the eleven months ended May last show a total export of electrical goods of \$46,321,910, in comparison with \$27,103,876 for the eleven months ended May, 1916, and \$17,724,676 for the eleven months ended May, 1915. Of course, to a very great degree much of this increase can be attributed to an increase in prices. However, there seems to be no doubt that the total volume of goods shipped abroad is now greater than ever before in the history of the industry. There is a great demand for American goods in those markets which were formerly supplied by the nations of Europe and which have had to curtail or go out of the export field. This is particularly true of those markets formerly supplied by Germany and Austria.

The figures in the accompanying table are the official figures supplied by the Bureau of Foreign and Domestic Commerce:

Articles	May		Eleven Months Ended May	
	1916	1917	1916	1917
Batteries	\$157,397	\$204,526	\$1,409,960	\$2,566,830
Dynamos or generators	133,534	235,768	1,322,996	2,276,929
Fans	33,528	66,604	331,898	403,192
Insulated wire and cables	292,068	627,984	2,867,088	6,558,542
Interior wiring supplies, etc., including fixtures	38,393	121,928	782,150	1,020,933
Arc lamps	2,539	1,643	18,537	14,691
Carbon-filament lamps	9,833	15,438	140,684	136,546
Metal-filament lamps	140,649	345,261	1,148,356	1,785,751
Meters and other measuring instruments	79,641	84,294	703,841	955,077
Motors	428,984	427,224	3,897,827	5,245,908
Telegraph instruments (including wireless apparatus)	16,187	101,940	139,972	519,474
Telephones	358,675	156,917	1,145,381	1,670,352
Transformers	173,988	151,766	937,346	1,103,279
All other	1,572,175	2,047,418	12,257,840	22,064,406
Total	\$3,437,609	\$4,588,711	\$27,103,876	\$46,321,910

INDUCING CUSTOMERS

TO BUY FROM STOCK

Shipping Promises on Special Goods Are Only Approximate and Dependent Upon Several Factors Beyond Producers' Control

Manufacturers for some time have been trying to persuade customers not to order special equipment, but to buy standard equipment from stock whenever possible. Not only are deliveries on special goods very long, but they are uncertain, although a rigid delivery date may be among the stipulations.

One of the large producers of small motors has recently called the attention of its distributors and local houses to this condition in the following language, which well sums up the situation:

"The attention of purchasers of goods which are not in stock should be called to the fact that promises of shipment can, of necessity, not be more than approximate shipping dates.

"Promises of shipment on goods which are not in stock and which must be manufactured after receipt of order cannot be regarded as definite assurances of shipment on the date set. The ability of the company to make shipment of special goods as expected is dependent on many factors beyond its control.

"Under these conditions every effort should be made to induce the customer to accept and use goods which are in stock and can be shipped promptly."

COPPER SHORTAGE MAY DEVELOP

Already Deficiency in Production That Had to Be Made Up from Surplus

Commenting on the copper situation, *Copper Gossip*, published by the National Conduit & Cable Company, has the following observations to make regarding a threatened shortage of copper:

"At the present rate of consumption, it will never do to allow a permanent decrease in the production of copper. The current situation demonstrates how rapidly we are approaching danger from a shortage in supplies of the red metal. During the first half of this year the exports of copper from the United States amounted to 595,353,920 lb.; and estimating domestic consumption at the conservative rate of 110,000,000 lb. a month, the total absorption of copper for the half year is 1,255,353,920 lb. For this same period the aggregate refinery production was estimated at 1,055,000,000 lb., or 200,353,920 lb. less than the quantity required for purposes of domestic manufacture and foreign shipment.

"The deficiency had to be made up from surplus stocks. With the strike conditions at Western mines greatly reducing output it is plainly apparent that an actual shortage of copper may develop in the near future.

NEW YORK METAL MARKET PRICES

	Aug. 13			Aug. 20		
	£	s	d	£	s	d
Copper:						
London, standard spot	125	0	0	120	0	0
Prime Lake	28.50	to	29.50*	to	to	to
Electrolytic	27.00	to	27.50*	to	to	to
Casting	26.00	to	26.50*	to	to	to
Wire base	33.00	to	33.50*	34.00	to	37.00
Lead, trust price	11.00			11.00		
Nickel, ingot	50.00					
Sheet zinc, f.o.b. smelter	19.00			19.00		
Spelter, spot	8.67½			8.40		
Tin, Straits	62.50*			62.75		
Aluminum, 98 to 99 per cent.	46.00	to	48.00*	to	to	to

OLD METALS

Heavy copper and wire	25.00	to	26.00	25.00		
Brass, heavy	15.50	to	16.25	16.00	to	16.50
Brass, light	13.50	to	14.00	12.50	to	13.00
Lead, heavy	9.00	to	9.25	8.50	to	9.00
Zinc, old scrap	6.25	to	6.50	6.25	to	6.75

*Nominal.

THE WEEK IN TRADE

BUSINESS continued firm and steady during the week, with virtually no changes in prices taking place. In some lines there was the customary lull that precedes the fall buying, but this was made up by additional activity in other directions.

There are several price advances contemplated, it is understood, but producers are anxiously awaiting some definite sign from Washington regarding the position that the government is to take in the matter of prices.

Government construction work at the present time holds the middle of the stage, but much of it, such as cantonments, will be completed shortly and will permit producers to turn out their goods through the regular channels. At present government orders have taken the entire capacity of many electrical factories.

The raw materials situation is actually becoming worse, and in the matter of metal conduit particularly is causing considerable anxiety to the trade.

NEW YORK

Seasonal conditions generally prevail in the local market outside of government demands. Business on the whole is well maintained in volume, although the character is changed considerably. Except for government work contractors are not busy. New building is very small, although there is some prospect of its picking up during the fall months. Local owners, bankers, architects, contractors and supply men will probably have a conference on the building situation in the near future.

Prices show little tendency to change. There is so much uncertainty regarding the government's position in connection with prices that producers are generally holding back until some more definite statement comes from Washington.

CONDUIT.—Owing to the underlying conditions in the raw-materials market iron conduit is harder than ever to obtain. Prices, however, remain about the same.

PORCELAIN.—Just as the porcelain situation began to clear up a bit the cantonment demand arose and again tied up the supply. Mills are rushed on standard material, but because the government demand is for immediate delivery it will not be long before the mills will be able to give more attention to the trade.

ARMORED CONDUCTOR.—Local stocks are gradually being cleaned up, a considerable quantity being used in government work in the near vicinity. Some distributors, however, still have some pretty long stocks.

WIRE.—The demand is very steady and prices show but little variation. One manufacturer is quoting on as low as 34-cent base, but most of them are running on 36-cent and 37-cent base. Outlook for fall business is very promising, and already orders are being received. July was the largest month on record for authorized capitalization of new enterprises, some \$400,000,000 being authorized. While, of course, all of this will not go into new building, it is indicative of a rapid growth in new enterprises which must be housed either in new buildings or old where alterations will undoubtedly have to be made. In either event an excellent demand for wire is expected.

INCANDESCENT LAMPS.—Jobbers' stocks, which earlier in the summer were considerably above normal, have shortened until they are now more nearly normal. An excellent business in July reduced local stocks generally.

INSULATION.—The Electrose Manufacturing Company, Brooklyn, N. Y., has received from the United States government a year's contract for the supply of all high-tension insulators for radio installations for both the army and the navy. In effect this is a renewal of last year's contract.

HEATING APPLIANCES.—Business is seasonable, being rather quiet just at present. After Labor Day, however, the demand for holiday stocks generally sets in and a big business is expected. There are rumors of price advances.

CHICAGO

The very definite peace talk of the last week seems fully to have awakened the trade to a realization that there may be some truth in predictions from financial sources that the war will end near the close of 1917. A checking up of sales records in some sources reflects this awakening and shows the situation to be about as follows: A number of large central station syndicates have ordered local operating managers to stop buying. These operating managers are in good shape to obey that order to the letter, because they have on hand staple stocks which are on the average about 100 per cent in excess of their usual quota for this time of year. There is a logical reason for the existence of these stocks. Deliveries have been so poor that stocks larger than ordinary were absolutely necessary. As an instance it may be stated that a certain central station not far from Chicago formerly ordered meters so closely that a delay of one day in shipping would exhaust its stock. This same station now has meters enough ahead to last a month. Some stations have enough meters to last eight months. The natural result is a decrease in orders to manufacturers. The factories, of course, have in some instances eighteen months' business booked ahead, so the situation is not in any sense critical. Nevertheless, cognizance must be taken of the fact that central stations are buying less freely and probably will continue this policy for at least two months.

TRANSFORMERS AND METERS.—It is noticeable that the average size of transformers ordered is increasing with greater rapidity as the necessity for effecting economies grows. One manufacturer states that the average sized unit now purchased is about 12 kw. The same tendency is noticeable in meters, but the increasing demand for 25-amp. instead of 5-amp. watt-hour meters is attributable to range sales.

FUSES.—The volume of business is a little less than normal, but manufacturers are looking to shipbuilding activities to stimulate sales.

VAPOR-PROOF LIGHTING EQUIPMENT.—Industries such as flour mills, which heretofore used any kind of improvised lighting available, are beginning to buy vapor-proof lighting equipment, which is found to be more suited to their needs. The development and more general distribution of these goods, originally intended for munitions factories, into the wider sphere is seen as the natural result of the success and the popularity they earned in extra-hazardous places.

LABOR.—The electrical contractors of Chicago, who have been embroiled in the strike precipitated by union demands for increased wages, are in a very much more optimistic mood than they have been at any time during the trouble. Forty contractors, or 75 per cent of the electrical contracting industry in the city, are at work again, employing men who are members of the new union. This union, known as the American Brotherhood of Electrical Workers, Local No. 1, has been formed with the sanction of the employers since the strike began. The members of this union can, of course, work on jobs with union men of other trades.

BOSTON

A falling off in business compared with last week appears in the New England jobbing trade. High prices, long deliveries and midsummer slackness of general trade appear to be responsible. No price advances, however, were reported within the week. The question of deliveries on steel stampings and conduit is causing much concern. Labor is actively employed, but the building trade is extremely quiet, with poor prospects for this fall. Collections are reported as not so good. Government work is increasing in volume and scope, but on account of the method of parceling it out it is not eagerly sought. It is still any one's guess as to whether prices will go higher, though there is some prospect of lower prices in the coal trade resulting from government action, which will probably ease the industrial situation somewhat. The New England Telephone & Telegraph Company has inaugurated a policy of endeavoring to persuade prospective subscribers who desire telephone service to

delay their immediate demands for new or extensive installations in favor of the government's requirements. It is hoped that by spreading new installation work over a longer period than usual all interests ultimately may be served. Urgent demand for service is handled as usual.

SECOND-HAND EQUIPMENT.—The volume of business shows a moderate reduction in various lines, although the demand for transformers is so keen that none appear to be on the second-hand market. Large generators for industrial plant service, especially in munitions fields, are finding a ready and extended sale. Second-hand steam engines are moving very slowly, but the market for second-hand steam turbines is very active. Prices have in general followed the increases in prices noted in first-hand machinery, but no recent change is noted.

APPLIANCES.—This has been a quieter week in appliance movement, and not much gain is expected until after Labor Day. Prices remain firm and stocks fairly large. An active campaign for holiday orders among central stations began this week.

ELECTRIC RANGES.—Government orders are being filled steadily, and a fair domestic demand is noted in central station exchange sales.

CONTRACTING WORK.—Contractors are busy on government and repair jobs; industrial needs are influential, while domestic requirements are very light. The labor situation is good at present, and the draft has not been serious in its effect to date.

CONDUIT.—Demand continues strong, with deliveries very uncertain and prices most unstable.

ELECTRICAL INSULATING MATERIALS.—A good volume of business is recorded, but there is a dearth of small orders compared with last year. Deliveries are rather long for this class of material. No recent price changes are noted except an advance of 20 to 45 per cent in porcelain earlier in the month, which is now being reflected in the retail trade. Steel stampings are very hard to obtain for auxiliary construction purposes.

ELECTRIC CONTROLLING APPARATUS.—Business is excellent in this field—better than last year. No price advances have been noted since Jan. 1, and no sign of further increases is apparent at this time. Deliveries are inside motor delivery limits.

LAMPS.—The volume of trade holds up well, on the whole. Deliveries on standard sizes are improving and local stocks are increasing. No price changes are anticipated at present.

ELECTRIC VEHICLES.—Industrial electric vehicles continue to grow in popularity in Boston, and additions to existing fleets on the street have been quietly made this summer. The battery exchange system in Boston is clearly a factor in the growth of this business.

FIXTURES.—Movement is fair, but outlook poor for fall trade.

ATLANTA

All sources report business as being excellent with bright prospects for a continued demand in all lines. The erection of many new shipbuilding plants in the Southeast has created a strong demand for marine appliances and standard electrical equipment to be used in the yards. The Tennessee Coal & Iron Company, Birmingham, Ala., has large extensions under way, and it is probable that some big orders for electrical equipment will be placed shortly.

Permission was granted this week to the Georgia Railway & Power Company by the Georgia Railroad Commission allowing this company to issue \$2,500,000 gold collateral notes, which is 50 per cent of \$5,000,000 necessary to complete the developments contemplated. The additional \$2,500,000 will be financed from various sources. Specifications covering electrical equipment are out and it is expected that orders for complete materials and machinery will be placed about the middle of September.

Contract for electrical work at Camp McClelland, Anniston, Ala., including all street lighting, power and interior wiring, has been awarded to T. H. McKinney, Inc., contracting electrical engineer, Atlanta. The camp proper will cover an area of 12 square miles with additional artillery

proving ground. Thirty thousand National Guardsmen will be taken care of, including base hospital, infantry and re-mount station. Definite specifications covering electrical requirements will probably be available next week.

Collections for the Southeast are in excellent shape and average 10 to 15 per cent better than a year ago this time.

TRANSFORMERS.—The demand and deliveries on the large power sizes remain about the same. Deliveries on standard 2300-volt distributing sizes show a slight improvement.

FLASHLIGHTS.—This week's sales show a considerable increase over normal, and prospects look good for a steady increase in this line during the coming fall months.

METERS.—So far this month meter sales are following the normal trend, which has always indicated August as being on the rising curve prior to the peak registered during September. Deliveries on the residence types remain about the same. A strong demand continues for the poly-phase types, and shipments coincide with those promised on standard alternating-current motors.

POLES.—Nearly all utility companies are experiencing considerable difficulty in securing poles for necessary extensions. A large manufacturer with a number of plants throughout the Southeast has increased its facilities and thereby improved deliveries to favorite customers, but the demand exceeds immediate supply and deliveries from all sources are slowing up generally.

DRY BATTERIES.—Jobbers report that rainy weather during the past two weeks had tended to slow up business along this line.

FANS.—There is practically no demand for fans now, as the past two weeks have been cool, and as the season has advanced so far not much activity is expected from now on. One manufacturer reports this year's sales to-date covering the Southeastern territory to be 25 to 30 per cent better than last year. Business last year, however, was slightly below normal.

MOTORS.—This line is tapering off slightly owing to the fact that long deliveries have a tendency to lessen the demand from industrial sources.

WIRING DEVICES.—There is a steady demand and stocks are in fairly good shape. The government requirements have been on a strictly standard basis and have had very little effect on local stocks. A rumor has been circulated in Atlanta that prices on standard devices are to be reduced shortly. Investigators, however, do not seem able to find any authentic source for such information.

CABLE.—There is an apparent lessening in the demand for the heavier sizes, as large industrial work has slowed up for the time.

LAMPS.—Exclusive of government requirements for the 25-watt and 40-watt sizes, considerable activity has been noted this week; stocks are in good shape.

MARINE SETS.—Manufacturers report a good business in this line from the coastal cities during the past week.

ST. LOUIS

Very little change in general conditions has occurred since last week. Hence the usual enumeration of items is omitted in this report. No changes in prices, deliveries or collections were disclosed to the ELECTRICAL WORLD.

While it is true that the aggregate volume of sales is holding up well (the manager of the local office of one of the large companies says that this month now promises to be the best month the office ever had, even better than July), there seems to be a feeling that sales in supply lines may be decreasing. If such a decrease does occur, it may be due partly to the seasonal falling off which always occurs toward the fall of each year. The utility companies make their heavy purchases for summer construction in the spring and early summer, and obviously the purchases for winter construction are light. It may also in a measure be due to the facts, as previously explained in these columns, that utilities are curtailing purchases because of the high prices and that building operations, except those for industrial plants, are below normal.

One sales manager explained to the ELECTRICAL WORLD that while the jobbers' stocks line is not up to normal, considering the United States as a whole, it is in excellent condition, better probably than in most centers. One reason for this situation is that while the freight embargo was in force the manufacturers could not ship in certain directions. Shipments could, however, be readily made to Middle West points, and St. Louis then received her full share of stocks which had there been no embargo probably would have gone to other cities. It has been asserted that the Atlantic Coast cities were in particular affected by this stoppage of shipments and that they have not as yet recovered from it.

Complaint has been made that the payments for equipment furnished to cantonments are not as prompt as they might be. Some of these bills have been outstanding longer than a reasonable time, it has been stated. It could not be ascertained whether the government or the contractors are holding back in this connection.

SEATTLE

Orders from shipbuilding plants continue to dominate all lines of electrical activity. Hotels, offices and building along all lines are practically at a standstill. Small orders from shipbuilding plants for electrical equipment, such as wire, lamps, small motors and the like, swelled the volume of business during the past week. Recent orders were placed by the Chicago, Milwaukee & St. Paul Railway for pole-line equipment and poles to be used in the electrification of the main line from Othello over the Cascade Mountains to Tacoma, via Seattle. The bulk of the electrical material for this work, however, comes from the East. With 148 lumber mills reporting, the following official figures are given out for the past week: Normal production of lumber, 91,400,000 ft.; actual production, 44,512,096 ft. The decrease in lumber production is attributed directly to strikes in logging camps and lumber mills which remain unsettled.

Business along electrical lines, as compared with last week's report, is no better and no worse. Strikes are severely affecting sales of motors, transformers, wire, cable, lamps and the like to industries. Shipyard demand shows very slight increase. Stocks are low and buying light, just enough to supply demands. High prices of material are retarding the usual heavy fall buying. Credits and collections are good.

MOTORS.—Sales are dropping off as compared with two months back. Deliveries are slow, prices are increasing slowly, and stocks are low. Comparative heavy sales are expected as soon as the lumber strikes are settled and maximum price is reached.

FANS.—Sales are falling off with coming of fall. During the summer sales on sixes and fours were very satisfactory. Sales were pushed.

HOUSEHOLD DEVICES.—Electric sewing machines sales were pushed recently, and the result was very satisfactory; deliveries and supply meet demand. Washing-machine sales are picking up slightly, owing to the activities of dealers and central stations. Demand is being filled with but little difficulty. Heating-appliance sales are fairly satisfactory; deliveries are good and prices about the same. Electric ranges are moving satisfactorily, with prices about the same and deliveries fair.

WIRING DEVICES.—Demand is far below normal, owing to lack of building. Prices about the same.

POLE-LINE MATERIAL.—Most of the sales are for maintenance work only, and these are light. No new construction is anticipated until the present high prices subside and conditions are more settled. No particular change is seen in prices now. It is hard to obtain stock. These conditions also apply to wire and cable.

CONDUIT.—There has been a slight increase in demand. Stocks are low and deliveries very unsatisfactory. No increase is noticed in price.

LAMPS.—There is the usual seasonal demand. Sales are expected to increase materially in about a month. Large quantities are hard to obtain, although the various types are coming through fairly well.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor		List, per 1000 Ft.
B. & S. Size		
No. 14 solid.....		\$61.00
No. 12 solid.....		71.00
No. 10 solid.....		90.00
No. 8 solid.....		106.00
No. 6 solid.....		145.00
No. 10 stranded.....		95.00
No. 8 stranded.....		115.00
No. 6 stranded.....		160.00
No. 4 stranded.....		205.00
No. 2 stranded.....		266.00
No. 1 stranded.....		315.00

Twin-Conductor		List, per 1000 Ft.
No. 14 solid.....		104.00
No. 12 solid.....		135.00
No. 10 solid.....		185.00
No. 8 stranded.....		235.00
No. 6 stranded.....		370.00
No. 4 stranded.....		575.00

BATTERIES, DRY—Continued CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 30.....	.35	.35
50 to barrel.....	.31 to .31½	.32 to .32¾
Barrel lots.....	.28 to .28¾	.29 to .29¾

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Size, In.	Conduit, List per Foot	Couplings, List	Elbows, List
1/4.....	\$0.08 1/2		
3/8.....	.08 1/2		
1/2.....	.08 1/2		
3/4.....	.11 1/2		
1.....	.17		
1 1/4.....	.23		
1 1/2.....	.27 1/2		
2.....	.37		
2 1/2.....	.58 1/2		
3.....	.76 1/2		
1/4.....	\$0.05	\$0.19	
3/8.....	.06	.19	
1/2.....	.07	.19	
3/4.....	.10	.25	
1.....	.13	.37	
1 1/4.....	.17	.45	
1 1/2.....	.21	.60	
2.....	.28	1.10	
2 1/2.....	.40	1.80	
3.....	.60	4.80	

NET PRICE PER 1000 FT.—NEW YORK

Single-Conductor		List, per 1000 Ft.
No. 14 solid.....		\$54.90 to \$61.00
Less than coil.....		48.80 to 59.17
Coil to 1000 ft.....		
No. 12 solid.....		63.90 to 71.00
Less than coil.....		56.80 to 68.87
Coil to 1000 ft.....		

Twin-Conductor		List, per 1000 Ft.
No. 14 solid.....		\$78.00 to \$104.00
Less than coil.....		75.00 to 80.00
Coil to 1000 ft.....		
No. 12 solid.....		121.50 to 135.00
Less than coil.....		108.00 to 130.95
Coil to 1000 ft.....		

DISCOUNT—CHICAGO

Single-Conductor		Discount
Less than coil.....		+10%
Coil to 1000 ft.....		10%

Twin-Conductor

Less than coil.....	+10%
Coil to 1000 ft.....	10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1 1/2 std. pkg.....	—10% to 12%
1 1/2 to std. pkg.....	10% to 20%
Std. pkg.....	34% to 44%

DISCOUNT—CHICAGO

Less than 1 1/2 std. pkg.....	12% to +20%
1 1/2 to std. pkg.....	20% to 30%
Std. pkg.....	30% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28	.29

NET PER 1000 FT.—NEW YORK

Less than Coil	Coil to 1000 Ft.
3/8-in. single strip.....	\$67.50 to \$75.00 \$60.00 to \$69.75
3/8-in. double strip.....	71.75 to 75.00 63.75 to 72.00
1/2-in. single strip.....	90.00 to 100.00 80.00 to 93.00
1/2-in. double strip.....	95.00 to 100.00 85.00 to 96.00

NET PER 1000 FT.—CHICAGO

Less than Coil	Coil to 100 Ft.
3/8-in. single strip.....	\$75.00 \$63.75
3/8-in. double strip.....	78.75 71.25
1/2-in. single strip.....	100.00 \$65.00 to 85.00
1/2-in. double strip.....	105.00 85.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
3/4.....	.15	2.....	.55
1.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$55.00 \$24.50-\$25.50	\$21.50-\$24.75
1/4-in.—	\$40.00-\$60.00	\$27.00-\$30.00 \$23.50-\$27.00

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$36.67-\$55.00	\$25.50-\$27.50 \$23.10-\$24.75
1/4-in.—	\$40.00-\$60.00	\$30.00 25.20-27.00

DISCOUNT—NEW YORK

Less than 2500 lb.	2500 to 5000 lb.	6 to 8%	8% to 10%	11% to 13%
1/4 in. to 1/2 in.	6% to 8%	8% to 10%	11% to 13%	
3/4 in. to 3 in.	9% to 11%	11% to 13%		

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

Less than 2500 lb.	2500-5000 lb.	3.8% to 8%	5.8% to 10%	8% to 10%	8.8% to 13%
1/4 in. to 1/2 in.	6% to 8%	8% to 10%	11% to 13%		
3/4 in. to 3 in.	9% to 11%	11% to 13%			

(For galvanized deduct six points from above discounts.)

FLAT IRONS NEW YORK

Net.....	\$3.50
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CHICAGO

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1 1/5 std. pkg.....	28%
1 1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1 1/5 std. pkg.....	28%
1 1/5 to std. pkg.....	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.75 to \$6.30
1/5 to std. pkg.	4.50 to 5.25
Standard package, 500.	List, each, \$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500.	List, each, \$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt-B.	100	\$0.27
60-watt-B.	100	.36
100-watt-B.	24	.65
75-watt-C.	50	.65
100-watt-C.	24	1.00
200-watt-C.	24	2.00
300-watt-C.	24	3.00
Round bulbs, 3/4 in., frosted:		
15-watt-G 25	50	.50
25-watt-G 25	50	.50
40-watt-G 25	50	.50
Round bulbs, 3/4 in., frosted:		
60-watt-G 30	24	.72
Round bulbs, 4/8 in., frosted:		
100-watt-G 35	24	1.65

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$30.00 to \$34.88
Coil to 1000 ft.	21.00 to 26.52

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$37.20 to \$37.84
Coil to 1000 ft.	27.90 to 28.38

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	\$18.00 to \$29.00
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CHICAGO

Net per 100	\$14.17 to \$38.35
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OUTLET BOXES

Nos.	List, per 100
101—A, A1 1/2, 4 S.C., 6200, 320	\$30.00
102—B.A., 6200 S.E., 300, A.X. 1 1/2	30.00
103—C.A., 9, 4R, B 1 1/2	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list	List to 33%	List to 27%
\$10.00 to \$50.00 list	List to 42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list	40%	35%
\$10.00 to \$50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.00 to \$20.00
1/5 to std. pkg.	13.00 to 15.00
Standard package, 2200.	List per 1000, \$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.00 to \$20.54
1/5 to std. pkg.	13.00 to 19.24
Standard package, 2200.	List per 1000, \$20.

PORCELAIN KNOBS

NEW YORK

	5 1/2 N.C.—Solid Nail-it—N.C.	Std. Pkg. 3500	Std. Pkg. 4000
Per 1000 Net			
Less than 1/5 std. pkg.	\$10.50 to \$24.30		\$28.00
1/5 to std. pkg.	9.75 to 12.15		21.50

CHICAGO

	5 1/2 N.C.—Solid Nail-it—N.C.	Std. Pkg. 3500	Std. Pkg. 4000
Per 1000 Net			
Less than 1/5 std. pkg.	\$11.85 to \$18.00	\$20.75 to \$30.75	
1/5 to std. pkg.	9.00 to 11.40	16.30 to 24.20	

SOCKETS AND RECEPTACLES

	Std. Pk.	List
1/4-in. cap key and push sockets	500	\$0.33
1/4-in. cap keyless socket	500	.30
1/4-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No. Fuse

	List
High Grade:	
30-amp. S. P. S. T.	\$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

High Grade:	
Less than \$10 list	List to 5%
\$10 to \$25 list	11% to 16%
\$25 to \$50 list	14% to 24%
Low Grade:	
Less than \$10.00 list	5% to 5%
\$10.00 to \$25.00 list	11% to 16%
\$25.00 to \$50.00 list	14% to 24%

DISCOUNT—CHICAGO

Less than \$10 list	5% to 5%
\$10 to \$25 list	11% to 16%
\$25 to \$50 list	14% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp., three-point	100	.54
10-amp., three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net to +20%
1/5 to std. pkg.	15% to Net
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

	List, Each
Union and Similar	
No. 155	\$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list	List to 23%	18%
\$2.00 to \$10.00 list	20% to 23%	18%
\$10.00 to \$50.00 list	23% to 30%	18%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list	25% to 50%	15% to 40%
\$2.00 to \$10.00 list	25% to 50%	20% to 40%
\$10.00 to \$50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

Net price	\$3.10 to \$3.50
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CHICAGO

List price	\$4.50 to \$5.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

No. 18, less than full spools	\$0.52
No. 18, full spools	0.48

CHICAGO

	Per Lb. Net
No. 18, less than full spools	\$0.565 to \$0.6885
No. 18, full spools	0.35 to 0.56

WIRE-RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

Price per 1000 Ft. Net			
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	\$15.00-18.00	\$12.00-14.50	\$11.50-12.50
12	21.06-28.35	18.96-24.30	18.01-20.25
10	29.60-39.83	26.64-34.14	25.31-28.45
8	42.40-56.49	38.16-48.42	36.25-40.35
6	72.19-89.39	64.98-76.62	61.73-63.85

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14 ...	\$18.00	\$16.00	\$14.00
12 ...	25.99-29.89	21.96-25.62	20.13-22.50
10 ...	36.49-41.50	30.84-35.58	28.27-31.57
8 ...	48.84-60.13	43.80-51.50	40.15-44.86
6 ...	70.24-82.20	63.85-75.35	56.54-60.50

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$40.25 to \$45.00
25 to 50 lb.	39.25 to 42.00
50 to 100 lb.	38.00 to 38.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	\$42.35 to \$45.50
25 to 50 lb.	41.35 to 44.50
50 to 100 lb.	40.35 to 43.50

NEW APPARATUS AND APPLIANCES

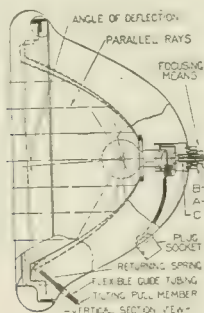
*A Record of Latest Developments and Improvements in Manufacturers' Products
Used in the Electrical Field*

Solderless Cable Connectors

Solderless connectors which have been designed for use with concentric-laid cable are made by the United Cable Connector & Manufacturing Company, 1543 North Fawn Street, Philadelphia, Pa. These connectors consist of two tapered and hinged jaws held together by a compression nut which when screwed on tight will cause the connector to grip the main cable firmly and also be securely fastened to the branch cable. It is pointed out that this connector has been designed to carry a greater load than the cables themselves and will not bend out of shape or become loose in service. It is also claimed that the use of the connector prevents waste of copper due to ordinary splicing, and that the cost of the connector is less than the actual cost of a soldered splice.

Auto Headlight with Tilting Mechanism

The Benjamin Electric Manufacturing Company of Chicago has developed a tilting reflector with means for controlling from the steering wheel. Through the use of this reflector the light zone is limited to the roadway, and there is no necessity for diminishing the intensity of illumination. The principle of the equipment is not to diffuse or dim, but to control the projected light by changing the position of the reflector from the steering wheel. The reflector is pivoted on a horizontal axis passing through the lamp center, carefully balanced and held in normal position by a returning spring. At all times the angle of the beam (also the



AUTO HEADLIGHT THAT IS CONTROLLED FROM STEERING WHEEL

reflector) is under the instant control of the driver. The highest point of the beam when the reflector is set at a full-tilted angle is but 36 in. (91.4 cm.) from the ground. This can be made less if desired.

The reflector is made slightly oval,

or elliptical; the vertical section through the axis is a true parabola.

No glare, it is claimed, is possible above the horizontal when the reflector is at full-tilt position, except momentarily on uneven roads. Even under those conditions the intense beam will be below the line of vision for the driver of an approaching car.

The diverging beam lights the roadway on the curving drives found in parks, etc.

White-Enameled Dish-Washing Machine

The Kitchen Service Company, 412 Orleans Street, Chicago, announces a new model of its "Minit" dish-washing machine. Underneath the basket as shown is a square shaft, and to this shaft are attached propellers or scoops. This shaft is connected directly to the electric motor by means of a spur gear. As the shaft is revolved at approximately 600 r.p.m., the propellers throw the water with great force upward and



ELECTRIC MOTOR ATTACHED BY MEANS OF SPUR GEAR

around the dishes in the basket. Every surface is cleansed both inside and outside—in that way removing all food particles, grease and every trace of dirt, it is claimed.

Breakage is practically impossible, for the reason that the hot water comes in contact with all surfaces inside and outside at the same time; therefore expansion is fairly equalized.

The legs or supports of the washer are of standard 1-in. (2.54-cm.) wrought-iron pipe, securely welded to the angle-iron framework. The body is formed from No. 24 gage sheet steel with all joints and corners welded. The propellers are riveted to the shaft and all parts are rust-proofed before being assembled. The motor is protected by a metal housing.

Three-Pint Percolator Pot

Percolator pots of solid copper, heavily nickel-plated and polished, are made by the General Electric Company of Schenectady, N. Y. Both the pot and spout are made of formed metal so that there are no seams to open and cause leaks. The inside surface is coated with tin. The ebonized wooden handle with comfortable grip always



SOLID COPPER PERCOLATOR POT

remains cool. The coffee container and the pump are of aluminum and are combined in one part. These, together with the cover and the aluminum distributor which spreads the dripping water over the coffee, are removable.

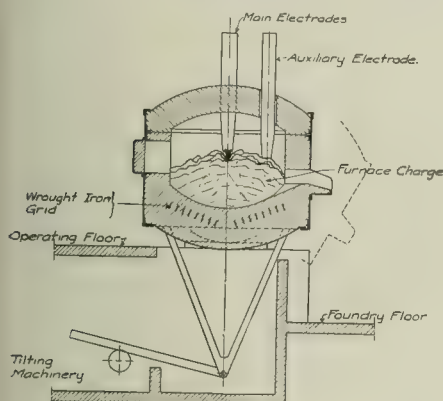
The pump fits over a short tube which forms a steam chamber in the center of a casting in the button of the pot. The heating unit is clamped to a flat disk forming the lower section of the casting. The heat is thus conducted directly to the short tube inside the pot where it is concentrated against the steam chamber. The capacity of this pot is 3 pints (1.6 l.).

Adjustable Cable-Reel Jack

The A. L. Swett Iron Works, Medina, N. Y., have developed a cable-reel jack that is constructed to carry a heavy load and at the same time is light enough to be easily portable. This jack is made in two sizes. The small size has a screw 14 in. (35.6 cm.) long with the height of stand to bearing point in yoke 20.5 in. (51.1 cm.). When the screw is up to the limit in this design the height to the bearing point in the yoke is 31 in. (78.7 cm.). The large cable-reel jack has a length of screw 16 in. (40.6 cm.), with a height of stand 26 in. (66 cm.), so that when the screw is up to the limit the height to bearing point in the yoke is 42 in. (106.6 cm.). It is said that this jack will swing a 7000-lb. (3175-kg.) reel.

Electric Furnaces for Single, Two or Three Phase Operation

The Booth-Hall Company, 505 West Washington Boulevard, Chicago, Ill., has developed electric furnaces for the melting and refining of steel and other ferrous and non-ferrous metals. En-

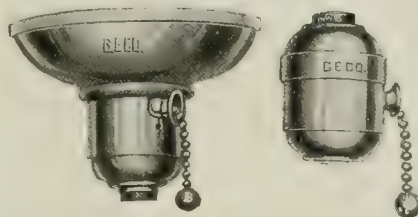


GENERAL LAYOUT OF A TWO-PHASE FURNACE WITH AUXILIARY ELECTRODE, ARCS DRAWN WITH MAIN ELECTRODES

operation, this depending on the local power supply conditions and upon the character of the work for which the furnace will be used. The single-phase furnace is operated by one single-phase transformer connected across one phase of a three-phase line. The two-phase furnace is operated by two single-phase transformers, Scott-connected, thus balancing the load over three phases of the three-phase line. The three-phase furnace is operated by three single-phase transformers, one transformer on each phase of a three-phase line.

Fluted-Catch Pull Switches

The General Electric Company has a complete line of fluted-catch pull switches in 250-watt, 250-volt sizes, including pull switches with side outlets and with bottom outlets and rosette switches with side outlets. These pull switches are furnished with short chains and 10 ft. (3 m.) of linen cord. Extra-length chain guides, insulated chains, etc., can be furnished. The standard finish on these pull switches is old or brushed brass. These switches



TWO TYPES OF PULL SWITCHES

conform to the National Electrical code standard. The caps and bases of these devices are the same as those used with fluted-catch sockets and receptacles, therefore the caps and bodies are interchangeable with socket shells and interiors.

Radiant Heating Unit for Electric Irons

The Simplex Electric Heating Company of Cambridge, Mass., has developed a heating unit for use in electric irons which employs the principles of radiant heating and conduction heating. A continuous coil of nickel-chromium resistance wire is suspended between flanges which project from the back of the iron casting that forms the heating surface. The coil is supported by heavy strips of India mica, through which it passes in such a way that the mica strips divide the space between the flanges into compartments that are closed at the top by a plate bolted to the flanged casting. It is pointed out that by this construction the heat is distributed evenly throughout the flanged casting and the suspended coil is free to expand and contract as much as may be necessary without becoming displaced. There are no close bends in the wire and it is possible to use a wire of relatively large diameter. This unit can be applied, it is said, to all flat heating surfaces as irons, ranges, stoves, hot plates, griddles and broilers.

Dust-Proof Lighting Fixture

Lighting fixtures designed, it is claimed, to preserve the initial efficiency of the unit as long as possible and to reduce the cost of maintenance have been produced by Young & Egan, Inc., 489 Fifth Avenue, New York City.

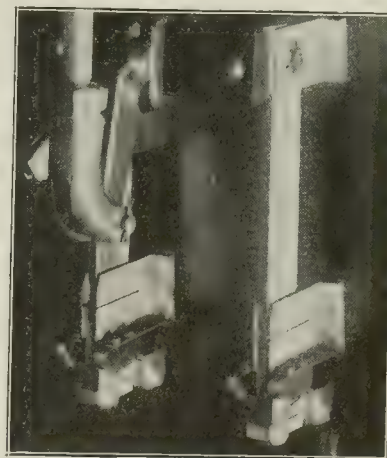
The fixtures consist of a one-piece clear inclosing globe to eliminate dust. A top member is superimposed, consisting of a white opal bowl-shaped reflector, which furnishes direct lighting, and a bottom member which is attached underneath the inclosing globe, securing the semi-indirect feature and at the same time acting as a screen over the source of light.

The top and bottom opal members are separate and can be made in tinted or iridescent glass etched in becoming patterns producing a decorative effect. These separate members can also be made in ruby glass for exit purposes or in blue glass to produce daylight effects.

Back-of-Board-Type Field Switches

In the starting of a synchronous motor from an alternating-current source with the field open-circuited, which is the practice of the General Electric Company of Schenectady, N. Y., on all alternating-current motors using 125-volt excitation, there is considerable induced voltage across the field terminals until the motor reaches synchronous speed. Under these conditions an exposed field switch on the front of a switchboard is more or less a source of danger to the operator.

A method of reducing this danger in connection with hand-operated field switches is by means of a back-of-board switch. It consists of an operating handle similar to an oil-circuit-breaker lever mounted on the front of the board and the switch proper mounted on a framework back of the switchboard. The switch is connected mechanically to the operating handle by



WAY OF CONNECTING SWITCH HANDLE

means of connecting rods and bell hangers. This brings all live parts on the back of the board and does away with danger to the operator of accidental contact from the front.

ergy is introduced to the furnace through one, two or three main vertical electrodes, the number depending upon whether the furnace proper is to operate single, two or three phase. The furnace is also provided with one auxiliary electrode and with wrought-iron grids, with a refractory facing, which are embedded in the hearth. The auxiliary electrode is inserted vertically through the roof, except in the small furnaces, where it is inserted obliquely through the door opening.

The following explanation is limited to the two-phase furnace, that being the type best suited to the usual power supply and steel-refining conditions. In starting a heat with a cold charge in the two-phase furnace a pawl on the auxiliary electrode holder is released, permitting the auxiliary electrode to rest upon the scrap charge. Arcs are then drawn with the two main electrodes, and the metal begins to melt under the arcs. The auxiliary electrode acts as a common neutral or return, no arc being drawn and therefore no metal melting under the auxiliary electrode. When a molten bath has accumulated upon the hearth, sufficient to make the hearth conductive of electricity, ammeters indicate that current is beginning to flow through the wrought-iron grids. The auxiliary electrode is then withdrawn entirely from the furnace, and the opening through which it enters the furnace is closed up. The furnace then continues to operate with the current entering the furnace through the main vertical electrodes and being carried through the bath and the hearth to the grids, and so out through the grids. The connections from the transformer to the furnace are so arranged that each of the two phases has an independent circuit.

These furnaces are advocated for single-phase, two-phase or three-phase

Trade Notes

LANDERS, FRARY & CLARK, New Britain, Conn., have had plans prepared for an addition to their plant, to cost about \$35,000.

THE ELECTRIC AUTO-LITE CORPORATION, 214 West Forty-ninth Street, New York, N. Y., has increased its capital from \$13,000,000 to \$15,000,000 for expansion.

KERWIN BROTHERS, Oelwein, Iowa, manufacturers of time switches, have appointed the O. B. McClintock Company, 33 Western Avenue, Minneapolis, Minn., their general sales agents.

THE NATIONAL X-RAY REFLECTOR COMPANY, Chicago, announces the appointment of Harvey B. Wheeler as supervising engineer in the Middle Western territory with offices at 120 West Eleventh Street, Kansas City, Mo.

J. W. STJERNSTEDT, manager of the Western Engineering Sales Company of San Francisco, has taken over the Pacific Coast agency for the Thordarson Transformer Company, and will maintain offices in the Rialto Building, San Francisco.

THE GENERAL ELECTRIC COMPANY, Harrison, N. J., has awarded a contract for the construction of a two-story reinforced-concrete addition to its local lamp works, 125 ft. by 250 ft., to Edward M. Waldron, Inc., 665 Broad Street, Newark.

JOSEPH STEINBERGER, president of the General Insulate Company, and Victor Charles Steinberger, manager and secretary of the company, have had their petition to change their family name to Rockhill granted by Judge Cropsey of the Supreme Court.

A. S. LINDSTROM has been appointed general manager of the Thordarson Electric Manufacturing Company of Chicago. Mr. Lindstrom was in charge of the Thordarson exhibit in the Palace of Machinery at the San Francisco Exposition and conducted the experiments with the million-volt transformer which were carried on at that time. Since the Exposition Mr. Lindstrom has represented the Thordarson Company on the Pacific Coast.

THE LACLEDE-CHRISTY CLAY PRODUCTS COMPANY, St. Louis, Mo., has sent a letter to the trade stating that because a number of its salesmen have been called to the colors it has been found necessary to make a temporary redistribution and enlargement of salesmen's territories to a certain extent. For this reason the company has sent to the trade a post card asking when buyers will be in the market for such material so as to conduct as much of its business as possible by mail.

J. E. SLIMP, who has represented the Ohio Brass Company for a number of years, first in the South with headquarters in Atlanta and later in New England with headquarters in Boston, has been transferred to an important position in the home office of the same company at Mansfield, Ohio. L. A. Wilson has been appointed to represent the company in New England. He will make Boston his headquarters. Mr. Wilson has traveled in New England for a number of years in the interests of the lamp department of the General Electric Company.

THE CENTURY ELECTRIC COMPANY of St. Louis, Mo., is just completing a three-story reinforced concrete warehouse containing about 19,000 sq. ft. of floor space and located on a private railroad siding. This additional space will enable the company to handle conveniently the large amount of raw material now required. The warehouse is so arranged that the heavy material, such as electrical sheets, commutator copper, bars of steel, etc., can be handled by electric cranes directly from the cars into the warehouse. Smaller cranes inside the warehouse will handle the smaller lots for distribution to the factory.

WESTINGHOUSE COMPANY MAKES PROMOTIONS IN PURCHASING DEPARTMENT.—Announcement has just been made by the Westinghouse Electric & Manufacturing Company of the promotion of W. J. Longmore, formerly purchasing agent of the company at its East Pittsburgh works, to be general purchasing agent of the company with headquarters at Pittsburgh, where he will have supervision of the purchases of the company as a whole, with special supervision over those involving contracts for material used by both the electric and machine works. Mr. Longmore is a veteran in the employ of the Electric company, having begun service at the Garrison Alley plant in October, 1881, and has been purchasing agent at the East Pittsburgh works since 1892. Charles G. Taylor, formerly

assistant purchasing agent, has been promoted to be purchasing agent at East Pittsburgh, where he has headquarters, and also of the Shadyside, Cleveland and Newark works. Mr. Taylor has been in the service of the company since 1887 and has acted as assistant purchasing agent since 1895. A. W. Fullerton, formerly purchasing agent of the Westinghouse Machine Company, which is now known as the machine works of the Westinghouse Electric & Manufacturing Company, has been appointed purchasing agent of the machine works at East Pittsburgh, Trafford and Essington, with headquarters at the first-named place. Mr. Fullerton has likewise been in the employ of the Westinghouse Machine Company for a number of years, having begun work in February, 1899, and has been in charge of the purchasing department for the Machine company since 1915.

New Incorporations

THE MUTUAL HEATING & LIGHTING COMPANY of Toledo, Ohio, has been incorporated by William J. Blebscheimer and others.

THE MICHIGAN CHANDELIER COMPANY of Detroit, Mich., has been incorporated with a capital stock of \$50,000 by Nathan Silberstein, S. Groosfoeld and others.

THE PALMYRA (ILL.) LIGHT, HEAT & POWER COMPANY has been incorporated, with a capital stock of \$10,000, by Lewis M. King, Clarence W. King and Nellie G. King.

THE STEINBOCK ELECTRIC COMPANY of Peekskill, N. Y., has been incorporated by H. E. Steinbock, Claude J. Holslag and Christian Jetter. The company proposes to manufacture electric welding apparatus.

AUSTIN & MOORE, INC., of Queens, N. Y., have filed articles of incorporation, with a capital stock of \$10,000, to do a general electrical contracting business. The incorporators are: William F. Austin, E. Moore and L. Siemering.

THE COMBINATION LIGHTING UNIT COMPANY of Pittsburgh, Pa., has been chartered by S. V. Reed, W. S. Wells and David Evans, all of Pittsburgh, Pa. The company proposes to manufacture and sell all kinds of lighting fixtures.

THE NEW DEVICES COMPANY of Newark, N. J., has been incorporated with a capital stock of \$10,000 to manufacture vacuum cleaners, etc. The incorporators are: B. N. Bishop, Richard Deubich of Newark and Louis Caper of Plainfield.

THE MOUNT FIRE ALARM CORPORATION of New York, N. Y., has been incorporated by Charles B. Mount, Thomas L. Dillon and Fred C. Wendland. The company is capitalized at \$300,000 and proposes to do a general electrical and mechanical engineering business.

THE TRANSCOM LIGHTING PRODUCTS CORPORATION of New York, N. Y., has been chartered, with a capital stock of \$5,000, by W. L. and E. S. Powers and R. S. Hart, 115 Lenox Street, Brooklyn, N. Y. The company proposes to manufacture lighting fixtures, electrical apparatus, etc.

THE AMERICAN ELECTROTHERMIC SMELTING CORPORATION of New York, N. Y., has been incorporated with a capital stock of \$100,000, by M. F. Conner, Jr., F. A. Collins and J. L. Covey, 568 West 149th Street, New York, N. Y. The company proposes to do a general mining business.

THE ELECTRIC STEEL & ENGINEERING COMPANY of Welland, Ont., has been chartered with a capital stock of \$2,000,000 by James S. Lovell, 119 Madison Avenue; Charles D. Magee, 300 St. George Street; William Bain, 189 College Street, and others, all of Toronto. The company proposes to manufacture iron, steel, machinery, tools, etc.

THE EASTERN NEVADA POWER COMPANY has filed articles of incorporation under the laws of the State of Delaware, with a capital stock of \$4,000,000, for the purpose of generating and distributing electricity for lamps, heaters and motors. The incorporators are: F. D. Buck, M. L. Horthy and M. W. Noblit, of Wilmington, Del.

THE PUGET SOUND CORPORATION of Olympia, Wash., has been incorporated by A. P. Gilles of Olympia; A. C. Lindsay, P. H. Hoag and A. C. Phillips, all of Chicago, Ill. The company is capitalized at \$5,000,000, and proposes to build steel ships and machinery, own and operate power plants and engage in general manufacturing business.

THE CONNECTICUT ENGINEERING & METAL PRODUCTS COMPANY of Greenwich, Conn., has been incorporated with a capital stock of \$10,000 by Raymond M. Boden of Waterbury, Ambrose M. Boles of Greenwich, Conn., and Charles C. Schoen of New York, N. Y. The company proposes to manufacture metal specialties and electrical goods.

THE WISCONSIN ENGINE & DYNAMO COMPANY of Milwaukee, Wis., has been incorporated by John I. Beggs, W. H. Cameron and Chester B. Pierce of Milwaukee. The company proposes to establish a plant in Milwaukee or suburbs to manufacture electrical machinery and equipment. Offices have been opened in the First National Bank Building, Milwaukee.

THE NORTHWESTERN BATTERY COMPANY of Milwaukee, Wis., has been incorporated, with a capital stock of \$40,000, to take over the business of the Northwestern Storage Battery Company and the Willard Service Battery Company. The incorporators are: C. B. Pierce, W. H. Cameron and J. H. Gugler. A new station has been erected on the old Peter Vachten property on Jefferson Street.

THE LEHIGH POWER SECURITIES CORPORATION has filed articles of incorporation under the laws of the State of Delaware, with a capital stock of \$60,500,000. This company has taken over the control of the properties formerly controlled by the Northern Central Company and also acquired the control of the Lehigh Valley Transit Company of Allentown, Pa., and the Lehigh Navigation Electric Company of Hauto, Pa.

Trade Publications

BUCKETS.—The Blaw-Knox Company of Pittsburgh, Pa., is distributing a leaflet descriptive of its "Bulldog" bucket.

CONDUIT SPECIALTIES.—M. B. Austin & Company of Chicago are distributing a leaflet descriptive of conduit unions, adapters, beam clamp conduit supports, bushings, steel lock-nuts, nipples, fixture studs, etc.

FACTORY LIGHTING.—"The Need for Better Factory Lighting" is the title of a new bulletin by the National Lamp Works of the General Electric Company, Nela Park, Cleveland, Ohio. The object of this bulletin is to summarize in an unbiased way the reasons for good lighting and to illustrate good lighting in representative plants by unretouched photographs taken at night with no other means of illumination than those in use in each plant.

ELECTRIC HEATING DEVICES.—The Hughes Electric Heating Company of Chicago has issued its 1917 catalog covering its entire line of heating devices. Electric bake ovens, electric ranges, industrial ovens, hot-plates, portable ovens, air heaters and hotel kitchen equipment, including large electric toasters, broilers, plate warmers, frying griddles and coffee urn heaters, are described and illustrated. Complete specifications and selling points are also included.

SINGLE-PHASE MOTORS.—The Century Electric Company, St. Louis, has issued bulletin 24, describing, illustrating and suggesting applications for its single-phase motors between 0.1 hp. and 40 hp. in size. Considerable effort is made to draw attention to the fact that the company's repulsion-start, induction-type motors possess characteristics with more desirable relations between starting torque and starting current than any other types of single-phase motors.

RAILWAY SUPPLIES.—Reprint No. 56, descriptive of the Norfolk & Western electrification from the railroad viewpoint, is being distributed by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. Other recent bulletins by this company are on No. 506 "Wee" railway motor, type SK direct-current commutating-pole generators, No. 514 "Baby" railway motors, No. 333-V-2 railway motors, No. 532-B railway motors and type 810 drum reverse switches.

FIRE PREVENTION.—The National Board of Fire Underwriters, 76 William Street, New York City, has prepared for the Council of National Defense a bulletin entitled "Safeguarding Industry." It includes a brief review of the present safety needs of large and small plants and other industrial institutions. They have been considered in their simple and non-technical phases, from the standpoint of such common-sense observations as may be exercised by any one of intelligence. More technical rules are also taken up.

New England States

RUTLAND, VT.—Foundations for a 1000-hp. waterwheel are being built at the East Pittsford power station of the Rutland Railway, Light & Power Company. This will increase the output of the station to 4000 hp. Machinery has already been purchased.

BROCKTON, MASS.—Bids will be received at the office of the Sewerage Commissioners, City Hall, Brockton, Mass., until Sept. 6 for furnishing three fuel oil engines, three centrifugal pumps, two oil storage tanks, with all necessary piping, etc. Plans, specifications, etc., may be obtained at the above office. Albin F. Nordbeck is chairman.

CHICOPEE, MASS.—Contract for alterations in the power plant of the National Scale Company at Chicopee has been awarded to the Ernest F. Carlson Company. Improvements include the installation of a new fire pump, for which contract has been awarded to the Holyoke Supply Company.

FITCHBURG, MASS.—The Saima Society, also known as the Finnish Socialist Club, has decided to install an electric-light plant at its farm near Rindge and Scott Roads and to Ashby line. The proposed plant will have sufficient output to maintain 150 lamps. Both arc and incandescent lamps will be used.

MILFORD, MASS.—The Milford & Uxbridge Street Railway Company has decided to purchase energy to operate its system from the New England Power Company. The local plant, which furnishes nearly all of the motive power, will be closed down. It will be kept intact for use in case of emergency.

NEWPORT, R. I.—Plans are being prepared for a new power plant at the Naval Torpedo Station at Newport, for which an appropriation has been made.

NEW HAVEN, CONN.—The Public Utilities Commission has granted the Connecticut Company permission to erect power cables along the New Haven-North Haven line through Montwese. These transmission lines will be equipped for transmitting energy at 11,000 and 33,000 volts.

NEW HAVEN, CONN.—The Public Utilities Commission has approved the petition of the Rocky River Power Company for permission to purchase the properties of the Housatonic Power Company of New Haven, the United Electric Light & Water Company of Waterbury and the Seymour (Conn.) Electric Light Company. The price is understood to be \$6,600,000. The consolidated companies will be known as the Connecticut Light & Power Company.

NEW LONDON, CONN.—Plans are being prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for a power plant and distributing system to cost about \$450,000 at New London, Conn.

Middle Atlantic States

ALBANY, N. Y.—Bids will be received by Dr. Herman M. Biggs, commissioner of health, Department of Health, Albany, until Sept. 7 for construction, including heating, sanitary and electric work, for laboratory building, Division of Laboratories, State Department of Health, Albany. Drawings and specifications may be consulted at the New York office of the Department of Architecture, Room 1224, Woolworth Building, and the Department of Architecture, Albany. Lewis F. Pilcher, Capitol, Albany, is State architect.

BROOKLYN, N. Y.—The Interborough Rapid Transit Company is planning to build a new substation, 50 ft. by 100 ft., on Nostrand Avenue, to cost about \$50,000.

ELMIRA, N. Y.—The construction of a substation, 40 ft. by 40 ft., to cost about \$10,000, is under consideration by the Elmira Foundry Company. A new boiler house, to cost about \$35,000, will be erected.

GENEVA, N. Y.—Contract has been awarded by the Geneva Cutlery Company for the construction of a new one-story power house, 60 ft. by 125 ft., at its factory at Torrey Park.

JAMESTOWN, N. Y.—The application of the Panama Traction Company to issue \$60,000 in capital stock and \$150,000 in bonds has been approved by the Public Service Commission. The proceeds will be used to construct the first section of the proposed railway between A-hville and Panama. The railway when completed will connect the Lake Shore Railway at Erie with the steamer service at Chautauqua Lake points.

LOWVILLE, N. Y.—No decision has yet been reached regarding the ornamental lighting installation. The local utility insists on a sum of \$6,400, while the town board refuses to go higher than \$5,940.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

MONROE, N. Y.—The Public Service Commission has granted the Orange & Rockland Electric Company permission to issue \$163,500 in capital stock, the proceeds to be used for extensions and improvements.

NEW YORK, N. Y.—Plans have been completed by the Fifth Avenue Coach Company, 10 East 102d Street, for the construction of a new plant, four stories, at Broadway and 132d Street, for the manufacture of motor buses. R. A. Meade is president.

NIAGARA FALLS, N. Y.—Plans have been prepared for an addition to the factory of the Oldbury Electrochemical Company, Buffalo Avenue and Industrial Railroad, Niagara Falls.

ROCHESTER, N. Y.—Contract has been awarded by the J. Hungerrord Smith Company, 410 North Goodman Street, Rochester, for the construction of an engine and boiler house.

ROCHESTER, N. Y.—The North East Electric Company, it is reported, has awarded contract for the construction of a new machine shop at Orchard Street and Lyle Avenue, to cost about \$15,000.

SYRACUSE, N. Y.—Work has been started on the erection of additional electric lamps in the various parks in Syracuse, according to Commissioner of Parks Frank Westcott. Three large arc lamps will be placed near the pool and drive in both Onondaga and Burnet Parks.

BAYONNE, N. J.—The City Commission has granted the Public Service Electric Company permission to extend its conduit system in a number of city streets. Improvements will be made to the street-lighting system in lower Broadway.

ELIZABETH, N. J.—Plans are being considered by the Diehl Manufacturing Company for extensions to its plant, but as yet definite arrangements have not been completed. The company manufactures electrical apparatus.

HOPEWELL, N. J.—Arrangements have been made by the Public Service Electric Company with the Borough Council for improvements to the street-lighting system, including the installation of larger lighting units.

JAMESBURG, N. J.—Plans have been made by the board of managers of the State Home for Boys at Jamesburg for the installation of new equipment for power plant at the institution.

NEWARK, N. J.—The Public Service Electric Company is planning to build a new switching station at its Essex power plant.

UNION HILL, N. J.—The Town Council has approved an ordinance authorizing an expenditure of \$23,000 for the police and fire telegraph alarm system. An appropriation of \$14,700 has also been authorized for street lighting during the coming year.

VENTNOR CITY (P. O. ATLANTIC CITY), N. J.—The City Council has rejected the bids submitted for a new street-lighting system. New specifications designed as asked in the estimates, which it is understood will include gas standards, will be asked for.

EAST BRADY, PA.—The Rex Hide & Rubber Company is planning to build a new power plant in connection with its proposed factory building to be erected at East Brady. The W. E. Moore Company, Union Bank Building, Pittsburgh, has charge of the engineering work.

GLENOLDEN, PA.—Plans have been prepared for the erection of a power house, garage and stable at Glenolden for the H. K. Mulford Company.

HALIFAX, PA.—The Millersburg Electric Light, Heat & Power Company has recently completed the erection of an electric transmission line from Millersburg to Halifax and is considering extending its lines to Millerstown, Newport and neighboring districts.

HARRISBURG, PA.—The Bell Telephone Company is contemplating the erection of a new telephone line to Paxtang, to cost about \$12,000.

HARRISBURG, PA.—Plans are being considered by the City Electrical Department for the installation of underground conduit lines in the Capitol Park district to replace the present overhead system.

HARRISBURG, PA.—Work has begun on the installation of a new police and fire-

alarm telegraph system. New underground conduits will be installed to eliminate the overhead wires in Court, Briggs, Cowden and other streets.

LANCASTER, PA.—The installation of a new street-lighting system in the business district is under consideration.

LEBANON, PA.—The new 33,000-volt transmission line of the Metropolitan Electric Company, now in course of construction from its West Reading power station to Lebanon, will soon be placed in operation. It is planned to use the local plant for a substation upon completion of the new line.

LEWISTON, PA.—The Union Light, Heat & Power Company, it is reported, has applied to the Public Service Commission for permission to operate in a section of Union Township.

MEDIA, PA.—The Philadelphia & West Chester Traction Company is contemplating extending its Collindale line to the Sharon Hill section.

MERCER, PA.—The Borough Council has accepted the contract of the Mercer County Light, Heat & Power Company for street-lighting for a period of two years. The contract calls for an initial installation of 85 lamps of 60 cp.

PHILADELPHIA, PA.—The United States government will make extensions to the power plant of the Frankford Arsenal, to cost about \$100,000.

PHILADELPHIA, PA.—Plans are being considered by the Philadelphia & Reading Railroad Company for the construction of a new power plant, together with a new cooling station at its Philadelphia yards.

PITTSBURGH, PA.—The Duquesne Light Company is contemplating an addition, 25 ft. by 25 ft., to its substation.

POTTSVILLE, PA.—Work has begun on the construction of a new addition to the electric power plant of the Philadelphia & Reading Coal & Iron Company at Bear Valley. The equipment will include a 250-volt direct-current generator.

POTTSVILLE, PA.—The Eastern Pennsylvania Railways Company is planning to erect a new one-story addition, 75 ft. by 100 ft., to its repair shops at Palo Alto. Plans are also being made for the construction of a new power plant in Palo Alto to replace the one recently destroyed by fire. The work will be in charge of the J. G. White Engineering Corporation, 43 Exchange Place, New York, N. Y.

SHAMOKIN, PA.—The Pennsylvania Lighting Company of Shamokin, it is reported, will be consolidated with the Edison Electric Illuminating Company of Mount Carmel, which was recently taken over by interests represented by Chandler & Company of Philadelphia. Extensions, it is understood, will be made to the plants and systems. The new company will operate in Mount Carmel, Shamokin, Locust Gap, Kulpmont and vicinity.

TUNKHANNOCK, PA.—Plans are being considered for the improvement of the lighting system in Tunkhannock, Pa. It is planned to install Westinghouse 60-cycle, 110-volt direct-current machines.

UPPER DARBY, PA.—The contract for electrical work in the new school has been awarded by the board of education to the Wyoming Electric Company.

WILKES-BARRE, PA.—The Wilkes-Barre Light Company has been awarded the contract for all the city lighting. The contract is for five years.

WILMINGTON, DEL.—Contract has been awarded by the William Freihofer Baking Company, North Twentieth Street and Indiana Avenue, Philadelphia, Pa., for the construction of a one-story concrete power plant at its baking establishment to be erected at Wilmington, Del., to cost about \$75,000.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company has filed a petition with the Public Service Commission for authority to exercise the franchises of the Baltimore Power Company, the corporation which was organized by consolidated interests as a medium through which to handle new financing.

BALTIMORE, MD.—Plans are being prepared by the Chesapeake & Potomac Telephone Company for the construction of a new three-story exchange building on Bridge Street, Elkton, to cost about \$10,000. Extensions and improvements are also contemplated to the system at Fairmont, W. Va., involving an expenditure of about \$200,000.

GARY, W. VA.—The United States Coal & Coke Company is planning for the installation of electrical equipment at its properties in Harlan County. H. N. Eavenson, chief engineer.

RICHMOND, VA.—The construction of a new power plant at the Virginia Medical

College is reported to be under consideration. Nolan & Baskerville, Travelers Building, are architects.

WASHINGTON, D. C.—The power house of the Washington & Old Dominion Railway Company at Rosslyn will be closed and energy will be purchased from the Potomac Electric Power Company to operate the system.

WASHINGTON, D. C.—Sealed proposals will be received at the Supervising Architect's Office, Washington, D. C., until Sept. 13, 1917, for furnishing and installing lighting fixtures in the United States post offices at Barnesville, Ga.; Bartow, Fla.; Bay City, Tex.; Beeville, Tex.; Deland, Fla.; Dickinson, N. D.; Eureka Springs, Ark.; Franklin, Va.; Marion, S. C.; Macon, Miss.; Rockville, Conn.; and Stamford, Tex. James A. Wetmore, acting supervising architect. (For details see Searchlight Section.)

WASHINGTON, D. C.—Sealed proposals will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until 10:30 a. m., Aug. 31, for furnishing among other things electric hoists and trolleys. Blanks and information relating to this circular, No. 1160, may be obtained from that office or the offices of the assistant purchasing agents, 24 State Street, New York City; Audubon Building, New Orleans, La.; and Fort Mason, San Francisco, Cal.; also from the United States engineer offices in the principal cities throughout the United States. Earl I. Brown, Lieut. Col., Corps of Engineers, U. S. A., general purchasing officer.

North Central States

LANSING, MICH.—Engineers B. E. Parks & Son have prepared plans for a ten-panel light and power oil switchboard for the Prudden power plant, Lansing, Mich., and awarded the contract to the Allis-Chalmers Manufacturing Company.

CINCINNATI, OHIO.—The Utilities Commission has authorized the Cincinnati Gas & Electric Company to issue \$2,500,000 in bonds, the proceeds to be used to complete a power plant being erected on the Ohio River.

CINCINNATI, OHIO.—The City Council has authorized Service Director Hornberger to advertise for bids for the installation of ornamental lamps on Third Street from John Street to Central Avenue and on Central Avenue from Third Street to Twelfth Street.

COLUMBIANA, OHIO.—The Youngstown & Suburban Railway Company is contemplating improvements to its local system, which include the construction of a substation, new depot, etc. Electrical machinery, it is understood, has been purchased. Energy will be supplied from Salem, where a power house will be erected for the purpose, to be used instead of the one at West Point. A branch road will be built from East Palestine to connect with the Youngstown & Suburban Railway in Columbiana.

COLUMBUS, OHIO.—Bids will be received by the Auditor of State, Columbus, Ohio, until Sept. 4 for furnishing material and construction of power house on the campus of the Ohio State University. Plans are on file at the office of the auditor and the Builders' Exchange, Columbus.

COLUMBUS, OHIO.—Bids are being asked by the Board of Purchase, City Hall, Columbus, for equipment for the municipal lighting system as follows: 270 street-lighting fixtures, 22 regulators and 23 control panels in accordance with plans and specifications on file in the office of the consulting engineer, 421 New First National Bank Building. George A. Borden is president.

ELYRIA, OHIO.—The Lorain County Electric Company has accepted the 25-year franchise granted by the City Council recently. The franchise provides for an improved lighting system on Middle Avenue, a sliding scale of prices for private consumers and a reduction in the price of arc lamps.

MARION, OHIO.—Orders have been placed by the Columbus, Delaware & Marion Electric Company for equipment and material for enlarging and rebuilding its distributing system in Marion, at a cost of about \$35,000. The company is now installing a steam turbine, water-cooling tower, boilers, etc., at its plant on Mill Street, to cost approximately \$125,000. Improvements on the local plant and system, to cost about \$125,000, are contemplated during 1918.

NEW BREMEN, OHIO.—The capital stock of the New Bremen Telephone Company has been increased from \$20,000 to \$30,000.

NEW PHILADELPHIA, OHIO.—Two 500-hp. boilers are being installed in the local plant of the Ohio Service Company. A new turbine was recently installed. The company has secured a contract to supply the Greer Steel Company of Dover with electricity and will also furnish energy to operate a 2000-kw. electric furnace to be installed at the Reeves steel mill.

TIPPECANOE CITY, OHIO.—The Village Council is considering a proposal from the Dayton Power & Light Company to take over the local municipal electric-light plant and furnish electrical service in Tippecanoe City.

CAPITO, KY.—The power house of the Atlas Coal Mining Company, it is reported, was recently destroyed by fire, causing a loss of about \$7,500, with about \$4,000 insurance.

HAZARD, KY.—The Kentucky River Power Company is contemplating extending its electric transmission lines within the next few months into the Whitesburg district to supply electricity to the coal fields there.

KIRKSVILLE, KY.—Plans have been completed by the United States government for the construction of a one-story power plant at its Kirksville station.

ELKHART, IND.—Plans are being prepared by the Foster Machine Company for the construction of building, 128 ft. by 132 ft., to provide space for its power plant. The company will also construct another building, 132 ft. by 165 ft., which will be used as a storeroom for raw material.

CHICAGO, ILL.—A permit has been granted to the Commonwealth Edison Company for alterations to its power house at Twenty-second and Fiske Streets, to cost about \$200,000; also for construction of a one-story locomotive house, to cost \$25,000, and a concrete ash pit, to cost \$11,000, at the same location.

EAST ST. LOUIS, ILL.—The Broderick-Bolte Electrical Company has been awarded the contract for the installation of electrical work in the three new school buildings which will be erected in East St. Louis, Ill.

PALMYRA, ILL.—The Palmyra Light, Heat & Power Company, recently organized with a capital stock of \$10,000, is planning to install a steam generating electric power plant. Lewis W. King, C. W. King and others are interested in the company.

ROCKFORD, ILL.—The Rockford & Interurban Railway Company is planning to extend its electric railway to Camp Grant.

CHIPPEWA FALLS, WIS.—Plans are being prepared by the Chippewa Valley Auto Company for the erection of a public garage and service building, at Columbia and Bay Streets, to cost about \$50,000. Contracts, it is understood, will be awarded about Sept. 1.

MADISON, WIS.—The Wisconsin Railroad Commission has granted the Wisconsin Interurban Company permission to issue \$600,000 in bonds, the proceeds to be used for the construction of an electric railway from Portage to Madison. Contract for constructing and equipping the proposed railway, it is reported, has been awarded to John T. Adams of Columbus, Ohio. J. E. Jones of Portage is president.

MILWAUKEE, WIS.—The Pawling & Harnischfeger Company of Milwaukee has awarded contract for the construction of an addition to its power plant 50 ft. by 85 ft., to provide space for the installation of a 500-hp. unit. Contracts have been awarded for machinery. Woodmansee & Davidson, Chicago, Ill., and Milwaukee, are engineers.

MILWAUKEE, WIS.—The controlling interest in the Wisconsin Power, Light & Heat Company has been purchased by Samuel Insull of Chicago, Ill., and associates. The Wisconsin company holdings include public utilities in 27 towns and cities in Wisconsin, embracing power plants and transformer systems, also power dams at Kilbourn and Prairie du Sac, as well as 107 miles of transmission lines now under construction.

MONTICELLO, WIS.—The City Council is considering an issue of \$5,650 in bonds, the proceeds to be used for improvements and extensions to the municipal electric-lighting system.

WAUSAU, WIS.—Contract, it is reported, has been awarded by the Wisconsin Valley Electric Company to the Allis-Chalmers Manufacturing Company of Milwaukee for furnishing and installing an auxiliary steam generating plant, including a steam turbine, Heine boilers, and Westinghouse automatic stokers. The plant will have an output of 1500 kw. and will cost between \$90,000 and \$100,000.

MINNEAPOLIS, MINN.—A power house to cost about \$9,000 will be erected by the

Minneapolis Steel & Machinery Company at 3210-3216 Snelling Avenue, Minneapolis, Minn.

VIRGINIA, MINN.—The Mesaba Railway Company contemplates replacing the wooden poles now in use with steel towers.

VIRGINIA, MINN.—The water and light commission, it is reported, will advise against the construction of a heating plant at the present time, owing to the abnormal prices of construction material.

CEDAR VALLEY, IOWA.—The Cedar Valley Electric Company is planning extensive repairs to its dam.

SIOUX CITY, IOWA.—Work has begun on the construction of boiler house, to cost about \$50,000, for the Sioux City Gas & Electric Company.

CLAYTON, MO.—At a special election held recently the proposal to grant the West St. Louis Water & Light Company of St. Louis a 20-year extension to its franchise was carried. In return for this the company agrees to make a reduction of 25 per cent in its water rates in this district.

GOWER, MO.—At an election held recently the proposal to issue bonds for the installation of a municipal electric-light plant was carried.

RUGBY, N. D.—The Northern States Power Company, Minneapolis, Minn., recently purchased a light plant at Rugby, N. D., from the Northern Telephone Company and is now operating the plant. Plans are under way to change the plant from direct-current to alternating-current operation at once.

ISABEL, S. D.—The installation of an electric-light plant in Isabel is reported to be under consideration.

MINOT, S. D.—The Northern States Power Company expects to build a new power plant next year at Minot.

PENDER, NEB.—At an election to be held Aug. 28 the proposal to issue \$16,500 in bonds for extensions to the municipal electric-light plant will be submitted to the voters.

INDEPENDENCE, KAN.—The installation of an ornamental lighting system in the principal streets of the city is under consideration.

KANSAS CITY, KAN.—Bids have been asked by the Water and Light Department for two boilers to be installed in the municipal electric-light plant. The cost is estimated at about \$60,000. L. H. Chapman is commissioner.

MCCRACKEN, KAN.—Work is progressing rapidly on the construction of the municipal electric-light plant in McCracken.

Southern States

HIGH POINT, N. C.—The city of High Point has decided to install an electric-generating plant to maintain the municipal electric-lighting system. Definite plans have not yet been decided upon. Energy is now purchased from the North Carolina Public Service Company.

ROXBORO, N. C.—Improvements are contemplated by the Little River Manufacturing Company, including the rebuilding of its power dam and other improvements in its power system.

SOUTHPORT, N. C.—The Town Council is considering the construction of a municipal electric-light plant.

ATLANTA, GA.—A resolution providing for a special appropriation of \$30,000 for the completion and operation of a power plant at the Georgia School of Technology was adopted.

COLUMBUS, GA.—It is reported that an expenditure in the neighborhood of \$200,000 will be made in improvements on the Second Avenue plant of the Columbus Power Company. Plans are partly completed for the installation of a new 6000-kw. turbo-generator with necessary additional boilers.

DUBLIN, GA.—Plans are being considered for increasing the output of the municipal electric-light plant to meet the increasing demand for electrical service.

DELAND, FLA.—The Deland Electric Light & Power Company has been granted a franchise to furnish electricity here for a period of 30 years.

NASHVILLE, TENN.—The City Commissioners will order an election for Sept. 27 to vote on \$55,000 of bonds to install boilers in the local electric light plant.

PULASKI, TENN.—The Pulaski Electric & Water Company, recently incorporated, is contemplating the construction of an electric-light plant.

MONTGOMERY, ALA.—The Montgomery Light & Traction Company is planning to double-track its railway from Montgomery to Pickett Springs, a distance of 6 miles.

FREDERICK, OKLA.—The city of Frederick is considering the purchase of one 250-hp. steam engine and one centrifugal, two-stage pump directly connected to motor, to have a maximum capacity of 20,000 gal. per hour; also one pump of same capacity, either steam plunger or turbine type. For details see Searchlight Section.

GUTHRIE, OKLA.—The Oklahoma Railway Company has secured a right-of-way within the city limits of Guthrie. The ground acquired will be used for trackage and a direct line in and out of the city and for terminal purposes.

RINGLING, OKLA.—Plans are being prepared by the People's Refining Company, E. D. Smith manager, Insurance Building, Oklahoma City, Okla., for the construction of a refinery, including four boiler stills and one steam still, two 125 hp. boilers, two underground storage tanks, seven steam pumps and power house, to cost about \$65,000.

DALLAS, TEX.—The Dallas Southwestern Traction Company has awarded the contract for the construction of 49 miles of its proposed interurban electric line between Dallas and Cleburne to the Cherokee Construction Company of Sapulpa, Okla. The contract calls for an expenditure of \$2,500,000. The survey was made some time ago and the right-of-way has all been obtained. The route of this first division of the road is through Eagle Ford, Irving and other towns.

SAN BENITO, TEX.—The local electric-light plant, it is reported, has been purchased by J. T. Lomax.

TEMPLE, TEX.—The Texas Power & Light Company has submitted a proposal to local business men offering to install an ornamental lighting system in the business section. The cost is estimated at about \$12,000, which the company will assume.

Pacific and Mountain States

BREMERTON, WASH.—At an election to be held on Sept. 18 the proposal to purchase the local electric-light and power plant, to be owned and operated by the municipality, will be submitted to the voters.

DEIRINGER, WASH.—A franchise for a power line straight from the Deiringer power plant to Tacoma to be used in an emergency has been granted to the Puget Sound Traction, Light & Power Company by the Board of County Commissioners.

EPHRATA, WASH.—The Grant County Power Company has petitioned the Board of County Commissioners for a franchise to erect and operate an electric power transmission line in Grant County.

OLYMPIA, WASH.—The State Board of Control awarded the contract for the construction of a power house at the State Insane Asylum at Sedro Woolley to Warrack Construction Co., Arcade Bldg., Seattle, for \$24,200. The improvement includes the construction of a 140-ft. concrete smokestack 11 ft. in diameter at the base and 6 ft. at the top. All bids for the boilers were rejected as too high and new bids will be called for.

SEATTLE, WASH.—The City Council has passed an ordinance authorizing the employment of J. L. Stannard, civil engineer, to investigate the possibility of Cedar River electric power development.

SEATTLE, WASH.—William D. Freeman, city purchasing agent, will receive bids until Aug. 31, 1917, for furnishing 4000 alternating-current wattmeters. Each bid to be accompanied by check for \$1,000. C. B. Bagley, secretary of Board of Public Works.

TACOMA, WASH.—C. F. Peterson of Seattle has offered the City Council an opportunity to buy the Cle Elum Halls power site, which is within the boundaries of Wenatchee forest reserve. No action will be taken until further information is received.

TACOMA, WASH.—The County Commissioners have granted the Puget Sound Electric Company a franchise to erect an electric transmission line from the Dieringer power plant to Tacoma. The proposed new line will be held in reserve for use in emergencies.

WHITE SALMON, WASH.—Ordinance No. 49 has been passed by the City Council granting a franchise to the Pacific Power & Light Company to maintain, construct and operate in White Salmon electric light and power lines, for the purpose of supplying the town with electricity. The franchise will run for a period of fifty years. C. H. Estes, clerk.

BAKER, ORE.—Repairs to the Fremont plant of the Eastern Oregon Power & Light Company will be made immediately to remedy damage done in recent fire. Loss amounted to \$6,000, with little damage to the machinery.

MARSHFIELD, ORE.—Charles Craine, formerly of Baltimore, is having a survey made of the Golden Falls property, near this city, with a view to developing a hydroelectric plant. Only preliminary work has been done so far. It is possible that both Silver Falls and Golden Falls will be developed.

PORTLAND, ORE.—The County Commissioners of Pierce County are considering the installation of electric lighting on the ferryboats. The report of H. H. Pickering, county electrician, was referred to Francis Capell, superintendent of bridges and ferries.

ROSEBURG, ORE.—Among the improvements contemplated by the Douglas County Water & Light Company during the coming year is the construction of a 185-ft. retaining wall 20 ft. high at Winchester, to protect the power plant from the wash of the river. The cost of the wall is estimated at \$5,000.

FRESNO, CAL.—Application has been made to the State Railroad Commission by the Merced Stone Company of San Francisco and the San Joaquin Light & Power Corporation of Fresno asking for authority for the Stone company to sell its electric plant in Mariposa and Merced Counties to the San Joaquin company for \$35,000.

GLENDALE, CAL.—An election will soon be held for the purpose of forming a new public highway lighting district, to be known as the Verdugo Lighting District of Los Angeles County.

LA GRANGE, CAL.—The State Railroad Commission has granted the Yosemite Power Company permission to sell its property in the La Grange division, which includes La Grange, Turlock, Waterford, Hughson, Ceres, Keyes, Hickman and Denair, to the Sierra & San Francisco Power Company at \$450,000.

LOS ANGELES, CAL.—The plan for the new lighting system on Broadway from the tunnel to Tenth Street was adopted by the City Council.

LOS ANGELES, CAL.—The new plant of the Los Angeles Shipbuilding & Dry Dock Company in the outer harbor district, Wilmington, is nearing completion. Work will begin at once on the erection of a power house, about 100 ft. by 200 ft. for plant operation. Fred L. Baker, president of the Baker Iron Works, 950 Broadway, is president and treasurer.

MILL VALLEY, CAL.—A communication has been received from the Pacific Gas & Electric Company calling attention to the advisability of arranging for an electrolier system of lighting streets by laying conduits while the present street improvement is being made. Action is now being taken.

OAKLAND, CAL.—The Oakland, Antioch & Eastern Railway Company and the Western Pacific Railroad Company, it is reported, have entered into an agreement whereby the latter will finance the construction of a branch line by the latter to tap Suisun and the Vaca Valley, which it is understood will extend from a point on the Oakland, Antioch & Eastern main line near Montezuma to Suisun, where connections will be made with the Vaca Valley and Suisun branch of the Northern Electric Railway. The cost of the proposed line is estimated at about \$500,000.

RIVERSIDE, CAL.—The Southern Sierras Power Company has applied to the California Railroad Commission for permission to operate in San Bernardino, Riverside, Kern and Inyo Counties.

PETALUMA, CAL.—The Town Council has decided not to appropriate money for an electrolier system at the present time. The installation was for Kentucky Street and was estimated to cost in the neighborhood of \$1,800.

STRATFORD, CAL.—A petition has been filed in the office of the County Clerk for presentation to the Board of Supervisors asking for the formation of an assessment district to provide a lighting system for the town of Stratford.

ZAMORA, CAL.—A movement has been started by the Board of Trade to secure an electric-lighting service for Zamora. Six pumping plants are planned for irrigation of the Zamora district if the service is secured. The Pacific Gas & Electric Company, it is reported, is considering extending its transmission lines from Woodland, a distance of 14 miles, to furnish electricity here.

GERALDINE, MONT.—The new electric-lighting plant being erected by the Geraldine Electric Company is nearly completed. A lighting improvement district has been created in the business section of the town.

KALISPELL, MONT.—The city has renewed its contract with the Northern Idaho & Montana Power Company for furnishing it with light in districts Nos. 1 and 2. Contract will run for a period of thirty-five months, at the price of \$3 a post a month,

the same rate that has heretofore prevailed. Under the contract, the city pays one-third of the cost and the property owners two-thirds.

TERRY, MONT.—The City Council has ordered installation of an electric lighting system in the city. Light will be placed at street intersections, the lamps being hung in the center from poles and to be of 100-watt size. The lighting system will later be improved by the installation of posts along the streets.

WHITEFISH, MONT.—Plans for installing cluster lightings on Central Avenue and Second Street are being considered.

BESSEMER, COL.—Plans are being considered for the installation of an ornamental lighting system on Northern Avenue.

VIRGINIA CITY, NEV.—The Nevada Valleys Power Company of Lovelocks has applied for a franchise to operate in Nevada County.

LAS CRUCES, N. M.—The construction of an interurban electric railway from Las Cruces to El Paso, a distance of 44 miles, it is reported, is being promoted by H. M. Gray of Las Cruces, and associates. Financial arrangements, it is said, have been made, and work will begin as soon as the survey is completed and the right of way obtained.

Canada

PRINCETON, B. C.—The Canada Copper Company, owner of the British Columbia Copper Company, contemplates the construction of a concentrating plant of 3000 tons daily capacity, involving an expenditure of \$2,000,000. The proposed improvements will include the construction of a hydroelectric plant and a 12-mile railroad spur from Princeton to Copper Mountain.

LAWRENCETOWN, N. S.—The Town Council contemplates an electric light plant for water power, involving the construction of dam and flume to cost \$5,000.

AMERANTH, ONT.—The hamlets of Waldemar and Laurel have petitioned the Hydro-Electric Power Commission for electrical service for the two hamlets and farms adjacent to each. This service will probably be furnished either from Grand Valley substation or by means of an outdoor pole-type substation located in the township.

COOKSTOWN, ONT.—A by-law providing an appropriation of \$9,500 for transmission and furnishing electricity in Cookstown will be voted on.

DERBY, ONT.—The township officials have entered into an agreement with the Hydro-Electric Power Commission of Ontario for electrical service.

LONDON, ONT.—The contract for electrical work for the tuberculosis hospital, to cost \$100,000, for the London Health Association has been awarded to the Hydro Commissioners.

MOOREFIELD, ONT.—A bylaw has been passed and tenders will likely be called shortly for hydroelectric system.

TORONTO, ONT.—The John V. Gray Construction Co., Ltd., has been awarded the contract for construction of a new power house for the Canadian National Carbon Co., Ltd., Toronto.

TORONTO, ONT.—Contracts have been let by the Hydro-Electric Power Commission of Ontario, covering the installation of a 4000-hp. generator and turbine at the Eugenia development. The installation of this unit will double the present capacity of the plant.

TOTTENHAM, ONT.—Improvements, to cost about \$9,000, to the municipal electric-light plant are under consideration.

TRENTON, ONT.—The construction of a transmission line from Halsey Falls to Trenton has been commenced. This line will operate at 44,000 volts and will be of pin-type construction, the conductor being of No. 2/0 copper cable.

WATFORD, ONT.—The construction work on the hydroelectric line to Watford is now completed.

SWIFT CURRENT, SASK.—By-laws have been passed by the City Council authorizing issues of debentures for \$30,000 and \$25,000 for improvements for the electric-light and power plant.

Miscellaneous

LIMA, PERU.—It is reported by Commercial Attaché W. F. Montavon at Lima, Peru, that electric locomotives, preferably running on storage batteries, are desired for use on the Cuzco-Santa Ana Railway.

1,236,401. CONNECTOR FOR ELECTRIC LEADS; Pierre Clerget, Levallois-Perret, France. App. filed Jan. 4, 1917. Consists in forming one-half of the connector with a knob adapted to be engaged through a button-hole-shaped aperture in the other half of the connector in order to make electrical contact with a spring contact contained in said other half.

1,236,448. ELECTRICAL FUSE; Thomas W. Kirkman, New York, N. Y. App. filed June 6, 1916. Improvements.

1,236,480. FACE PLATE FOR ELECTRICAL WALL RECEPTACLES; Johann G. Peterson, Jersey City, N. J. App. filed Feb. 19, 1917. Improvements.

1,236,485. SAFETY-LIMIT SWITCH; Fred A. Rundle, Harvey, Ill. App. filed Dec. 27, 1915. For cutting off the electric current when the mechanism has reached the safety limit in its path of travel in a given direction.

1,236,521. ELECTRIC SWITCH; Harold E. White, Glen Ridge, N. J. App. filed June 26, 1915. Improvements.

1,236,523. CONTACT POINT; Joseph A. Williams, Cleveland, Ohio. App. filed Aug. 9, 1915. Having a heat-resisting non-oxidizable tip united to a base or carrier in such a way that the contact point is durable, reliable and efficient in action.

1,236,551. SPLICING CLAMP FOR CABLES AND THE LIKE; James F. Dillon, Crown City, Ohio. App. filed Oct. 7, 1915. Adapted to splice the adjoining ends of cables through which an electric current is passed.

1,236,563. EXCESS-VOLTAGE-PROTECTING DEVICE FOR ELECTRIC LINES; Torsten A. F. Holmgren, Trollhattan, and Karl A. Lindstrom, Stocksund, Sweden. App. filed Feb. 17, 1914. Consists of a conducting wire mounted adjacent to (above, beneath or at the side of) the wires or wire strands forming the electrical lines proper.

1,236,584. LIGHTNING ARRESTER; Ray H. Manson, Rochester, N. Y. App. filed Nov. 27, 1916. Telephone.

1,236,592. ELECTRIC SIGN; Abraham Morgan, Independence, Mo. App. filed Jan. 18, 1917. Wording or characters of the sign to be conveniently changed from time to time.

1,236,595. PROTECTIVE SYSTEM FOR ELECTRICAL TRANSMISSION LINES; Lloyd C. Nicholson, Buffalo, N. Y. App. filed March 29, 1911. For extinguishing arcs on high-tension alternating-current transmission lines.

1,236,642. ELECTRIC HEATING DEVICE; Theodore Abtmeier, Wilkensburg, and Frank Thornton, Jr., Pittsburgh, Pa. App. filed April 6, 1915. For use in connection with certain types of coffee-percolating apparatus.

1,236,668. INSULATOR-CLAMPING DEVICE; James M. Brown, Pittsburgh, Pa. App. filed Jan. 4, 1916. Permits the use of an insulator of minimum size to withstand a predetermined shearing strain.

1,236,672. STORAGE-BATTERY GRID AND PLATE AND PROCESS OF MAKING SAME; Rufus N. Chamberlain, Chicago, Ill. App. filed March 14, 1914. Obtains a plate adapted to give an increased capacity for a given weight.

1,236,673. STORAGE BATTERY; Rufus N. Chamberlain, Chicago, Ill. App. filed March 27, 1916. Provides means for discharging or conveying a cool gas, such as air, into the lower part of the electrolyte of the battery.

1,236,674. CIRCUIT INTERRUPTER; Lewis W. Chubb, Edgewood Park, Pa. App. filed Dec. 26, 1913. Improvement.

1,236,675. VENTILATING MEANS FOR REACTANCE COILS; Lewis W. Chubb, Edgewood Park, Pa. App. filed May 14, 1915. Means for ventilating reactance coils which are inserted in polyphase circuits to limit to safe values the abnormal current flow therein arising from short circuits and other abnormal conditions.

1,236,716. OSCILLATING PHASE ADVANCER; Gisbert Kapp, Birmingham, England. App. filed Nov. 22, 1915. Employs a dynamo-electric machine wherein either the stator or the rotor winding is inserted in the alternating-current circuit in which it is desired to adjust the power factor, and the remaining winding is excited from a source of direct current.

1,236,726. MOTOR-CONTROL SYSTEM; Walter O. Lum, Wilkensburg, Pa. App. filed July 24, 1914. May be employed in connection with rolling mills and similar machines.

1,236,734. OUTLET BOX FOR ELECTRIC CONDUCTORS; William I. Patterson, Pittsburgh, Pa. App. filed April 28, 1914. Cover of the box is capable of adjustment with relation to the plane of the floor independently of the box and regardless of

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whether or not the box is in horizontal alignment with the floor.

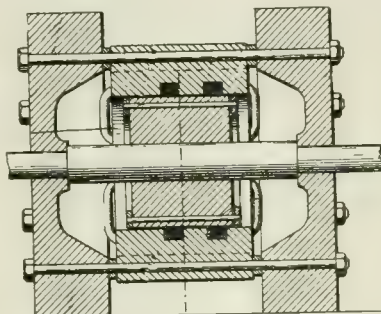
1,236,766. CONNECTOR; Bertrand P. Rowe, Wilkensburg, Pa. App. filed July 13, 1914. Efficient three-way connector and an inexpensive method of constructing such connectors from metal tubing.

1,236,772. RHEOSTAT; Melvin L. Severy, Arlington Heights, Mass. App. filed Dec. 22, 1914. Comprising a supporting member, a plurality of resistance units carried thereby, each having contacts located in the same curved surface, a shaft supported by said member concentric with said surface, arms rigid with said shaft, a cross-bar carried by said arms, and brushes carried by said bar in touch with said contacts.

1,236,786. ELECTRICAL MEASURING INSTRUMENT; Harold B. Taylor, Wilkensburg, Pa. App. filed Nov. 6, 1914. Ammeter for direct-current electrical circuits that shall indicate correctly the value of the current traversing the circuit without the necessity of interrupting its continuity.

1,236,790. IGNITING MECHANISM FOR INTERNAL-COMBUSTION ENGINES; Harry R. Van Deventer, Sumter, S. C. App. filed Oct. 1, 1914. Improvements.

1,236,792. X-RAY APPARATUS; Julius B. Wantz, Chicago, Ill. App. filed Feb. 13, 1915. Adapted for use with either the common or ordinary form of X-ray tube, or the recently devised so-called Coolidge



1,237,248—Electric Motor

tube, or other tubes employing a heating element, permitting the operator to use the variety of tube desired.

1,236,796. CURRENT REGULATOR FOR AUTOMOBILE LIGHT CIRCUITS; Albert Wehmeier, St. Louis, Mo. App. filed July 1, 1916. In the form of an inductance coil which serves as an impedance to regulate the current flow in the magneto light circuits of automobiles, particularly of the Ford make.

1,236,809. DIMMER FOR AUTO-HEADLIGHTS; Floyd G. Withrow and John P. Weeks, Grand Rapids, Mich. App. filed Nov. 6, 1916. Structure adapted to be interposed in the usual lighting circuit for attaining this end, it being possible through the structure produced to have the lights at either their full or diminished intensity for any desired length of time.

1,236,886. INSULATOR FOR TELEGRAPH AND TELEPHONE WIRES; Arvid C. Sorensen, Webster, N. D. App. filed Feb. 9, 1917. Wires are permitted to have a certain amount of play.

1,236,916. ELECTRIC REGULATION; John L. Creveling, New York, N. Y. App. filed Oct. 7, 1911. Automatic.

1,236,931. SYMPATHETIC GOVERNOR FOR ELECTRIC POWER DISTRIBUTION; Luther S. Henley, Lebanon, and Frederick R. Keller, Manheim Township, Lancaster County, Pa. App. filed July 3, 1914. So constructed as automatically to cut out a portion or all of the power supplied to a unit of a minor or auxiliary character when the power required by all the units being operated by the system approaches the capacity of the generating unit, so as to avoid the cutting out of a major or main unit and thereby maintain the continuous action or operation of said unit.

1,236,941. ELECTRIC IGNITION APPARATUS; Edward S. Huff, Detroit, Mich. App. filed Nov. 20, 1916. Material will not accumulate upon the contact points of the make-and-break apparatus.

1,236,976. INDICATION-TRANSMITTING APPARATUS; Jacob Perepelkin, Petrograd, Russia. App. filed July 7, 1917. The principal object is that the finder or indicator of a receiver shall not be caused to indicate falsely by reason of casual vibrations or shocks; that is to say, the reading by the indicator at the receiver should be changed only when caused to be so by the operation of the transmitter.

1,236,989. ELECTRICAL MAKE-AND-BREAK DEVICE; Edward T. Shaw, Pittsfield, Mass. App. filed March 30, 1916. For electric ignition systems for internal-combustion engines.

1,237,005. MULTIPLE-FUSE CARRIER; Charles A. Williams, Brooklyn, N. Y. App. filed Dec. 30, 1916. Plurality of fuses may be carried, so that when one fuse burns out another may be quickly and easily brought into position.

1,237,015. ELECTRICAL CONDENSER AND PROCESS OF MAKING SAME; William C. Britton, Jr., Kennett Square, Pa. App. filed March 23, 1916. Improvement.

1,237,033. ARC LAMP; Cromwell A. B. Halvorsen, Jr., Lynn, Mass. App. filed Aug. 31, 1915. Improvements.

1,237,080. ELECTRIC MOTOR STARTER; Thomas A. Melville, Fargo, N. D. App. filed Oct. 25, 1916. Combined rheostat and circuit breaker so designed as to incorporate the functions of the circuit breaker and the rheostat in a unitary article.

1,237,105. WARNING SIGNAL; Francis Scognamiglio, New York, N. Y. App. filed Oct. 11, 1913. Improvements.

1,237,112. PORTABLE ELECTRIC LIGHT; George A. Soehnelein, Brooklyn, N. Y. App. filed Oct. 5, 1916. Improvements.

1,237,124. ELECTRIC LIGHT REGULATOR; Leonard Sykes, Fort Wayne, Ind. App. filed Nov. 4, 1916. Series of exposed coils and a movable contact adapted to be rocked across the coils to establish electrical connection, therewith vary the resistance to the current passing to the filament of the lamp.

1,237,133. INDICATOR SYSTEM; Earl H. Wildasin, Wilkensburg, Pa. App. filed Sept. 30, 1916. For use in connection with motor-driven vehicles.

1,237,172. STARTING AND IGNITION MACHINE; Frank Conrad, Pittsburgh, Pa. App. filed Jan. 30, 1914. Improvement.

1,237,181. RECIPROCATING ELECTRIC MOTOR OR ENGINE; Ethan I. Dodds, Central Valley, N. Y. App. filed Jan. 22, 1913. Designed to provide a reciprocating electric motor, which may be used for a variety of purposes, but which is particularly well adapted for operating air pumps or compressors such as those employed upon electrically propelled vehicles for providing the supply of compressed air for the air brakes of the vehicles.

1,237,187. HOLDER FOR INCANDESCENT ELECTRIC LAMPS; George E. Farrar, Perth, Western Australia, Australia. App. filed April 11, 1917. Simple means whereby an incandescent electric lamp holder may be attached to the flexible cords carrying the shrouded flexible wires in an economical and effective manner.

1,237,191. FLASHLIGHT; Richard N. Friend, Sioux City, Iowa. App. filed Dec. 9, 1916. Improved support of cylindrical flashlights.

1,237,211. FUSE; Swan J. Leveen, Rock Island, Ill. App. filed Jan. 7, 1914. Improvements.

1,237,226. INDUCTION-MOTOR SYSTEM; Harry F. Stratton, Cleveland, Ohio. App. filed April 29, 1913. Relates to a controller for alternating-current motors of the induction type, by which controller such a motor may be started by automatically cutting resistance out of the secondary circuit of the motor.

1,237,234. VARIABLE-SIGNAL TRANSMITTER; Clarence E. Beach and Herman W. Doughty, Binghamton, N. Y. App. filed Aug. 7, 1914. Particularly adapted to the type of such transmitters which is provided with operating handles or knobs for use in the formulation of different signals, by adjusting the various handles to the particular digit desired and then initiating the operation of the transmitter by any suitable mechanism.

1,237,240. TIME-LIMIT-CONTROLLING DEVICE FOR ELECTRIC SWITCHES; George A. Burnham, Saugus, Mass. App. filed Dec. 23, 1912. Improvement.

1,237,248. ELECTRIC MOTOR; Allan W. Forbes, Worcester, Mass. App. filed Jan. 18, 1913. Single-phase induction type and means for starting the same.

Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN

Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, SEPTEMBER 1, 1917

No. 9

The Glory of National Service

SERVICE is the shibboleth of our industry. Its insignia are stamped on the minds and consciences of managers and linemen alike in characters ineffaceably brilliant, and it would appear sometimes that the apparatus also was imbued with its spirit. It is the alpha and omega of the trade and profession, which scatters and yet increases and carries its own reward.

It were vain to picture the world to-day minus its electric transmission of intelligence, of light and of power. Society without them, though handicapped, would survive—industry never. In one form electricity traverses the heavens above, the earth beneath and the waters under the earth, communicating to every nation the achievements, aims and aspirations of the others, thus laying the foundation for a common human brotherhood. In another form the pent-up energies of the watercourses and of the fuel of the earth have been employed to ease the burdens on the shoulders of man and to give him light.

Having made itself indispensable to civilized communities in times of peace, it is but natural that in the emergency occasioned by the war the nation should seek to use the force of electricity in the rapid and successful prosecution of that combat, wherein every agency known to science is engaged. The response of its votaries to the nation's appeal has been prompt. In all that the industry has done in and through its great unit organizations it has had working a tenser degree of individual vitalized man power than it has ever developed before. That which the individuals have attempted, that which they are carrying through with energy made strong by patriotic fervor, is far more effective by reason of the tremendous corporate and organization units through which the industry mainly acts. But the organizations are relying for their stimulating imagination and their inspiration upon highly trained and carefully directed human mentalities.

The human element in the industry has always been a markedly conspicuous feature of its unusual progress. This is so plain to the ordinary observer that it has become a commonplace and is accepted like any other ordinary routine circumstance. The individual is known to a great extent through his labor with the larger unit to which much of his time is given. He works, invents, plans as an essential part of an organization broader in scope and interests because of its combination of individual forceful effort. He makes the aggregate result bulk heavier, and the benefit of

the concentrated drive is in turn passed to the one whom industry at the moment is serving. At present it is the nation that is benefiting.

Complete details are not for the public just now. Too much is at stake involving the industry with the fate of the nation to permit disclosure of either detail or principle of much that is being done. But it is right that the industry should claim modestly that it is doing its bit in more ways than one. The assertion can be made even though for reasons of war the basis of it is withheld at the time. In loans and gifts of money, in the willing use of time and resources, in brains, in research, in invested capital, the industry is forward in serving its people and government.

Such service is not measured wholly by surface pledges, although it is fair that these should have been asked too. One has but to draw on his intimate knowledge of the high character of individuals composing the heart and soul of the industry to know that they have been ready with service. The incomparable Edison is a public word because of the picturesque favor with which the people of the whole land view him. He has not had to disguise the fact that he is working nearly twenty-four hours a day. And there are many others, unknown outside of the industry, unknown outside of a small circle in the industry in some cases, who are doing in obscurity the utmost of which they are capable, and doing it just as willingly as the captains of industry.

All the precious traditions of the industry are being surpassed in this year of test for the freedom established by our fathers. Built essentially on a public service, doing more for the general public than for private users, the great body of men and their leaders recognize a keener sense of obligation this year. They are less apt to question, they are more apt to do first and question afterward. That exceptional service has to be given they accept as an opportunity, not as a burden. Manufacturer, central station, engineer, supplier of materials, all are rendering service.

We doubt if when the international skies are cleared any finger can point to our failure to grasp the opportunity provided by the national call of democracy. The conviction is firm in us that in any crisis the men who compose our great industry will meet the supreme test which the times bring. Everything which can be done by electrical men has been and will be done to further the glory and perpetuate the fair name of our country, its untarnished character, its institutions and its ideals.

The Searchlight in Practice

LIEUT. S. G. HIBBEN'S paper on our present searchlight equipment gives a very practical notion of the conditions that have to be met and the results reasonably to be expected. The searchlight for military or naval use is radically different from other projectors in that the fundamental quality sought is extreme concentration of the beam in order to obtain reasonably long range of observation. The improvements in recent years have been largely in the direction of securing the maximum concentration possible in the source of light by the use of cored and sometimes impregnated carbons worked at the highest practicable current density.

Given a light source of specified size, the angular dispersion of the beam, when the source is as nearly as possible in focus, depends on the dimensions of the mirror system, since the angular variation of the reflected beam at various parts of the source depends on the angular spread of the source as it would be seen from the point of incidence concerned. Therefore for shore work the standard mirror is 60 in. (1.52 m.) in diameter, which is about the largest dimension for which the glass projector mirror can be produced without extreme cost and liability to breaking. Many attempts have been made to substitute for the Mangin mirror generally used a parabolic metallic reflector, very attractive at first thought on account of its cheapness, simplicity and freedom from risk of breakage. In point of fact the difficulty of getting a sufficiently accurate figure on such a mirror and the still greater difficulty of holding that figure constant under the varieties of temperature are so great that no useful results have followed, although such mirrors are very successfully used in general projecting work where extreme concentration of the beam is not necessary. In the largest units here mentioned the current runs between 160 amp. and 180 amp., with about 55 volts at the arc, so that, as a reference to the table will show, the current density in the crater is pushed extremely high. Lieutenant Hibben gives an interesting approximate formula for the equivalent candlepower in the beam as compared with the intensity of the source. It at once appears from his figures that the multiplying factor as between source and beam candlepower rises to some 3000 in these great and accurately designed searchlights, a figure three or four times as high as is reached in common projector practice.

The illustrations of the searchlight in practice are rather striking. The range even of the 60-in. (1.52-m.) lamp on objects like the gray of a ship's war paint does not ordinarily exceed in the clearest air much over 10,000 yards (9.14 km.), while under average conditions it will not greatly exceed half this figure, and slight haze may cut the penetration down to 3000 yards or 4000 yards (2.74 km. or 3.96 km.). One of the great problems at present is how to deal with such conditions of low visibility both for picking up objects and for gunfire, and no entirely satisfactory answer has as yet been obtained.

One interesting matter is the direction of the beam in lighting up a target. Practice shows that the searchlamp should be so placed as to throw a beam well out of the immediate line of vision to avoid back glare from haze as well as to prevent giving too much information to the enemy, the most favorable direction being about 30 deg. off the line of fire. Besides the great lamps specially described by Lieutenant Hibben, there is a large field for the service for smaller and easily portable units to be used for lighting the front, for picking up air craft and similar purposes. These are on the whole less exacting in their requirements, but considering the height at which air craft now fly a beam of large penetrating power will often be required. Perhaps one of the most useful engineering tasks now at hand is the design of portable searchlight sets combining the maximum of efficiency with the minimum of liability and ease of transport.

Holding Coal Prices in Check

THE regulative hand of the government is far-extended in the effort to relieve industry from burdens made almost intolerable by the rapacity of coal producers and dealers. Price-fixing of coal strikes squarely at one of the worst features of the high-cost menace. It gives consumers ground for expecting that the skylarking which characterized coal quotations last winter will be certainly less evident during the coming season, and for hoping that it will not be evident at all in many communities. Whatever improvement it makes will be just that much net gain—that much more than would have been obtained in price concession otherwise.

Connected with the question of price is the question of quantity production. Price reduction alone will not solve the problem of coal consumers; stimulation of volume produced is of equal or greater importance. On the surface it appears that stimulation of production would have followed more liberal prices, that output would have jumped with the prospect of large profit. Against this outsider's point of view, however, we have the knowledge that the action taken at Washington was the definite result of analytical study of coal production costs and that in any event the prices are provisional. The eyes of the government are wide open as to the necessity of encouraging production. If the scale fixed is too low to yield a profit which will accelerate output it is beyond argument that the scale will be altered.

It is the responsibility of getting enough coal for his plants which wears first upon the central station operator; he may balk at the price, but he pays it rather than stop service. With him it is more than a public obligation to continue service uninterruptedly, it is a honored tradition of the industry. So, while high coal prices have changed the calculations in cost sheets, he has kept steadily in mind the essential requirements. Facing the hard facts of exorbitant cost, he met the coal market as it was and he accepts it as it is to-day. Central stations are bound by contracts covering part of their coal necessities; they buy the proportion

their coal not covered in this way in the supply-and-demand-regulated outside market. With the maturity of old agreements, contract prices have moved upward under the extraordinary pressure of the last year. Contracts did not hold good with coal operators in all cases last winter when outside dealers boosted bids and secured first call on the supply. We do not advocate that central stations treat agreements as lightly as some coal operators did. But with the shoe on the other foot, where the government has put it by repressing the runaway prices which were demoralizing industry, central stations have a very good talking point for negotiating with coal companies.

The Technique of Street Lighting

OUR readers will welcome James R. Cravath's first paper dealing with the lighting of cities of moderate size. A great metropolis has problems of its own and is so densely populated that special methods of lighting are both appropriate and justified by the conditions. Mr. Cravath's present paper deals with the general situation and the general principles that underlie proper illumination of the streets. Particularly instructive is his discussion of the difference between incident illumination and brightness, as reckoned with under the various conditions of seeing to be found in practice. The modern oiled road has somewhat complicated the lighting situation. Its normal surface is extremely dark and diffuses a very small proportion of the light, often no more than 6 or 8 per cent. On the other hand, its specular element of reflection, to use the technical term for Mr. Cravath's very descriptive "glint," particularly at large angles of incidence, is rather astonishingly large, especially when the surface is well polished by traffic, and it often looks in distant view considerably brighter than its surroundings or than the ordinary surface of an oiled street. This peculiarity is both an advantage and an evil—an advantage in that it tends to equalize the apparent brightness along the surface, as Mr. Cravath points out; a disadvantage, especially by day, in producing a serious element of glare.

At night the surface glint considerably increases the visibility of objects, because of silhouetting, but affects hardly at all and sometimes unfavorably the numerous objects which are seen chiefly in virtue of their shadows. These two conditions, silhouetting and shadowing, determine visibility of objects immediately in the roadway, the former being chiefly useful for large objects at a distance, the latter involving the details of the surface. In addition, there is the ordinary requirement of raising illumination high enough to ren-

der objects easily visible in virtue of their differences of luminosity. Which of these three conditions must be regarded as of primary importance depends somewhat on the nature of the street and the character of the traffic. We fully agree with Mr. Cravath that the discussion of the relative values of illumination reckoned on the horizontal and on the vertical is somewhat fruitless, since under ordinary conditions meeting the general requirements of street illumination the ratio between the horizontal and vertical components does not vary enough to give to the matter any particular significance. The common American way of compromising by reckoning with the illumination normal to the ray and taking into account lights on one side of the object only is perhaps as good a first approximation as could be desired.

Another matter not unworthy of detailed attention is that of glare. As Mr. Cravath points out, the best remedy for glare is increasing the height of lamps. This is desirable for other reasons as well. The statement that the use of a diffusing globe on the lamp has very little effect on the glare is considerably too broad, since the phenomenon of glare depends on the concentration of light in the image upon the retina, and not merely on the quantity which falls on the eye. This is one reason for the greater effect noted in nearly central vision as compared with the blurred peripheral vision produced by a lamp out of the main field of view. At distances which produce the image of the source in what is practically a point two lamps giving equal candlepower, one with and one without the diffusing globe, cannot be told apart and produce the same element of glare. At shorter distances a point is reached where the diffusing globe will produce materially less glare, and at still shorter distances the difference between the two becomes very marked indeed. The practical case in which this condition is particularly noticeable is in the use of gas-filled incandescent lamps close along the road, from which the glare is often very offensive in spite of the moderate candlepower in the source. Glare, too, is profoundly affected by the state of adaptation of the eye, so that the power and spacing of individual units is by no means a negligible factor, a condition particularly noticeable in the case of intense sources placed too far apart on an otherwise somewhat dark street. The technique of street illumination in the comparatively small places Mr. Cravath is discussing is perhaps on the whole somewhat more difficult than lighting in large cities, and the present series of articles we believe will be particularly welcome to those interested in the ordinary lighting problems where economy and efficiency must be shrewdly combined.

THE spirit of this issue will be carried out in subsequent issues of the ELECTRICAL WORLD. Besides articles on a systematic method of changing transformers and adjusting plant facilities to handle Central States coal instead of Eastern fuel, there will be a semi-technical article on the

The Coming Issues

effect of field-circuit constants on transient short circuits in alternators. The second article in the series by James R. Cravath on street lighting for small towns and cities will be devoted to types of available and suitable lighting units for such installations.



(c) E. Muller, Jr.

Buying Electrical Materials for the Navy

Relations of the Navy Department and Its Large Requirements to
the Electrical Industry Discussed by Rear Admiral
McGowan—Co-operation of Wire Manufacturers

REAR ADMIRAL SAMUEL MCGOWAN, paymaster general of the navy and chief of the bureau of supplies and accounts of the Navy Department, analyzed this week for the Washington correspondent of the *ELECTRICAL WORLD* the present situation of his division, which is making large purchases for the government, and which may make still larger purchases if Congress passes the bill which is now pending, providing for approximately 150 new torpedo-boat destroyers.

"The general situation of the Navy Department, so far as it concerns the purchase of electrical material," Admiral McGowan said, "concerns itself particularly with the purchase of electrical wire. Of this we are now buying about 1,000,000 ft. (304,800 m.) a month, wire of all classes and conditions. The getting of wire is the principal item at this moment. Our idea is that the country is short of wire production. The fact that this country is short of wire production is complicated by the fact that Great Britain, which has been the great world manufacturing center of wire, as well as dies used for drawing wire, is also short of production. This situation has been still further complicated by the fact, from the Navy Department's information, that the special steel which has been used for the manufacture of these dies has been made in Great Britain heretofore, and that there has not yet been developed in this country an adequate source of supply of this special steel.

"Nevertheless, the wire industry has been brought into very close contact with the Navy Department. We have just had a meeting here of all the manufacturers' representatives. We mentioned to them our requirements, and they have worked out a plan of procedure. A committee, consisting of prominent men in the industry, has been appointed. This includes LeRoy Clark of the Safety Insulated Wire & Cable Company, Wallace

S. Clark of the General Electric Company and Edward Sawyer of the Atlantic Insulated Wire & Cable Company. This committee is informed from time to time of our requirements, and the committee endeavors to see to it that we get what we want, also that there shall be left ample production for our possible demands. The committee is a sort of co-ordinating element. In case quotations received on ordinary bids do not give satisfaction as to prices or deliveries, the committee ascertains the situation at each mill, and informs us what is necessary to get us what we want, arranging in some cases for raw materials or having shipments expedited by the government, also in some cases arranging to have ordinary commercial business set aside."

GOVERNMENT NEEDS

Admiral McGowan also discussed lamps and other electrical materials in connection with government policies, saying:

"Lamps are purchased through the general supply committee of the government, based on an efficiency test of the Bureau of Standards. We follow the recommendations of the Bureau of Standards. I think this is rather well known. But so far as electrical fittings are concerned, many of our fittings have been made lately at the Portsmouth Navy Yard. There has been some criticism of giving what might possibly be called commercial work to a government navy yard. What we did in respect to that and other government navy yards however, was with the desire to conserve the labor force. With that for a short time we had some little difficulty.

"Now, however, the navy yards are filled with repair and construction work. We are no longer worried about maintaining our labor force in the yards.

"The tendency therefore now comes to get work

done by commercial firms—using our dies, our blue-prints and drawings, and every other facility we now have available.

"Our ordinary stock requirements, such as material needed at the navy yards for repair work and maintenance work, are pretty well covered by existing contracts. Requirements for new construction of electrical material cannot be known very long in advance. At the present time that depends in one instance upon what Congress does. The department has sent in recommendations for about 150 torpedo-boat destroyers. If these are built within a short time there will be, of course, an enormous demand for electrical machinery. On other kinds of electrical machinery, principally motors, the production is very much below the present demand. There is not much demand right now for dynamo machinery, but ground was broken on Aug. 25 for the new armor-plate plant at Charleston, W. Va., and there will be some interest in that in the electrical industry."

CO-OPERATION FROM THE GOVERNMENT

In pointing out how the government facilitates the work of manufacturers, Admiral McGowan said:

"So far, the industries have responded in a most commendable manner to the needs of the government. In order, in some cases, to get our war needs, we have been obliged, in a sort of way, to ask the War Industries Board to exercise priority over many important commercial requirements. Every one has been very cheerful about this work, however, and the industry can realize now that, in many ways, the government can be of assistance to it. The industry has found that the government can create a constant flow of raw material, and can possibly be of assistance in the labor situation. The government can help out on the question of the car supply in the way of getting materials to or product from mills and factories. All that we ask is that the industry establish the need for the materials and tell

us how we can help. We have organized a section in this division of the Navy Department which takes care of that kind of work solely.

"We feel that we have made it to the interest of the



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industry to understand that it is dollars and cents in pocket to have a navy contract. That works toward creating a good will toward the navy. That is what we want to get. If we can get that we are always assured of our source of supply at fair prices."





EAST PITTSBURGH WORKS OF THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY ACTIVE IN WAR-TIME WORK

Manufacturers Help in the War Program

The Work of the Associated Manufacturers of Electrical Supplies in Aiding the Government—Great Manufacturing Companies Turn Resources to National Service—Individuals Do Their Part

THE Associated Manufacturers of Electrical Supplies has shown from the first a keen interest and desire to aid in the work of supplying the government with such material as is covered by the products of the manufacturers embraced in its membership.

As early as January, 1916, President Robert K. Shepard wrote to President Wilson, tendering the facilities of the association in planning for the mobilization of the electrical industry for the benefit of the country.

Later, in a conference in Washington with the manufacturers of wires and cables, arrangements were made by which three leading manufacturers from the association were constituted a supervising committee, to handle and equably apportion all orders of the government, with a view to hastening production by the various American manufacturers of insulated wire, so that the emergency needs might be met expeditiously, without imposing upon a few manufacturers an unreasonable proportion of the total requirements, to the detriment of business in general.

The manufacturers agreed with the supervising committee to accept such apportioned orders and to fill them at prices determined by agreement between the department and the supervising committee. The result of this has been prompt shipments, saving many months which would have been required under the usual procedure.

The demands of the government covered in large quantities hundreds of devices manufactured by the various members of the association, including lamp receptacles and sockets, fuses, porcelain of all kinds, certain lines of overhead insulating material and certain

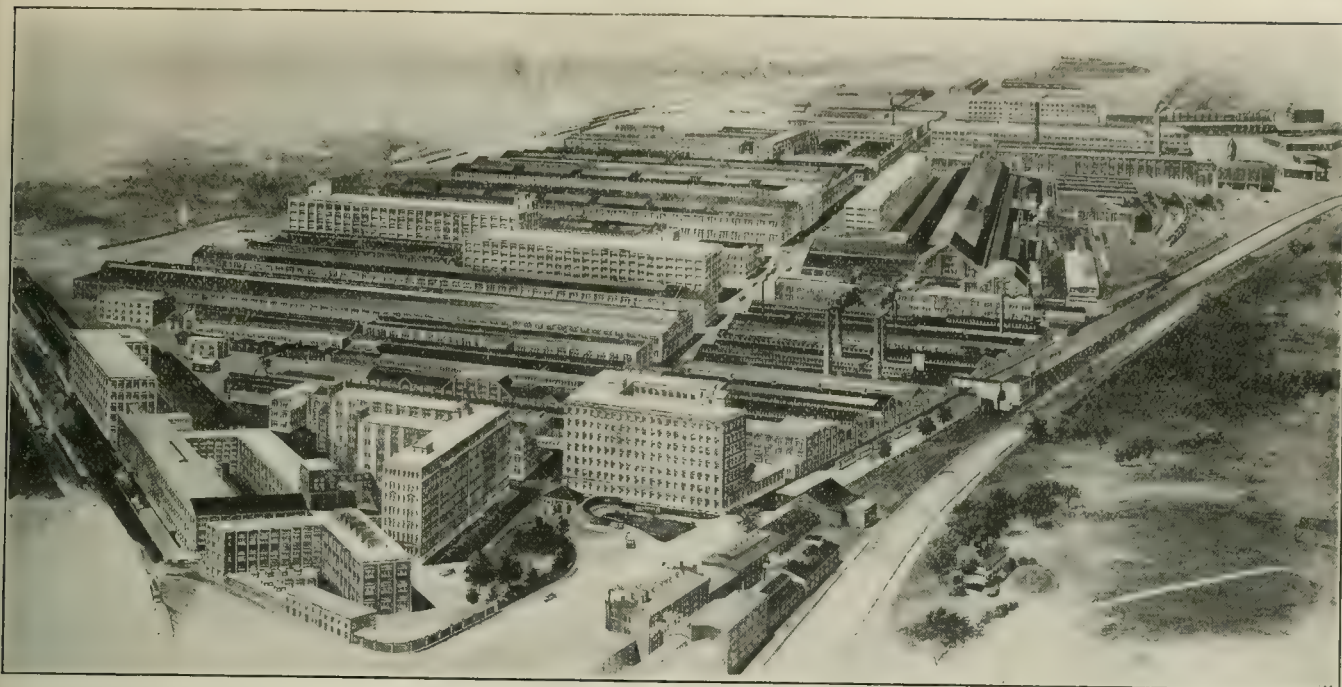
kinds of fixtures, and recently large orders have been placed for fan motors, and in meeting these demands similar methods have been adopted in the various sections of the association as were used in the furnishing of wire and cable. The manufacturers met and compared their facilities for meeting the requirements and this resulted in the acceptance of the orders with agreements on matters of delivery which could not have been obtained through individual companies.

The office of the general secretary, Charles E. Dustin, has been in direct communication with the various departments of the government, submitting detailed data covering the products of members, so segregated that the department could know readily to whom to submit specifications for requirements. This has resulted in large orders having been placed with prompt deliveries in each case, the different members co-operating with a view to giving the government their best efforts in all directions.

GENERAL ELECTRIC ENLARGES FACILITIES

The General Electric Company has increased its manufacturing capacity and output at an unprecedented rate as a result of the industrial and war activities. Both industrial orders and requirements in connection with work needed by the government have justified extensive enlargement of production facilities. Much new construction is planned or under way at the main Schenectady works and at other plants of the company and its subsidiaries.

Not only through the use of its manufacturing resources, but also through the services of a number



SCHENECTADY WORKS OF THE GENERAL ELECTRIC COMPANY, WHERE MUCH APPARATUS IS BEING MANUFACTURED

of officials and employees the company is rendering service to the government. Work which is being done is of a confidential nature, but it is of the largest measure of service to the country. In such work the closest co-operation is arranged with the government forces so that the outcome may be of the maximum possible advantage.

As of Jan. 1, 1917, the total manufacturing floor space of the plants of the General Electric Company was 15,301,000 sq. ft. (1,407,000 sq. m.). From Jan. 1 to date (Aug. 29) there has been completed additional floor space aggregating 1,000,000 sq. ft. (92,900 sq. m.), in addition to which there are under construction buildings with an aggregate floor space of 2,600,000 sq. ft. (239,200 sq. m.), of which from 40 to 50 per cent will be completed by Jan. 1, 1918.

LARGE NEW WESTINGHOUSE PLANT

Of the new activities undertaken by the Westinghouse Electric & Manufacturing Company the largest is the construction of the plant at Essington, Pa. The entire production of this plant can be applied to government service. On part of the 500 acres (202 hectares) comprising the site of the Essington plant buildings now under construction will provide an aggregate of 14 acres (5.6 hectares) of floor space. Already partial operation has been started, and it is expected that the buildings now planned will be ready for complete manufacturing uses by Dec. 1. The present construction program will furnish 25 to 30 per cent of the ultimate plant planned for this point. Turbines and condensers will be the first products manufactured at the Essington plant. The largest works of the Westinghouse company, at East Pittsburgh, occupy 53 acres (21.4 hectares) of land, so that there is abundant room for expansion at Essington to a size far beyond that of the earlier manufacturing headquarters.

The Essington site has a frontage of $1\frac{1}{4}$ miles (2 km.) on the Delaware River. The first contracts for materials were let early in January, and every effort has been made to rush construction. An enormous

amount of underground work has been done. In the first development there are 5 to 6 miles (8 to 9.6 km.) of railroad track. Westinghouse, Church, Kerr & Company have charge of the designing and construction. The work is under the supervision of Calvert Townley, assistant to the president of the Westinghouse Electric & Manufacturing Company.

As in the case of other companies, individuals connected with the Westinghouse company are serving the government in various capacities.

WESTERN ELECTRIC COMPANY ACTIVITIES

Dependence upon the maintenance of communication in modern warfare places a large part of the Western Electric Company personnel in a position where it can serve the country to excellent advantage. Particularly is this true of the engineering department, which consists of men trained for telephone and telegraph work in both wire and wireless branches. From among them two complete radio or field telegraph companies have been recruited and are ready for intensive training.

A number of engineering department and other executives whose training has fitted them for such service have received commissions in the Signal Officers' Reserve Corps. Others hold commissions in the National Guard, the Quartermasters' Reserve Corps, the navy and the Naval Militia. The ranking Western Electric officer is Major F. B. Jewett, S. O. R. C., chief engineer of the company.

The number of men who are already under oath to the government is 806, and 450 of these are now in active service. The total number of men registered under the draft law is 9676, but no data are available as to the number actually in the first call.

Among other companies, the Crocker-Wheeler Company is doing important work. The Wagner Electric Manufacturing Company has been awarded contracts for the manufacture of munitions, as explained more fully in the news columns of this issue. A number of other companies are engaging in activities which provide materials for the prosecution of the war.

War Contributions of the Industry

Indications That Subscriptions to Liberty Loan and Red Cross Funds Reach Hundred-Million-Dollar Mark—Number of Men Registered Under Selective Draft Also Shown

SPECULATION has been rife over the extent to which the electrical industry has contributed in men and money to the successful conduct of the war. There follow detailed statistics showing subscriptions by utilities, manufacturers, jobbers and others and their employees of \$46,625,000 in Liberty bonds and \$2,236,862 to the Red Cross fund, and indicating that 29,065 men registered. In addition, the companies here reporting have furnished the government with 6824 men for national service. As will be noticed, however, these statistics are not complete.

On the basis of the reports received there should be no hesitation in saying that the total subscriptions of the electrical industry to the Liberty Loan reached at least \$100,000,000, while it is doubtful if the Red Cross subscription fell far short of \$5,000,000. It is not easy to estimate the number of men engaged in the industry

who have been registered under the selective draft. Almost 30,000 are here reported, and it is reasonable to believe therefore that the total will be in excess of 50,000. In like manner the indications are that around 15,000 men from the industry are in national service.

Several ambulances have been donated by members of the industry, including one by the Electrical Supply Jobbers' Association, for which \$2,000 was appropriated. Another fund to which money was subscribed was that of the Y. M. C. A. for work among the national forces.

At the outbreak of the war there were in round numbers 275,000 men engaged in the electrical industry. Of this number, 18.2 per cent are registered in the selective draft, and 5.7 per cent have already entered the nation's service. By the end of the current year another ten or fifteen thousand will undoubtedly be mustered in, a loss in man power of around 10 per cent.

Name of Company	Liberty Loan Subscription	Red Cross Subscription	Listed and Drafted	Name of Company	Liberty Loan Subscription	Red Cross Subscription	Listed and Drafted
Alva (Okla.) Light & Power Co.	\$110	1		Dayton (Ohio) Power & Light Co.	\$6,400	\$3,250	101
American Brass Co., Waterbury, Conn.	1,000,000			Detroit (Mich.) Fuse & Mfg. Co.	7,400	1,235	15
American Railways Co., Philadelphia, Pa.	100,000			Doehler Die Casting Co., Brooklyn, N. Y.	10,400	1,100	12
Amer. Tel. & Tel. Co., New York, N. Y.	\$8,692,100	582,500	4,600	Dossert & Co., New York, N. Y.		350	6
Bell System	3,800		12	Douglas (Ariz.) Traction & Light Co.	22,000	370	58
American Transformer Co., Newark, N. J.	7,300	1,000	4	Dubuque (Ia.) Electric Co.			
American Lava Co., Chattanooga, Tenn.	50,000		200	Dunham, Garrigan & Hayden Co., San Francisco, Cal.	143,500	3,500	13
Anderson Electric Car Co., Detroit, Mich.	150	25	8	Eastern Oregon Lt. & Pwr. Co., Baker, Ore.	1,450	450	12
Antigo (Wis.) Electric Co.	2,100	250	32	Economy Fuse & Mfg. Co., Chicago, Ill.	80,000		
Androscoggin Electric Co., Lewiston, Me.	60,000		21	Edison Elec. Ill. Co. of Brooklyn, N. Y.	540,000		
Ansonia (Conn.) Electric Co.	2,850	768	6	Edison Electric Light & Power Co. of Amsterdam, N. Y.	1,200	26	6
Archbald Brady Co., Syracuse, N. Y.	1,050			Electric Bond & Share Co., New York, N. Y.	200,000		3
B. F. Ashcroft & Sons, Sulphur Spgs., Tex.			5	Electric Fuse Guard Co., Newark, N. J.	500		20
Atlantic Coast Elec. Co., Asbury Park, N. J.	4,100	400	25	Electric Machinery Co., Minneapolis, Minn.	3,000		
Austin & Co., M. B., Chicago, Ill.				Electric Ry. & Manufacturers Supply Co., San Francisco, Cal.	4,000	390	
Baker & Co., Newark, N. J.	16,000	1,250	6	Elec. Sales Service Co., San Francisco, Cal.	1,200	350	1
Baylis & Co., Bloomfield, N. J.	5,000	150		Electric Storage Battery Co., Phila., Pa.	44,950	7,934	
Belden Mfg. Co., Chicago, Ill.	12,550	2,176	109	Electric Supply Co., Memphis, Tenn.	10,000	100	4
Beloit (Wis.) Water, Gas & Electric Co.		1,300	102	Electric Sup. & Equip. Co., Hartford, Conn.	1,500	1	5
Benjamin Electric Co., Chicago, Ill.		600	13	Electrical Supply Co., New Orleans, La.	100	50	8
Benton Harb. (Mich.) & St. Joe Ry. & Lt. Co.	5,000	326	16	Electrical Testing Lab., New York City	57,400	1	
Binghamton (N. Y.) Ry. Co.	75,000	25,000	150	Electro Dynamic Co., Bayonne, N. J.	2,270,950	3,377	104
Bliss Co., E. W., Brooklyn, N. Y.	27,750	670	21	Electric Boat Co.	1,000		1
B. R. Elec. & Tel. Mfg. Co., Kansas City, Mo.	6,500		33	Elkins (W. Va.) Power Co.	3,600	50	8
Brown Instrument Co., Philadelphia, Pa.	4,900	900		Elliott-Lewis Electrical Co., Phila., Pa.	30,000	1,000	
Bruce-Macbeth Engine Co., Cleveland, Ohio	20,000	2,000	150	Emerson Electric Mfg. Co., St. Louis, Mo.	1,000	250,000	
Burke Electric Co., Erie, Pa.	500,000	25,000		Empire State Gas & Elec. Assn., N. Y. City	1,000		5
H. M. Byllesby & Co., Chicago, Ill.				Esco Electric Supply Co., Albany, N. Y.	13,000		5
Cambridge (Mass.) Electric Light Co.	53,000	500	5	Eugene Munsell Co., New York, N. Y.	200		5
Cameron Electric Mfg. Co., Ansonia, Conn.	11,700		19	Eugene (Ore.) Water Board	9,600	1,200	37
Campbell Electric Co., Lynn, Mass.	2,250	350	15	Eureka Co., North East, Pa.			
Capital Electric Co., Salt Lake City, Utah	2,750	700	40	Excelsior Springs (Mo.) Water, Gas & Electric Co.	500		5
C & C Electric Mfg. Co.	5,000		22	Federal Sign System (Elec.), Chicago, Ill.	35,100	584	19
Central Hudson Gas. & Elec. Co., Poughkeepsie, N. Y.	29,700	1,000	74	Ferracute Machine Co., Bridgeton, N. J.	10,000		12
Central Indiana Ltg. Co., Indianapolis, Ind.	100	33		Florida Elec. Supply Co., Jacksonville, Fla.	1,050	35	
Central Maine Power Co., Augusta, Me.	2,800			Gas & Elec. Improvem't Co., Boston, Mass.	5,350	60	
Central Mass. Electric Co., Palmer, Mass.	650	75	14	Gardner (Mass.) Electric Light Co.	400	100	
Central Power Co., Grand Island, Neb.	50,000	5,000	6	General Electric Co., Schenectady, N. Y.	8,002,900		2,000
Century Electric Co., St. Louis, Mo.	250	125	46	General Light & Power Co., Cloquet, Minn.	5,700		7
Charlottesville (Va.) & Albemarle Ry. Co.	6,250		7	Globe Mfg. Co., Perry, Ia.	2,250	10	3
Chattanooga (Tenn.) Ry. & Light Co.	1,000	410	7	Gloucester (Mass.) Electric Co.	750,000	15,000	1,200
Cheyenne (Wyo.) Light, Fuel & Power Co.			3	B. F. Goodrich Co.	1,100	55	3
Cities Service Co., New York, N. Y.	9,100	*4500	2	Great Barrington (Mass.) Elec. Light Co.	40,000		
Citizens Light & Power Co., Adrian, Mich.	3,050	50	2	Great Western Power Co., San Francisco.	15,000	100	42
Cliff Elec. Distributing Co., Niagara Falls	600	100	8	Greenfield (Mass.) Elec. Light & Power Co.	2,000	425	
Clinton (Mass.) Gas Light Co.	4,150			Gulport (Miss.) & Miss. Coast Tract. Co.	75,100		2
Cohoes (N. Y.) Gas Light Co.	2,200	199	8	Guernsey Ball Bearing Co., Jamestown, N. Y.	800	150	
Columbia & Montour Electric Co., Bloomsburg, Pa.	1,000	500		G & W Electric Specialty Co., Chicago, Ill.	13,850		132
Columbus (Ohio), Delaware & Marion Ry.	6,000			Hartford (Conn.) Electric Light Co.	10,000	2,500	80
Combustion Eng'g Corp., New York, N. Y.	1,070,000	31,500	1,800	Harvey Hubbell, Inc., Bridgeport, Conn.	7,050	137	87
Commonwealth Edison Co., Chicago, Ill.	5,700,000		1,100	Harwood Electric Co., Hazelton, Pa.	1,550	25	
Consolidated Gas Co., New York, N. Y.	211,000	100,000		Holabird Electrical Co., San Francisco, Cal.	100,000		
Consol. Gas, El. Lt. & Pr. Co., Baltimore	100	25		Holyoke (Mass.) Water Power Co.	100	100	10
Cope, T. J., Philadelphia, Ia.	50	250	5	Home Gas & Electric Co., Greeley, Col.	100,000	5,700	382
Corrus Christi (Tex.) Railway & Light Co.	1,500		50	Home Wire Co., New York, N. Y.			
Cortland (Ohio) Lighting Co.	167,500	8,500		Hoopeston (Ill.) Gas & Electric Co.	13,000		25
Crocker Wheeler Co., Ampere, N. J.	34,450	1,000	125	Hoover Suction Sweeper Co., New Berlin	87,000	2,500	150
Cumberland County Power & Light Co., Portland, Me.	4,750	465		Hubbard & Co., Pittsburgh, Pa.			
Cutter Co., George, South Bend, Ind.							

Name of Company	Liberty Loan Subscription	Red Cross Subscription	Listed and Drafted	Name of Company	Liberty Loan Subscription	Red Cross Subscription	Listed and Drafted
Hughes Electric Heating Co., Chicago, Ill.	\$8,000	\$5,900	18	Fine Bluff (Ark.) Co.	\$2,200	\$383	2
Huntington (Ind.) Light & Fuel Co.	12,000	1,200	11	Portland (Ore.) Ry., Light & Power Co.	35,400	4,150	574
Hurley Machine Co., Chicago, Ill.	7,350	5,800	29	Port Glover Electric Co., Cincinnati, Ohio	15,000	500	10
Huron (S. D.) Light & Power Co.	3,200	111	6	Public Service Co. of Northern Illinois	250,000	7,500	...
Illinois Electric Co., Los Angeles, Cal.	2,650	100	8	Public Service Corp. of N. J., Newark, N. J.	770,350	15,000	...
Illinois Traction Co., Peoria, Ill.	...	...	...	Public Service Operating Co., Owatonna	...	...	6
Indiana Rys. & Light Co., Kokomo, Ind.	...	5,100	...	Queensboro (N. Y.) Gas & Electric Co.	30,550	...	...
Inter-Mountain Electric Co., Salt Lake City, Utah	7,600	500	21	Quincy (Ills.) Gas, Electric & Heating Co.	1,350	40	5
Interstate Pub. Serv. Co., Indianapolis, Ind.	3,650	154	12	Reliance Elec. & Engin'g Co., Cleveland, O.	2,500	1,125	30
Iowa City (Ia.) Light & Power Co.	750	50	10	Robbins Electric Co., Pittsburgh, Pa.	1,000	300	8
Iron City Electric Co., Pittsburgh, Pa.	7,200	600	15	Robbins & Myers, Springfield, Ohio	79,000	10,754	393
Jackson (Tenn.) Railway & Light Co.	...	300	11	Robertson Cataract Elec. Co., Buffalo, N. Y.	24,300	2,400	12
Jamesville (Wis.) Electric Co.	7,000	175	8	Rochester (N. Y.) Ry. & Light Co.	44,650	2,650	248
Johns-Pratt Co., Hartford, Conn.	35,000	2,150	66	Rockland (Me.) Thomaston & Camden Street Ry. Co.	4,500	450	10
Keene (N. H.) Gas & Electric Co.	500	250	5	Rogers (Ark.) Light & Water Co.	650	37	4
Keene (N. H.) Mica Products Co.	4,700	200	12	Rosewell (N. M.) Gas & Electric Co.	...	...	8
Kimble Electric Co., Chicago, Ill.	...	100	...	Roth Bros. & Co., Chicago, Ills.	1,500	90	46
Laclede Gas Light Co., St. Louis, Mo.	200,000	16,000	439	Rutenber Electric Co., Marion, Ind.	...	125	10
Laconia (N. H.) Gas & Electric Co.	600	210	0	St. Cloud (Minn.) Public Service Co.	10,150	300	...
Lakewood (N. J.) & Coast Electric Co.	17,000	...	...	St. Paul (Minn.) Electric Co.	4,100	320	11
Leeds & Northrup Co., Philadelphia, Pa.	...	...	...	St. Petersburg (Fla.) Lighting Co.	1,600	125	5
Leighton (Pa.) Electric Light & Power Co.	1,100	...	60	Salisbury (Md.) Light, Heat & Power Co.	2,500	100	8
Liberty Light & Power Co., Richmond, Ind.	3,500	80	1	Sangamo Electric Co., Chicago, Ills.	15,500	1,000	...
Light & Development Co. of St. Louis, Mo.	50,000	...	...	San Joaquin Light & Pwr. Co., Fresno, Cal.	30,650	5,511	63
Lincoln Electric Co., Cleveland, Ohio	6,200	750	100	Schenectady (N. Y.) Illuminating Co.	6,450	5,000	...
Lineman Protector Co., Detroit, Mich.	...	139	...	Shapiro & Aronson, New York, N. Y.	5,350	...	5
Litscher Electric Co., C. J. Grand Rapids	10,000	900	3	Shawnee (Okla.) Gas & Electric Co.	650	...	6
Lux Mfg. Co., Hoboken, N. J.	15,000	100	12	Sherwin-Williams Co.	200,000	50,000	...
McCarthy Bros. & Ford, Buffalo, N. Y.	7,700	750	15	Simplex Wire & Cable Co., Cambridge, Mass.	116,400	...	...
McEwen Bros., Wellsville, N. Y.	...	445	10	S. Morgan Smith, York, Pa.	100,000	...	20
McGraw Co. { Omaha, Neb. }	1,500	1,000	60	South Norwalk (Conn.) Electric Works	...	...	9
McGraw Co. { Sioux City, Ia. }	...	...	...	Southern Cal. Edison Co., Los Angeles, Cal.	250,000	200,000	...
McGraw-Hill Pub. Co., New York, N. Y.	110,000	1,000	...	Southern Illinois Ry. & Power Co., Harrisburg, Ill.	...	...	18
McNaughton, McKay Electric Co., Detroit	1,550	150	4	Southern Sierras Pwr. Co. }	...	...	...
Mackay Companies, New York, N. Y.	1,000,000	...	...	Nevada-Cal. Pwr. Co. and }	7,300	1,775	135
Macon (Ga.) Railway & Light Co.	...	1,000	40	Associated Companies }	...	...	...
Mahoning & Shenango Railway & Light Co., Youngstown, Ohio	128,000	580	432	Southwest General Elec. Co., Dallas, Tex.	38,200	1,014	52
Manchester (N. H.) Trac. Lt. & Pwr. Co.	6,600	1,013	...	Southwestern Gas & Electric Co., Texarkana (Ark.) Division	1,800	...	...
Manhattan Elec. Sup. Co., New York, N. Y.	250,000	...	...	Spray Engineering Co., Boston, Mass.	8,700	...	14
Marshall Wells Hardware Co., Portland, Ore.	54,000	...	25	Standard Underground Cable Co., Pittsburgh, Pa.	135,200	50,000	300
Mellicrate Mfg. Co., New York, N. Y.	200	...	...	Standard Woven Fabric Co., Walpole, Mass.	30,000	200	73
Menominee (Mich.) & Marinette Light & Traction Co.	2,100	...	6	Stanley & Patterson, New York, N. Y.	8,000	...	25
Metropolitan Eng'g Co., Brooklyn, N. Y.	50,000	...	...	Steam & Elec. Mchry. Co., Bay City, Mich.	2,000	200	...
Middle West Utilities Co., Chicago, Ill.	129,000	7,850	...	Swett Iron Works, A. L., Medina, N. Y.	6,000	1,200	...
Minnesota Gas & Electric Co., Albert Lea, Minn.	1,200	300	4	Tennessee Eastern Electric Co., Johnson City, Tenn.	500	232	9
Minnesota Utilities Co., Chisholm, Minn.	1,500	85	10	Charles H. Tenney & Co., Boston, Mass.	62,700	...	67
Missouri & Southeastern Utilities Co., Blythesville, Ark.	100	...	2	Terre Haute, Indianapolis (Ind.) & Eastern Traction Co.	...	...	50
Mitchell-Rand Mfg. Co., New York, N. Y.	1,050	...	1	Terry Steam Turbine Co., Hartford, Conn.	105,950	4,012	...
Mitchell (S. D.) Power Co.	1,500	15	2	Texas Gas & Electric Co., Houston, Tex.	5,000	500	14
Moberly (Mo.) Light & Power Co.	650	200	10	Toledo, Bowling Green & Southern Traction Co., Findlay, Ohio	5,000	...	10
Mohawk Elec. Supply Co., Syracuse, N. Y.	...	...	...	Tower Binford Electric & Mfg. Co., Richmond, Va.	750	10	0
Mohrte Co., Urbana, Ohio	150	...	11	Trumbull Elec. Mfg. Co., Plainville, Conn.	12,050	1,774	...
Montana Electric Co., Butte, Mont.	2,500	572	3	Union Electric Co., Pittsburgh, Pa.	11,000	1,430	16
Morris & Somerset Electric Co., Morristown, N. J.	2,600	...	10	Union Elec. Lt. & Pwr. Co., St. Louis, Mo.	...	\$811	127
Mountain Electric Co., Denver, Col.	550	118	4	Union Elec. Supply Co., Providence, R. I.	...	...	2
Municipal Gas Co., Albany, N. Y.	119,950	432	84	Union Gas & Electric Co., Cincinnati, Ohio	737,500	10,385	460
Narragansett Electric Lighting Co., Providence, R. I.	26,000	115	34	Union Metal Mfg. Co., Canton, Ohio	10,000	500	...
National Electrical Credit Men's Association, Chicago, Ill.	...	125	...	United Electric Light & Power Co., New York, N. Y.	61,000	...	...
National Pipe Bending Co., New Haven	2,000	15	4	United Lt. & Rys. Co., Grand Rapids, Mich.	79,600	...	...
National Tank & Pipe Co., Portland, Ore.	6,500	...	1	Virginia Ry. & Power Co., Richmond, Va.	50,000	...	...
Newburyport (Mass.) Gas & Electric Co.	9,950	520	10	Wabash Valley Electric Co., Clinton, Ind.	...	...	4
New England Butt Co., Providence, R. I.	21,000	500	10	Wagner Electric Mfg. Co., St. Louis, Mo.	100,000	10,000	496
New England Power Company System, Worcester, Mass.	6,800	1,250	90	Walker Co., Henry L., Detroit, Mich.	...	...	...
New Process Gear Corp., Syracuse, N. Y.	23,300	13,740	48	Walker Vehicle Co., Chicago, Ill.	506,600	...	...
New York (N. Y.) Edison Co.	303,050	...	...	Ward Leonard Elec. Co., Mt. Vernon, N. Y.	9,000	...	17
New York (N. Y.) Insulated Wire Co.	50,000	...	...	Ward Motor Vehicle Co., Mt. Vernon, N. Y.	...	...	...
Niagara Falls (N. Y.) Power Co.	1,023,700	26,900	62	Ware County Light & Power Co., Way Cross, Ga.	200	340	5
North Carolina Electric Power Co., Asheville, N. C.	5,000	...	210	Washington Elec. Supply Co., Butte, Mont.	3,000	150	3
Northern Connecticut Light & Power Co., Thompsonville, Conn.	1,000	150	5	Washington Pipe & Foundry Co., Tacoma	20,000	500	10
Northern Electric Co., Minneapolis, Minn.	...	...	6	Washington Water Power Co., Spokane	19,600	4,716	25
Northern White Cedar Assoc. Members, Minneapolis, Minn.	22,850	3,690	...	Waynesboro (Pa.) Elec. Light & Pwr. Co.	...	...	5
Northwestern Electric Equipment Co., St. Paul, Minn.	15,250	1,000	10	Webster (Mass.) & Southbridge Gas & Electric Co.	4,500	...	0
Quissbaum Co., V. M., Ft. Wayne, Ind.	1,550	27	3	Westboro (Mass.) Gas & Electric Co.	...	5	0
Racine (Wis.) Service Co.	...	20	...	Westchester Light'g Co., Mt. Vernon, N. Y.	37,200	...	9,676
Rio Brass Co., Mansfield, Ohio	25,000	500	...	Western Electric Co., New York, N. Y.	...	...	...
Riohite Co., New York, N. Y.	42,100	1,060	...	Western United Gas & Electric Co., Aurora, Ill.	8,500	50	...
Ryan (N. Y.) Electric Light & Power Co.	450	580	9	Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.	2,900,000	471,000	...
Sylvania (Wash.) Light & Power Co.	...	500	5	West Indiana Utilities Co., Brazil, Ind.	...	30	1
Pacific Gas & Elec. Co., San Francisco, Cal.	386,400	...	...	Wilson Co., H. A., Newark, N. J.	17,150	100	3
Pacific States Elec. Co., San Francisco, Cal.	12,000	1,100	12	Wisconsin Pub. Serv. Co., Green Bay, Wis.	4,500	20	45
Packard Electric Co., Warren, Ohio	10,300	793	158	Wisconsin Valley Elec. Co., Wausau, Wis.	6,500	300	5
Packard Wire Fence Co., New York	92,200	1,500	...	Worcester (Mass.) Electric Light Co.	113,800	...	98
Parker & Co. Properties, Boston	29,200	...	...	York (Pa.) Railways Co.	...	...	...
Parker & Son, J. H., Parkersburg, W. Va.	2,750	100	1	Edison Light & Power Co., York, Pa. }	32,000	2,500	...
Penn Central Lt. & Power Co., Altoona, Pa.	10,000	350	109	Yonkers (N. Y.) Elec. Light & Power Co.	6,850	...	...
Pennsylvania Water & Power Co., Holtwood, Pa.	...	50,000	...	Youngstown (Ohio) Sheet & Tube Co.	3,856,000	155,368	1,000
People's Gas & Electric Co., Savannah, Ill.	1,700	100	1				
Pettingell Andrews Co., Boston, Mass.	20,000	1,250	...				
Philadelphia (Pa.) Electric Co.	425,000	...	943				
Philadelphia (Pa.) Hydro-Electric Co.	15,000	...	1				
Phillips, Leo A., New York, N. Y.	1,000	...	...		

*\$30 per month. †Employees, \$75 per month. ‡Employees, \$500 per month. §\$34.50 per month. ¶\$125 per month.
 §City division of company has been giving \$250 per month to Red Cross.

Electric Ship Propulsion in the Navy

Construction of Electrically Driven Battleships and Battle Cruisers
Undertaken with Fullest Confidence in the Step, Says Admiral
Griffin—A Summary of the Advantages

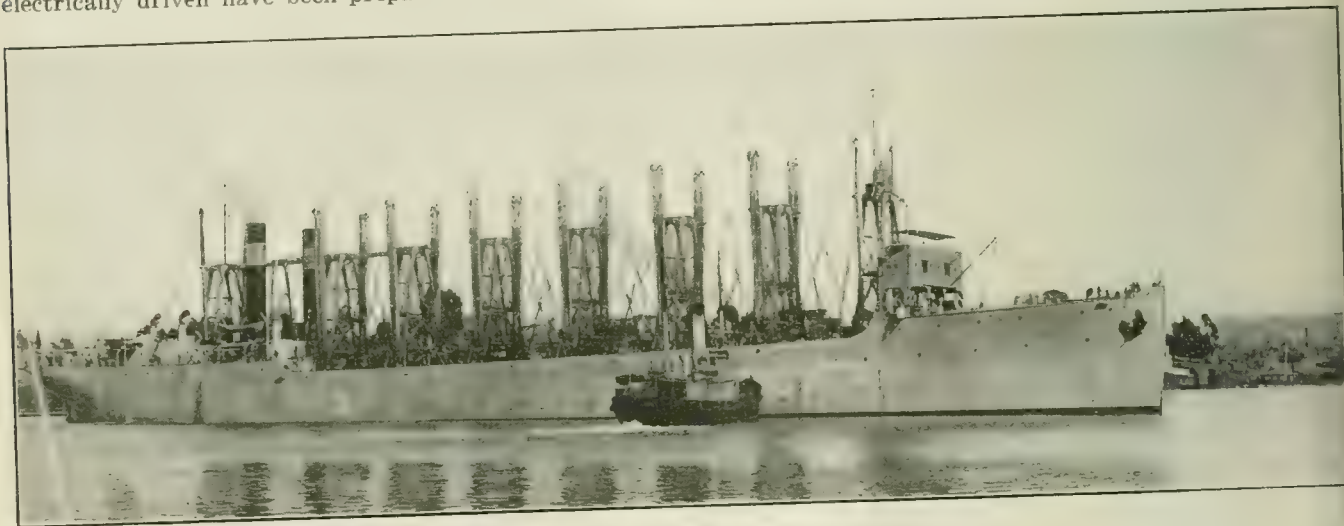
REAR ADMIRAL GRIFFIN, chief of the Bureau of Steam Engineering of the Navy Department, is looking forward to the rapid completion of the new battleship *New Mexico*, now being built at the New York Navy Yard, the first warship in the world, aside from the collier *Jupiter*, to be electrically driven.

It has been under the direction of Admiral Griffin that the plans for the new battleships and battle cruisers of the United States Navy which are to be electrically driven have been prepared.

be with one turbine and two motors. This makes it possible to overhaul the other turbine whether it is at sea or not.

The turbines are always operated under fairly good load conditions and hence always give good economy. Since only one turbine is used at the lower speeds, the load on it will always be twice as much as for direct-connected machinery.

The turbines are always operated under fairly good speed conditions and this insures good economy of the turbines. This is due to the fact that the speed-reduction ratio is variable. This is accomplished by winding the stators of the motors for two different numbers of poles, either of which can be put into operation by simply throwing a



THE ELECTRICALLY-DRIVEN U. S. COLLIER JUPITER

The Washington correspondent of the *ELECTRICAL WORLD* discussed the construction of the new electrically driven ships with Admiral Griffin, and was requested, in accordance with the public policy, not to publish in the *ELECTRICAL WORLD* any technical details.

"We went into the building of battleships and battle cruisers to be electrically driven only after the most careful consideration and knowledge based on our experience with the machinery of the collier *Jupiter*," said Admiral Griffin. "We feel the fullest confidence that we are not making a mistake and that the machinery of all these battleships and battle cruisers will prove to be what we want. Some of us steam engineering men are now becoming electrical men. We move with our profession."

An official statement was prepared not long ago in Washington which gave some of the advantages of the electric drive on the larger ships. Admiral Griffin's attention was drawn to it by the Washington correspondent of the *ELECTRICAL WORLD*, and he said he desired to indorse it. This was the statement:

Electrical propulsion virtually gives duplicate means of propulsion. With two turbines and two motors, one or either of them could break down and still leave a means of propulsion; this is of course true in the case of direct-connected machinery; but in the case of the electric drive, if it is a turbine that is broken down, the propulsion would still be twin-screw. The two turbines would be so designed that either would be capable of giving about seventeen or eighteen knots, and the normal method of running would

switch. For example, if the generator has two poles and the motors are arranged to have either thirty poles or fifty poles, the reduction in the first case would be fifteen to one, and in the second case thirty-five to one.

This combination of good load conditions and high speed is really the vital point, so far as economy at cruising speeds on a battleship is concerned; and it is an advantage that any other form of propulsion will find it difficult to overcome.

The governor absolutely eliminates all racing in a seaway with the attendant strains on shafting and danger of throwing propeller blades.

Speed can be maintained with much greater accuracy than with any other form of propulsion. This is of little importance to a merchantman; but it is not necessary to emphasize the importance of this to a battleship to anyone who has been in the fleet.

The space taken up is less than required for other form of propulsion.

The arrangement of the machinery is much more flexible than any other form of propulsion, as the position of turbines and motors is not fixed.

The readiness with which repairs can be effected is a great argument.

Owing to the small size of the turbines, the upkeep will be very materially reduced.

The rapidity of operation is much greater than with other forms of propulsion.

After indorsing the above official ideas, which caused the adoption of the electrical propulsion idea for several battleships and five battle cruisers now being built for the navy, Admiral Griffin said:

"But the biggest advantage has not been stated."

Electric propulsion does not require a separate turbine for backing. You reverse your motor instead of bringing into play a turbine which has been running idle."

While the New Mexico at the New York Navy Yard will soon be completed, the other large new ships of the navy which are being built with the electrical drive are not so well advanced. The Colorado and Washington are being built at the New York Shipbuilding Company's yards, the Maryland and the West Virginia at the Newport News Shipbuilding & Dry Dock Company yards, the Tennessee at the New York Navy Yard and the California at the Mare Island Navy Yard. These are all battleships.

Five battle cruisers are being built, two under contract at the Newport News Shipbuilding & Dry Dock Company yards, one at the Philadelphia Navy Yard, one at the New York Shipbuilding & Dry Dock Company yards, and one at Fall River. These ships will be given names famous in American history.

QUICK ELECTRICAL SERVICE FOR AVIATION FIELD

Dayton Power & Light Company Provides Energy for Wilbur Wright Aviation Base—Engineering Co-operation with Government

The Wilbur Wright aviation field, established by the government as a base for training and instructing aviators for the United States Army, the electrical service for which is being supplied by the Dayton Power & Light Company, is located at Fairfield, Ohio, 9 miles (14.4 km.) northeast of Dayton. The field comprises approximately 2500 acres (6177 hectares), upon which 105 buildings are constructed, twenty-four of which are hangars, each having a capacity for housing six airplanes. The base consists of what are recognized by the government as two units; in other words, there are two separate and distinct sections, identical in every respect, lying adjacent to each other, but in combination they appear as one base.

All of the buildings used as officers' quarters, barracks, hospitals, etc., will be supplied with steam heat, two central heating plants being installed.

In this connection it is interesting to learn that the Dayton Power & Light Company extended the third wire from its Osborn substation to Fairfield, a distance of 1.5 miles (2.4 km.), and from that point erected a quarter-mile (0.4-km.), three-phase, 2300-volt line to the aviation field within forty-eight hours.

This was followed by the erection of a 2-mile (3.2-km.), three-phase, 2300-volt line required by the contractor to place the power service at his disposal at the various buildings under construction. This power service was for the purpose of operating saws, drills, etc., required in the erection of the buildings. This work was accomplished in record time, and it has been admitted that the Dayton Power & Light Company had service available whenever required by the contractor.

Following the completion of this line, primary lines were extended in the rear of the hangars for a distance of 1.5 miles (2.4 km.). As each building was completed the proper transformer was erected to supply service. A total of sixteen transformers were erected for the temporary electric light and power requirements of the contractor.

The transmission line from the Osborn substation soon became taxed to its capacity and a 3-mile (4.8-km.) line from the Dayton-Osborn and New Carlisle transmission line of the Dayton Power & Light Company was erected in about three days in order that sufficient electrical capacity could be supplied.

This latter line when totally completed will be a 40-ft. (12-m.) Class B Idaho cedar pole line, spans 200 ft. (60.9 m.), No. 4 B. & S. hard-drawn stranded bare copper insulated with Ohio Brass Company No. 11,622 and mounted on Lee pins. The voltage of this transmission line is to be 13,200, 60-cycle, three-phase, it being the ultimate intention to increase this to 33,000.

This transmission line terminates in a high-tension substation which houses electrolytic arresters, three 150-kva., 13,200/2300-volt, single-phase, 60-cycle transformers with a 60-kva. regulator. Underground cable is used to connect this substation to the primary line in the rear of the building, at which point it rises to the top of the pole line along which the primary line is routed. All buildings are served by underground cables from this pole lead.

The power load of the field is concentrated at one point in each unit, making it convenient to furnish all power service for each of the two units from one transformer installation.

All power for the field is supplied by two 100-kva., three-phase, 2300-volt to 230-volt transformers. The power demand is made up of water pumping, aero repair, garage, etc., the total load being approximately 200 kva. The light load will approximate 300 kva. All power and light will be supplied by means of eighteen distributing transformers. The high-tension line and substation have been so designed as to provide ample means to double the present electric developments.

The engineers of the Dayton Power & Light Company co-operated and furnished considerable engineering advice.

PROGRESS ON WORK FOR THE HAMPTON ROADS NAVAL BASE

Development of Plans of the Virginia Railway & Power Company for Furnishing the Electrical Service

The following statement showing progress of work done by the Virginia Railway & Power Company for the United States naval operating base at Hampton Roads, Va., has been given to the ELECTRICAL WORLD by J. Carlyle Stephens, electrical engineer of the company:

July 6, 1917.—First request received from the supervising architects for collaboration in ascertaining the requirements of the base and deciding on a general plan of distribution. The company placed its engineering staff at the disposal of the government for this service.

July 17, 1917.—Approved plan in shape to get prices and delivery on material. This plan consisted of a central outdoor substation of approximately 1000-kva. capacity, transforming from 11,000 to 2300 volts, and for the present, three 2300-volt, three-phase distributing circuits.

July 26, 1917.—Authority received for ordering material and having delivery of same placed on war basis.

July 30, 1917.—Company's representative took actual charge of construction work, and work begun.

Aug. 20, 1917.—Large portion of transformer consignment, wire and other material received. Up to this time all poles have been set, and such wire as could be supplied locally put up.

Middle West Is Speeded Up for War

Electrical Companies with Headquarters in Chicago Are Turning Men and Resources to the Service of the Government in Any Direction Where Help Is Needed

IN PROVIDING the fundamentals of war—money, men and materials—the electrical industry in the Middle West has been forward.

Prominent in the work of helping the nation in every way, large or small, is the Commonwealth Edison Company of Chicago. The company has donated the use of the old Edison building, 120 West Adams Street, for the Illinois State Council of Defense and other war bodies.

When the aviator Ruth Law dashed into the State Council of Defense, stating that she had no money with which to light her aeroplane electrically while she was flying in the interests of the government, the Commonwealth company gladly provided the electric sign illumination for the machine. On other occasions quantities as high as two hundred of 200-watt lamps have been supplied to army organizations which needed light immediately and were unable to purchase the desired equipment at once. In common with other companies the company supplied the government with a list of transformers which it could release for cantonment work.

ACTIVITIES OF OFFICIALS

Samuel Insull, president Commonwealth Edison Company, Public Service Company of Northern Illinois, Middle West Utilities Company and West Penn Power Company, and prominent in control of many other utility properties, has given and is giving of his time and strength to numerous activities connected with the war.

The powers of the Illinois State Council of Defense, granted by the Legislature, are very broad. The council, under the chairmanship of Samuel Insull, has done much for the Great Lakes naval training station, Great Lakes, Ill., and has taken a leading part in the movement to regulate coal prices in the public interest.

E. W. Lloyd, general contract agent Commonwealth Edison Company, is assistant secretary of the State Council of Defense, and many other officers and department heads are con-

tributing time and effort in furtherance of the work.

Major Peter Junkersfeld has traveled much in the last three months as supervising constructing quartermaster for the sixteen cantonments for the new National Army.

George R. Jones, the Public Service company's purchasing agent, is chairman of the organization known as the "Four Minute Men," which is arranging for talks before moving picture audiences and keeping up enthusiasm in that manner. Keene Richards, formerly the company's superintendent at Lacon, Ill., has been commissioned captain in the Signal Corps.

HELP FROM BYLLESBY ORGANIZATION

In the Byllesby organization H. M. Byllesby has been giving a large percentage of his time to co-operative work. George H. Harries, the vice-president of the company, is now a brigadier general in charge of three regiments of the Nebraska National Guard at Deming, N. M. W. R. Thompson, manager of engineering construction, is among those who have joined the Officers' Reserve Corps.

Three properties of the company are furnishing utility service to cantonments.

While meeting these unusual demands at some points, the company is taking constructive measures for conservation at other places.

SERVICE OF THE MANUFACTURERS

Among the manufacturers the various companies located in different cities are an important factor in government work. They are not only supplying vast quantities of materials but in addition are furnishing large quotas of men for national service in the fighting forces and elsewhere.

In the heating device field the Hughes Electric Heating Company is supplying a steady government demand for army and navy bake ovens. A new type of oven has been developed to meet army conditions.



ILLINOIS STATE COUNCIL OF DEFENSE BUILDING



A BUSY SCENE AT ROCKFORD, ILL.

Typical Work at the Cantonments

Examples of Rapid Necessary Construction by Central Station Companies
to Meet the Government Requirements for Troops So that
Electric Service Shall Be Ready When It Is Wanted

IN DIFFERENT sections of the country central station companies have handled their forces of men rapidly in order to complete without delay the construction work necessary for providing electric service for the government cantonments. To get the material in time has involved great effort in various cases. Central station officials and employees have worked loyally to do their part. The following examples are presented in the ELECTRICAL WORLD as typical of the patriotic spirit in which the industry has come forward to the national call.

The same attitude of readiness to furnish service is reported throughout the country generally.

WORK HASTENED IN LITTLE ROCK

C. J. Griffith, general manager Little Rock (Ark.) Railway & Electric Company, in writing to the ELECTRICAL WORLD, says:

The Little Rock Railway & Electric Company is constructing a transmission line from its power house to the Twelfth divisional cantonment, located approximately 8 miles from the city.

Prior to the location of this cantonment at Little Rock, the company was furnishing light and power for the officers' reserve training camp at Fort Logan H. Roots, which is on the route of the transmission line to the cantonment. In order that the

construction forces of the cantonment might have immediate service, the line was extended from Fort Roots to the cantonment and 2300-volt service furnished to the contractors, James Stewart & Sons, on July 27, their requirements being approximately 100 kw.

The demand at the Twelfth divisional cantonment will approximate 1000 kw., 350 kw. of which will be used for pumping purposes, and the remainder for lighting and miscellaneous power purposes. The 13,200-volt line mentioned above will be of sufficient capacity to care for Fort Roots and a number of large power consumers in this vicinity, these amounting to about 750 kw.

The transformers for this work are being furnished by the Wagner Electric Manufacturing Company, St. Louis, and consist of three 750-kva., three 350-kva., three 200-kva. and three 100-kva. This does not include the distribution transformers at the cantonment. The three 200-kva. transformers will take care of the demand of the existing customers on this line. The poles were purchased from the Page & Hill Company, Minneapolis; the wire from the Phillips Insulated Wire Company and John A. Roebling's Sons Company; insulators from the Ohio Brass Company and Parker Insulator Company, and the switching and lightning protective devices from the General Electric Company.

The contract for furnishing light and power to the cantonment was closed on July 8, and it has been a herculean task to assemble the necessary material and apparatus.

BRIGADIER-GENERAL HARRIES CALLS FOR PERSONAL SELF- SACRIFICE

CAMP CODY, DEMING, N. M.,
Aug. 27, 1917.

To the ELECTRICAL WORLD:

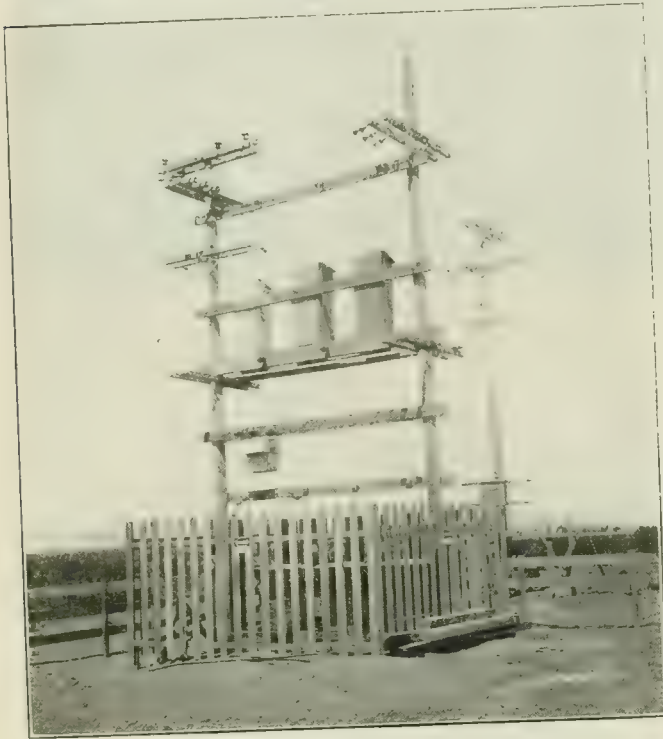
Surrounding conditions, with their insistent demands, render impossible any well-balanced thought of matters other than the imperative military duty of the hour. To suggest any one great national service thing which could be undertaken by the electrical industry of the country is beyond me. What can be done, though, by every man, woman and corporation in the business is to give (to the last measure of human and mechanical energy) unselfish loyalty and whole-hearted endeavor in every practicable phase of that personal self-sacrifice without which our existence as a free people cannot be justified.

GEO. H. HARRIES.

WORK OF THE SAN DIEGO COMPANY

L. M. Klauber, superintendent electric department San Diego (Cal.) Consolidated Gas & Electric Company, sends the following description of the work at Camp Kearny to the **ELECTRICAL WORLD**:

Camp Kearny, is located on a tableland east of Linda Vista station on the Atchison, Topeka & Santa Fé Railway from San Diego to Los Angeles, and about 14 miles north of the business district of the city of San Diego. Here there is a large level tract of land covering approximately 8000 acres, (3237.5 hectares) known as the Linda Vista Mesa. The camp site, though located only 6 miles (9.7 km.) from the shore of the Pacific, is at a considerable elevation.



SUBSTATION SERVING CANTONMENT

no portion of it being situated below the 425-ft. (129.5-m.) contour.

From the time the location of the National Guard cantonment was given out, there was some delay before contracts were awarded and actual construction begun. Nevertheless, the San Diego Consolidated Gas & Electric Company began construction work immediately and continued it throughout this period, so that when the general contractor began work electric energy was available on the site for lighting and power; and gas for cooking within a few days after the contractors' forces began to erect the temporary buildings for their own accommodation.

The San Diego company tapped one of its main 11,000-volt feeders at the south side of Mission Valley, which is north of San Diego, and erected 10.5 miles (16.9 km.) of three-phase 11,000-volt circuit to the camp site. The conductor is No. 4 bare, the pole spacing on tangents being 350 ft. (106.7 m.); 110 50-ft. (15.2-m.) poles and fifty-five 40-ft. (12.2-m.) poles were set for this line. The 50-ft. (15.2-m.) poles were used along a portion of the line which will in future be occupied by one of the company's 66-kv. transmission lines. Digging on this line was rather difficult; across the mesa lands every hole must be blasted in hard pan.

While the electric extension was being run the gas department installed 9 miles (14.4 km.) of 6-in. (15.2-cm.) high-pressure gas main, the joints being welded.

At the camp site we have a temporary substation stepping down from 11,000 to 2300 volts. This has a capacity of 300 kva. and will be added to from time to time as may be required.

The company has been awarded the contract for the dis-

tribution system on the camp site. This will involve approximately 11 miles (17.7 km.) of pole line carrying various 2300-volt secondary and street-lighting circuits. The main primary feeders will be three-phase No. 2 medium hard-drawn double-braid weather-proof. Secondary circuits will vary from No. 6 to No. 2 wire. Street-lighting circuits will be 0.25-in. (6.4-mm.) galvanized steel. About 400 poles will be set on the camp site, mostly 40 ft. and 30 ft. (12.2 and 9.1 m.). Main lines will be jointly used with the communication companies. Street lights will be 100 cp. 6.6-amp. Mazda C units, mounted on 4-ft. (1.2-m.) arms. Approximately 350 will be installed.

Temporary business during the construction period which has been so far connected includes 50 hp. at a sawmill, a 40-hp. air compressor, a 10-hp. hoist at a reservoir and two 5-hp. portable saws. More of the latter will be added as construction proceeds. All of the contractors' camp buildings are electrically lighted, as well as the temporary military camps about the site. There are two moving picture shows in operation.

The total permanent connected load has not yet been definitely decided. There will be approximately 190 hp. of pumps at the cantonment site, and the city of San Diego will have a booster pump located some 6 miles (9.7 km.) south of the site, with a 100-hp. motor. The total lighting load will be in the neighborhood of 450 kw.

The company now has about 120 men employed in the gas and electric distribution systems being installed on the camp site. The company camp is located on the south edge of the site at a considerable distance from the other contractors' camps. Material is delivered by railroad, the Santa Fé having extended its lines within a few days after the arrival of the contractor.

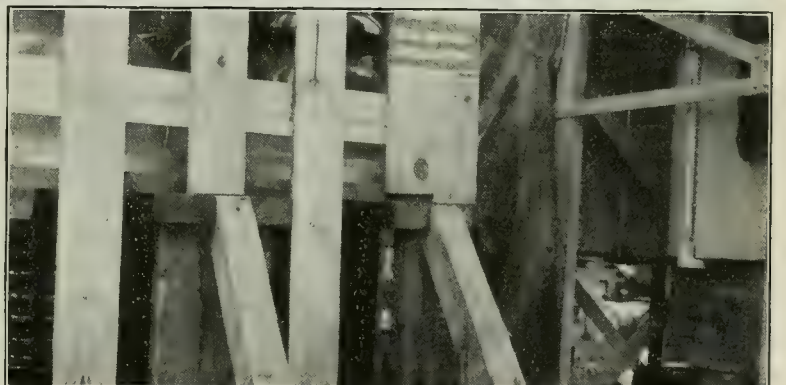
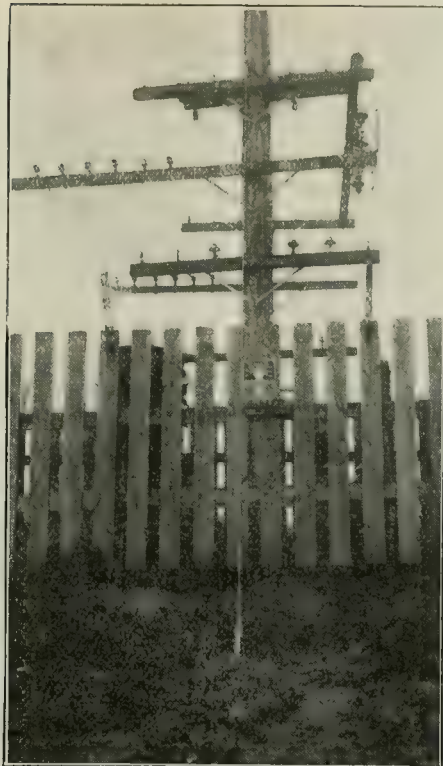
We have had no difficulty in securing adequate labor locally. Material, both for the construction of our line to the cantonment site and for the construction of the distribution system for the government, has been drawn from our local stock, so that there has been no delay. Poles, cross-arms, transformers, wire and hardware were available in adequate quantities.

RAPID ELECTRICAL CONSTRUCTION AT AYER CANTONMENT

Soon after this issue of the **ELECTRICAL WORLD** reaches its readers, the United States army cantonment at Ayer, Mass., will be in active occupancy by the first levy of drafted troops to be concentrated in the Northeast for preliminary training prior to overseas service. Electricity has been a vital factor in the construction of this cantonment, officially known as Camp Devens, and it will play an equally useful part in the life of the camp during the training periods.

To furnish a permanent electrical supply it was necessary to build a 66,000-volt transmission line 8.2 miles (13.1 km.) long from Leominster, Mass., to the cantonment, and this task was performed, including the design and erection in part of a permanent substation, in one month and fourteen days. The work was done by the Power Construction Company, Worcester, Mass., affiliated with the New England Power Company, which supplies energy for all the permanent electrical service of the cantonment, the Ayer Electric Light Company acting as distributor of electrical energy for construction service only.

An article describing the use of electricity at Camp Devens was published in the **ELECTRICAL WORLD** for July 28, 1917, page 171. Before emphasizing the permanent substation and line work which has been completed since that date, attention may be called to the temporary substation erected near the southeast corner of the camp for construction service. At this point three 100-kva. General Electric transformers were installed within a stockade to reduce the pressure from



TYPICAL RAPID CANTONMENT DISTRIBUTION AND SUBSTATION CONSTRUCTION

12,000 to 2300 volts for local distribution. This service is taken from the New England Power Company system at Clinton, Mass., by a single-circuit, three-phase tap into a local transmission line running between Clinton and Ayer village, the connection being made in the town of Harvard about 5 miles (8 km.) from Ayer. The incoming line terminates on a wooden-pole structure erected within the stockade, and a set of choke coils and horn-gap lightning arresters is mounted on the overhead structure. From the incoming line taps are taken through disconnecting switches to a set of oil switches controlling the supply of energy to the transformer bank, and by the use of long cross-arm construction the 2300-volt leads are easily cared for and carried away to the various distributing centers. A distant view of the transformer stockade with a typical 2300-volt line and two sets of Westinghouse lightning arresters of the pole type used in the camp distribution service is shown in an accompanying illustration.

CANTONMENT WILL CONTAIN 1118 BUILDINGS

The cantonment will accommodate more than 40,000 troops when present construction work is completed and will contain 1118 buildings, of which 622 are scheduled for completion by Sept. 1. At this writing 7500 men are at work on the cantonment, the general contractors being Fred T. Ley & Company of Springfield, Mass. The permanent electrical supply is distributed from a semi-outdoor substation. As it was impossible to obtain outdoor transformers of the size needed in time, it was necessary to provide for housing the available units, and these are installed in a structure of wooden studding and asbestos-coated walls. Besides the outdoor line terminal facilities, which include General Electric K026 66,000-volt oil switches and aluminum cell lightning arresters, the plant contains a 20-ft. by 28-ft. (6-m. by 8.5-m.) regulator and oil-switch house from which leads are carried to a distributing frame on the south side of the substation, from which the various 2300-volt lines lead to different parts of the camp.

Provision is made for two incoming 66,000-volt lines spaced 36 ft. (10.9 m.) apart. The incoming leads terminate on Locke five-disk strain insulators attached to disconnecting switches, which are connected by short taps with the high-tension oil switches. Beyond the latter another set of disconnects is provided and the incoming leads are then carried through choke coils and an installation of General Electric outdoor high-tension metering equipment located just outside the transformer house. A horizontal transfer bus installation is provided between the oil switches and choke coils, with taps at the end through disconnecting switches to the lightning arresters. In the middle of the bus section the leads are dead-ended on strain insulators, the construction providing for the installation of disconnecting switches as soon as the second line is completed. An extra set of disconnecting switches is provided between the horizontal bus and the lightning arresters so that the latter can be isolated while the incoming leads are alive during construction or under operation. Three 500-kva. water-cooled General Electric transformers are installed in the substation.

The line installation from Leominster to Camp Devens when complete will consist of two independent pole lines equipped with Thomas wishbone type cross-arms and

Locke suspension insulators. The two lines will be spaced 40 ft. (12 m.) apart on a right-of-way 125 ft. (38 m.) wide, and about 600 40-ft. (12-m.) chestnut poles are required. On straight line four-disk insulators are used, five-disk units being provided on dead-ends. A standard spacing of 6 ft. (1.8 m.) between conductors is employed, and one complete transposition is made in the 8.2 miles (13.2 km.) run. This is easily effected by reversing the wishbone arms at succeeding poles. Each pole is equipped with a 7/16-in. (12-mm.) steel guy wire which grounds the wishbone arm at the bottom of the pole. The average span is 200 ft. (60 m.). The line wire is No. 2 copper.

The Camp Devens line is tapped into the 66,000-volt lines of the New England Power Company outside the substation of the Leominster Electric Light & Power Company, which is fed by two branch lines tapping the Fitchburg-Clinton lines of the system about 2 miles (3.2 km.) away. The high-tension oil switches at Camp Devens are of the manually operated type, equipped with 12-volt direct-current trip coils. The direct-current supply is derived from a set of small storage batteries which are frequently charged at a local garage.

To complete the line construction by Aug. 20, the date required by the government, the Power Construction Company concentrated its entire staff upon the task. Work was begun on July 5, orders being placed for line and substation equipment and designs started. The substation was made alive on Aug. 19. The utmost co-operation by manufacturers was sought and obtained. Personal representatives of the construction company went to various factories, stayed with the orders while the manufacturers were handling them, and inspected the product as rapidly as possible, in some cases accompanying shipments to Massachusetts. Lighter material was sent by express and heavier material was rushed through by fast freight on account of its military importance. The label used on an oil-switch shipment is shown in one of the illustrations.

RAPID HANDLING OF MATERIALS

In a single day an entire carload of poles was unloaded and distributed from Shirley, Mass., a halfway point between Ayer and North Leominster on the Fitchburg division of the Boston & Maine Railroad. The inspection of insulators began five days after the order was placed at the Locke factory and in twenty-five days all insulators had been inspected and shipped. At Leominster the line construction crew placed some of the wishbone cross-arms forty minutes after the train arrived at the local station. Long-distance telephone service played a most important part in rushing the work. The substation switchboard, an eleven-panel outfit, was built by the Westinghouse company at its East Pittsburgh factory in four weeks. About 100 orders were placed in connection with the substation material, and a maximum force of thirty men was employed on this part of the work.

From start to finish the work was given the preference over other production and construction tasks, and in completing the installation of actual service a day ahead of the time set by the government, the engineers of the Power Construction Company, the operating organization of the New England Power Company, manufacturers and transportation interests achieved a distinct patriotic service.

Meeting the Nation's War Telephone Needs

Bell System Responds to the Supreme Call for Efficiency—
Resources Placed Promptly at the Disposal of the
Government and Enlarged Rapidly

LONG before the United States severed diplomatic relations with Germany the American Telephone & Telegraph Company had established harmonious and effective methods of co-operation with the government to meet the anticipated requirements for wire communication. A year ago, working with the Navy Department, telephone officials planned and carried out a three days' mobilization of communication forces, during which war conditions were simulated.

Instantaneous communication was provided over the wires of the Bell system by both telephone and telegraph from the office of the Secretary of the Navy at Washington to all the naval stations in the continental United States, and telephone communication was maintained between the office of the Secretary of the Navy and a battleship in the Atlantic Ocean.

Immediately upon the rupture of diplomatic relations with Germany the officials of the Bell system got in close touch with the Council of National Defense, the president of the War College, the chief signal officer of the army and the director of naval communication and other officials of the Department of the Navy.

Plans for co-operation were established, and as a result, notwithstanding the extraordinary demands for communication, all the requirements of the government are being met satisfactorily.

In accordance with these plans, throughout the Bell system in every part of the United States, all government toll calls were given immediate precedence over commercial business. To give this special service to the government required the special drilling of 12,000 long-line operators in all parts of the country.

About 10,000 miles (16,093 km.) of wire have already been taken from commercial use and turned over exclusively to the service of the Navy, War, Agricultural and other departments for special wire service in connection with the national emergency.

The national capital now has twice as many long-

distance toll lines as before the war, and when all the additions to its telephone facilities now under way are completed, Washington will have 500 long-distance wires radiating to every part of the country, with proportionate increases in toll switchboards and operating forces.

Work on a new underground cable from Washington to New York is now well under way, notwithstanding the difficulties in obtaining raw material which have been met and overcome by engineers and scientists. This cable will contain 80,000 miles (128,747 km.) of wire and will be a valuable addition to the existing underground system which provides the national capital with all-underground communication with Baltimore, Wilmington, Philadelphia, Trenton, Newark, New York, Bridgeport, New Haven, Hartford, Providence and Boston. All these points are the centers of extraordinary activity in the manufacture and supply of munitions and war materials of all kinds.

Owing to recent progress in long-distance transmission, the government at Washington has good telephone service with the headquarters of every army

department and naval district in the United States and all centers of extraordinary activity in the manufacture and supply of munitions and war materials, and these telephone facilities are being constantly increased.

A comprehensive study of the telephone traffic of the country indicates that still further increase in these facilities will be required to meet the anticipated needs of the army and navy and the general requirements of the war business of the country. Some indication of the extent of these requirements is shown by the fact that on all the main wire routes centering in Washington the growth in telephone traffic during the last few months has been greater than the entire growth during the preceding eight years.

Work is being pushed actively on large additions to the local switchboard facilities at Washington, and large increases have been made in the operating forces.

The government's private branch exchange facilities



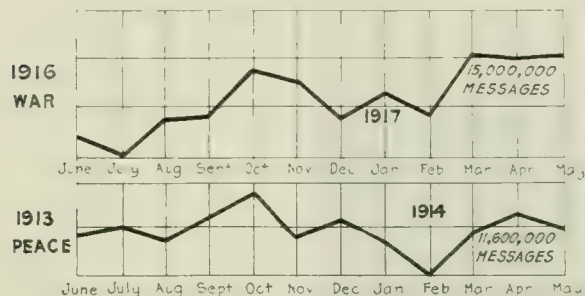
MAJOR JOHN J. CARTY

Chief Engineer American Telephone & Telegraph Company, Now
in Active Service in the Signal Corps, U. S. A.

have been largely augmented. Where it has appeared that existing switchboard facilities might prove inadequate, new switchboards or large additions to existing boards have been engineered and installed for various government departments.

WORK THROUGHOUT THE COUNTRY

To anticipate every possible need of the government for service has required a vast amount of work, not



LONG-DISTANCE TELEPHONE TRAFFIC—BEFORE AND AFTER THE RECOGNITION OF A STATE OF WAR

only in Washington but in many other parts of the country. The toll-line situation throughout the Bell system has been checked in detail and every provision made to meet adequately a large increase in the government's requirements for communication between the various army headquarters, state capitols, the various army posts, and the national and state mobilization camps in each department, and the work has already been started.

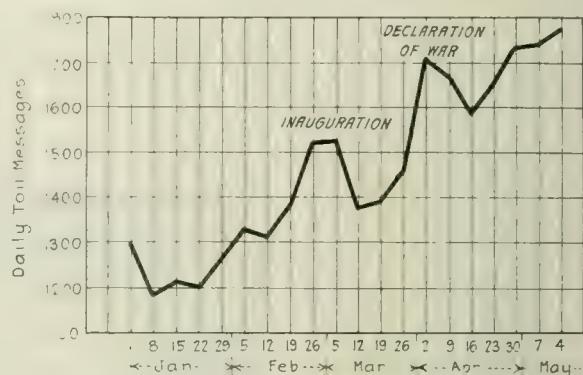
Existing telephone plants at all the important army posts, navy yards, etc., have been increased greatly, switchboard positions added, cable plant increased and station equipment augmented to meet increased activities. Additional plant has been furnished for reserve officers' training camps and for the enlarged units of the regular army.

The thirty-two cantonments in different parts of the country, now in process of construction, already require a large amount of telephone equipment. When occupied by the National Army it will be necessary to maintain telephone systems which will call for hundreds of positions of switchboards, a large amount of outside plant, and equipment for thousands of stations. It will also be necessary to make considerable additions to the local telephone plants in nearby cities or towns and to increase greatly the number of toll lines.

It is expected that about 40,000 men will be trained at each

one of these camps, and this means practically the establishment of a new city of 40,000 inhabitants, for which complete telephone service, both local and toll, must be provided, not only for military purposes of the camp, but also personal needs of officers and men.

This has required detailed studies, involving many important engineering problems. The work of provid-



DAILY GROWTH OF TOLL AND LONG-DISTANCE CALLS IN WASHINGTON, D. C., UNDER WAR CONDITIONS

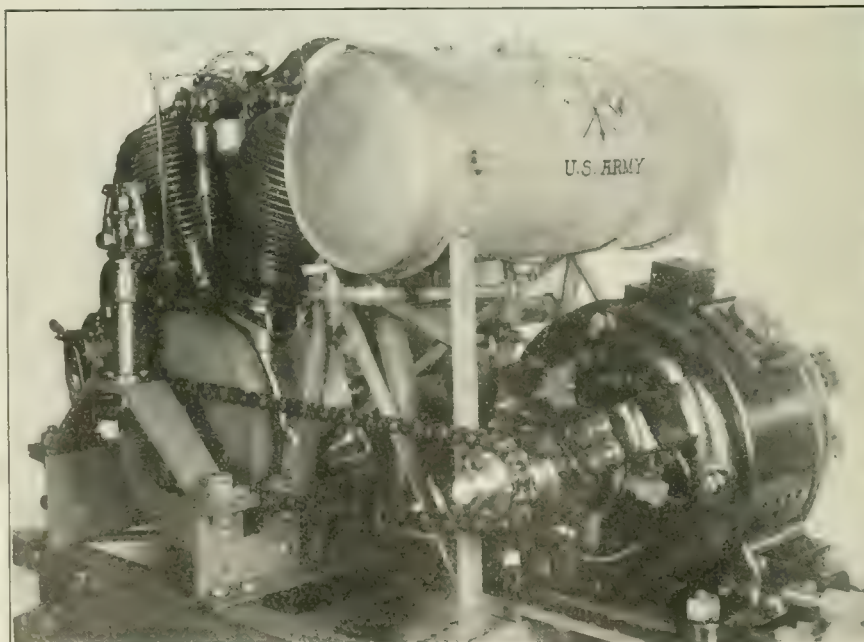
ing switchboards, loading coils, cables and other material in vast quantities is practically completed. In most cases these camps are located several miles from the nearest city and it has been necessary to provide long lengths of cable containing from 50 to 100 pairs of wires for trunking purposes. Temporary switchboards and trunking facilities have been provided for government officials and contractors during the construction period.

Telephone facilities have also been provided for smaller training camps throughout the country, such as officers' reserve, recruiting and signal corps camps.

The exigencies of war have required a reorganization and enlargement of the United States Coast Guard telephone system, and in this work the Bell system engineers have been giving great assistance. The plans call for providing telephone connections at approximately 100 lighthouses and 200 coast guard stations, the laying of about 300 miles (483 km.) of submarine

cable, construction of over 650 miles (1046 km.) of pole line and stringing over 1200 miles (1931 km.) of wire. To connect the Coast Guard system with the Bell system and to provide the quality of service required has made it necessary for the associated companies of the Bell system to add largely to their own plants.

All over the country, important railroad points, bridges



RADIO SKID SET—2-KW. ENGINE AND ALTERNATOR



RADIO-TELEGRAPHY HAS A LARGE PART IN THE SUCCESS OF MILITARY MOVEMENTS—MAST OF 2-KW. WIRELESS WAGON USED IN GOVERNMENT SERVICE



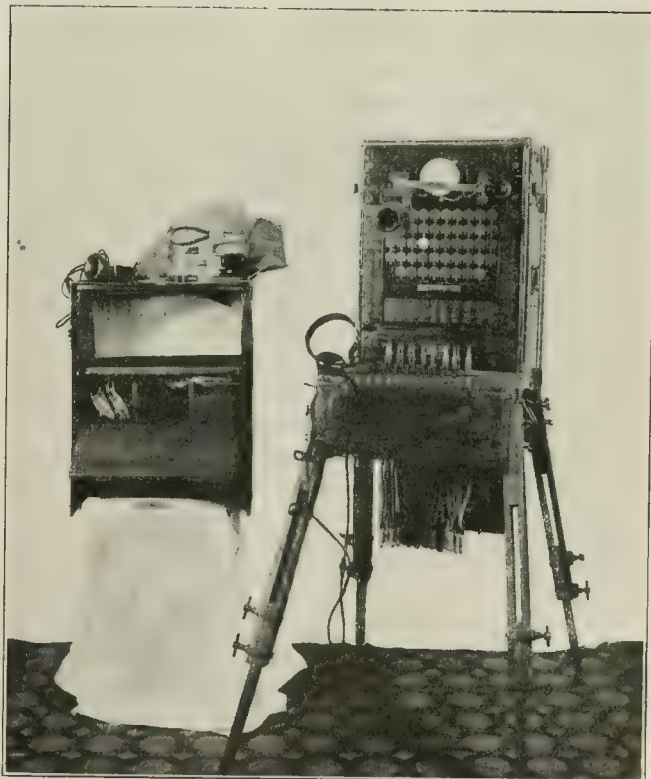
ONE OF FOUR COMPANIES OF SIGNAL CORPS MEN FROM BELL SYSTEM LINED UP AT MONMOUTH PARK (N. J.) CAMP



BASE OF A RADIO TOWER



KEEPING IN CONSTANT COMMUNICATION WITH ALLIED FORCES, THE MILITARY COMMANDER IS HELPED BY WIRELESS—
RADIO TRACTOR ERECTING 60-FT. MAST



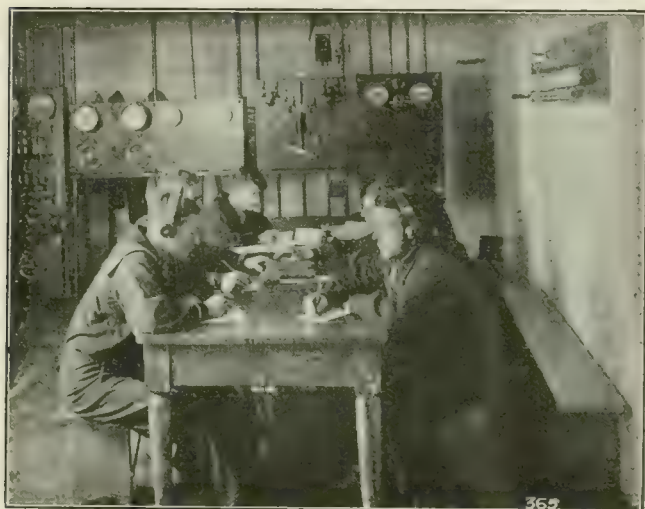
CAMP TELEPHONE SWITCHBOARD

and water-supply systems have been guarded by detachments of the National Guard, and it has been necessary for the telephone companies to provide special equipment at important points and facilities of communication between those points and headquarters.

SIGNAL CORPS ENLISTMENTS

By arrangement with the Signal Corps, United States Army, fourteen battalions of the Signal Corps, United States Reserves, have been organized throughout the Bell system and certain specially trained men have also been detached from company service to the naval coast defense and to the navy. More than 150 have been admitted to the officers' training camps.

The majority of units of the Signal Corps have been recruited to practically full strength and nearly all the officers have received commissions. Several battalions



LEARNING HOW TO SERVE THE GOVERNMENT

have been ordered into camp at various locations and are now receiving intensive training under regular army officers. Other units, not yet called into active service, are drilling and attending lectures and conferences conducted by regular army and militia officers.

About 2500 men have thus been enrolled. Besides this, approximately 2000 Bell employees are members of the National Guard and the Naval Militia or are otherwise under oath to present themselves when called, making a total of over 4600 Bell employees who are now or will be in the near future in military service, or more than 10 per cent of the male employees of the system between twenty-one and thirty years.

Many Bell employees now in military service are technically trained men whose places cannot be easily filled, yet the system has encouraged employees to join the government fighting forces and has striven to meet the extraordinary demands for service and the depletion of its effective staffs.

INCREASED TRAFFIC DEMANDS

An excellent idea of the increased traffic demands upon the Bell system is indicated by the accompanying diagram showing that peace traffic for twelve months before the war meant 11,600,000 long-distance messages, while in 1916 the long-distance messages aggregated over 15,000,000.

A large proportion of the time of scientific staffs of the Bell system and its laboratories has been devoted

to special work in close co-operation with the army and navy, the nature of which cannot be published at this time.

In addition to these vast telephone activities the Bell system has been notably active in aiding in other directions. In accordance with the plan worked out by the company 54,160 employees have purchased on the installment plan \$3,850,800 Liberty bonds; in addition, the company itself subscribed for \$5,000,000, and officers and employees have taken large amounts through other agencies. Many of the officials spent much time and effort in working for success of the loan. They have also been active in the Red Cross campaign, the company contributing \$500,000. Money has also been raised in the organization for several ambulances.

The Bell system has also aided directly and indirectly through its employees in such movements as those concerned with food conservation, national or state defense, draft registration, hospital units and other patriotic services.

The construction program of the Bell system, to provide for the extraordinary commercial and manufacturing activity created in this country by the European war, is the greatest in the history of the telephone business; yet shortage of material and difficulties in obtaining labor and transportation have been so imperative that it has been necessary to divert telephone material and apparatus from commercial use and apply them exclusively to government service. It seems inevitable that still larger amounts of material and apparatus must be so applied in order to meet the constantly increasing requirements.

Under such conditions it will require the conservation of every resource of the Bell system and co-operation by the telephone-using public to cope with a situation unprecedented in the nation's history and bound to grow more imperative as time goes on.

Work of the Underwriters' Laboratories

Co-operating with the Bureau of Steam Engineering of the navy and with the manufacturers of rubber-covered wire, the services of the Underwriters' Laboratories, Inc., have been used in connection with the examination, testing and labeling at factories of more than 1,000,000 ft. (304,800 m.) of No. 14 gage duplex lead cable for use on submarine chasers. The bureau's specifications for this material require that it be labeled. Special attention has been given to the test performance of all of this material at the several factories which participated in the delivery of the entire amount to the navy.

The Laboratories registered last April for war service with the Bureau of Standards, the National Research Council and the Navy Department. Materials and appliances bearing the labels of the Underwriters' Laboratories are being specified as munitions, and some of the institution's force is at present engaged in inspections and tests of such materials. In a letter to the staff President Merrill said: "All officers and employees will appreciate the vital importance of registering 100 per cent efficiency in our service on war munitions. There must be no failure in field service or on shipboard of any device, material or appliance examined, tested and passed by us."

Co-ordinating Colleges and Government

Educational Section of the Committee on Engineering and Education of the
Advisory Commission of the Council of National Defense
Does a Necessary Work

CO-ORDINATION of the work of colleges with the government policy in connection with war has been facilitated by the committee on engineering and education of the Advisory Commission of the Council of National Defense, of which Dr. Hollis Godfrey, president Drexel Institute, Philadelphia, is the chairman.

The educational section of this committee was created on May 5, when Dr. Godfrey called together college presidents for a conference in Washington. The conference and the committee which was formed as a result of it made certain general pronouncements on the policy to be pursued by higher institutions during the war.

A statement of the principles that were adopted at this meeting follows:

STATEMENT OF PRINCIPLES

It is our judgment that our colleges and universities should so organize their work that in all directions they may be of the greatest possible usefulness to the country in its present crisis.

We therefore believe, first, that all young men below the age of liability to the selective draft and those not recommended for special service who can avail themselves of the opportunities offered by our colleges should be urged so to do in order that they may be able to render the most effective service both during the full period of the war and in the trying times which will follow its close.

We believe, second, that all colleges and universities should so modify their calendars and curricula as will most fully subserve the present needs of the nation and utilize most profitably the time of the students and the institutional plant, force and equipment. With this end in view, we suggest that, as an emergency measure, the colleges consider the advisability of dividing the college year into four quarters of approximately twelve weeks each, and that, where necessary, courses be repeated at least once a year so that the college course may be best adapted to the needs of food production.

We believe, third, that in view of the supreme importance of applied science in the present war, students pursuing technical courses, such as medicine, agriculture and engineering, are rendering, or are to render, through the continuance of their training, services more valuable and efficient than if they were to enroll in military or naval service at once.

We believe, fourth, that the government should provide or encourage military training for all young men in college by retired officers of the army and national guard or by other persons competent to give military instruction, and that the colleges should include as a part of their course of study teaching in military science, in accordance with the provisions of the national defense act of June, 1916.

We believe, fifth, that the Bureau of Education of the Department of the Interior and the States Relations Service of the Department of Agriculture, with the co-operation of the committee on science, engineering and education of the Advisory Commission of the Council of National Defense, should be the medium of communication between the federal departments and the higher educational institutions of the country.

Finally, we believe that an educational responsibility rests on the institutions of higher learning to disseminate correct information concerning the issues involved in the war and to interpret its meaning.

At subsequent meetings the committee considered the very pressing questions of military training and the arrangements which might be made between the War Department and the colleges.

The committee has pursued vigorously the task of focusing public attention on the desirability of keeping higher institutions in full operation in order that the supply of trained men might not be cut off during the war. It has secured statements from the Commissioner of Education, the Secretary of War and the President. There is now a general recognition of the importance of preserving as nearly intact as possible the system of higher training.

In order to bring a still greater weight of influence to bear on these two fundamental questions the committee held a conference lasting three days with a commission representing the universities of Canada. The Canadian representatives gave the American committee a full account of the way in which the war has affected Canadian universities and of the contributions which these institutions have made to successful prosecution of the war. A document giving a summary of this conference will be issued soon.

At one meeting the thought was expressed that many of the questions coming before the section concerned secondary schools almost as intimately as higher institutions. As it was felt that the section should consequently have the constant advice of a representative group of school officers, an advisory committee with respect to secondary school problems was therefore appointed.

TENDERS OF EXPERT OFFICES

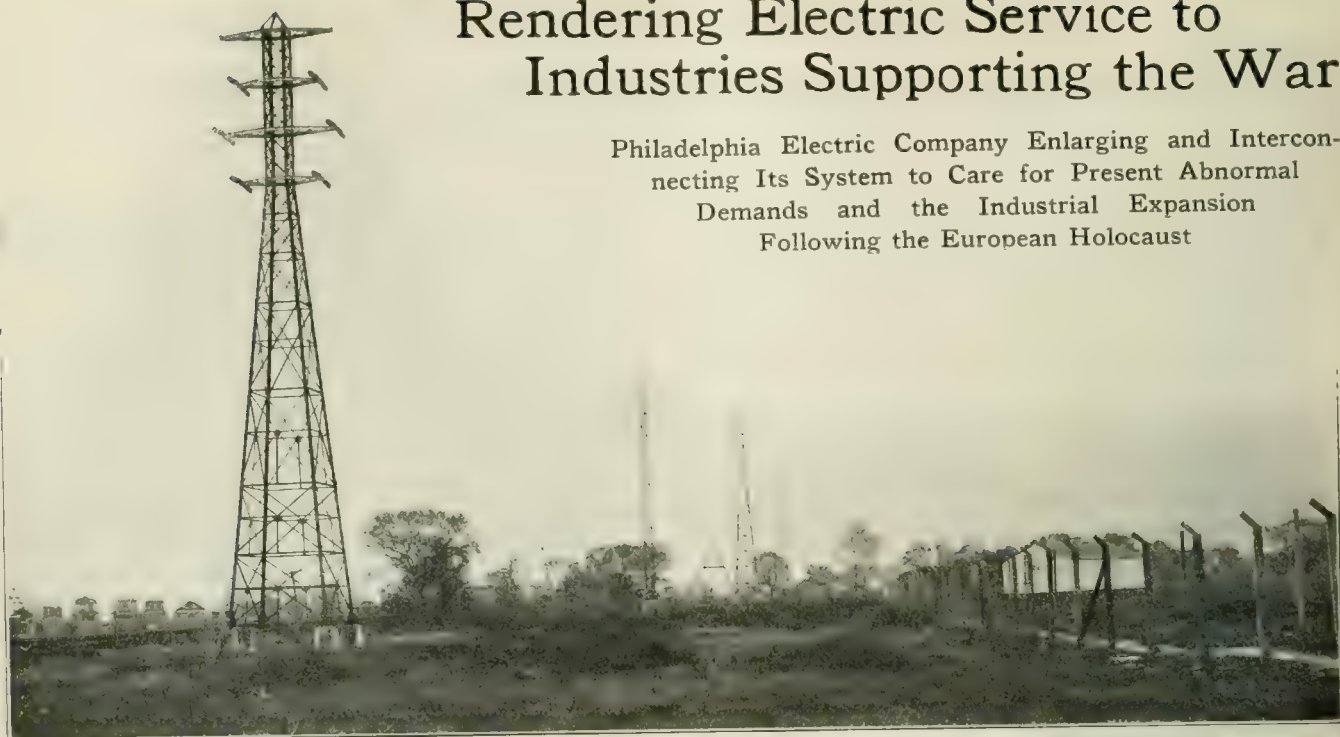
Many persons of highly expert qualifications have tendered their services to the government through the chairman of the section. As the section lacked facilities for undertaking the task of considering such offers carefully and referring them to the appropriate operating departments, it brought the matter to the attention of the Intercollegiate Intelligence Bureau, a voluntary organization under the chairmanship of Dean William McClellan of the University of Pennsylvania. This bureau expressed its readiness to co-operate with the section and agreed to take over all offers of services and to inform the Civil Service Commission, the War Department and other government agencies of the qualifications and residences of persons fitted to perform special tasks.

A detailed reply from the War Department to an inquiry by the section on the subject of military needs of the colleges has been received.

In the judgment of the committee the actual details of changes in curricula have been from the beginning the most important and complicated question with which it had set itself to deal. A sub-committee was appointed in July to take up the question of the possible modification of the course of study in engineering schools. This committee has been at work for several weeks and will report at the beginning of the academic year.

Rendering Electric Service to Industries Supporting the War

Philadelphia Electric Company Enlarging and Interconnecting Its System to Care for Present Abnormal Demands and the Industrial Expansion Following the European Holocaust



FACING unprecedented demands for electric power, due primarily to the great amount of government work being contracted for in and around Philadelphia, the Philadelphia Electric Company has been making extraordinary effort to install the necessary gen-

TABLE I—WAR LOAD ON PHILADELPHIA ELECTRIC COMPANY'S LINES

GROUP	No.	INDUSTRIES	TOTALS	
			Power, Hp.	Light, Kw.
A	16	Munitions and arsenals	34,767	60
B	16	Buildings—armories, Mint, Custom House, hospitals and Post Office...	656	29
C	20	Chemicals, dyes, soaps, and air products	7,441	306
D	8	Drugs and medicines	722	21
E	79	Equipment Clothing, shoes, bags, tents, leather and paper.....	6,256	267
F	10	Foodstuffs	2,870	61
G	12	Shipbuilders and marine machinery...	8,044	43
H	6	Batteries, searchlights and other electrical apparatus	1,128	252
I	40	Iron, brass, steel and other metal products	8,633	177
J	14	Machine shops	1,069	15
K	6	Oil and paint	268	34
L	3	Lumber	56	
M	29	Miscellaneous	1,912	5
	239		73,872	1,270

erating and distribution equipment to serve the normal as well as the abnormal loads thrust upon it.

In view of the great shortage of material and of labor this task is not only an exceedingly difficult one, but it is also expensive to the point of causing real concern. While the company is not called upon to furnish any energy for cantonments, it is now supplying approximately 75,000 hp. to industries engaged in government work, including shipyards, munition plants and works of various kinds manufacturing clothing, shoes, chemicals, steel and many other supplies. This load necessitates the building of line extensions, industrial substations and larger feeders, as well as the erection of a new waterside station at Chester, Pa., in time for this winter's peak load.

The territory between Philadelphia and Chester is

rapidly developing into one of the most important manufacturing districts in the country, and the electric power requirements are exceedingly large. The new generating station now building in Chester will have an ultimate capacity of 120,000 kw. and will be tied in with the Schuylkill waterside station, the main generating station of the Philadelphia system, by a high-tension transmission line. This line, which is already in operation, is 14 miles (22.6 km.) long and is made up of two three-phase, 66,000-volt circuits, each of which is capable of transmitting 30,000 kw.

Meanwhile the demand for electric energy within Philadelphia is such that the company has under contemplation the erection of another huge station in Philadelphia similar to the one now being erected at Chester. Of course, the company would not undertake such a large outlay at this time unless it was certain that the unprecedented industrial expansion now taking place in the vicinity of its system will continue after the war. Gigantic new shipbuilding plants are being erected by the government and by private individuals along the Delaware River, as well as large industrial works, including the new factories of the Westinghouse Electric & Manufacturing Company at Essington. Table I shows a list of industries now engaged on government work fed from the circuits of the Philadelphia Electric Company.

66,000-VOLT TRANSMISSION LINE

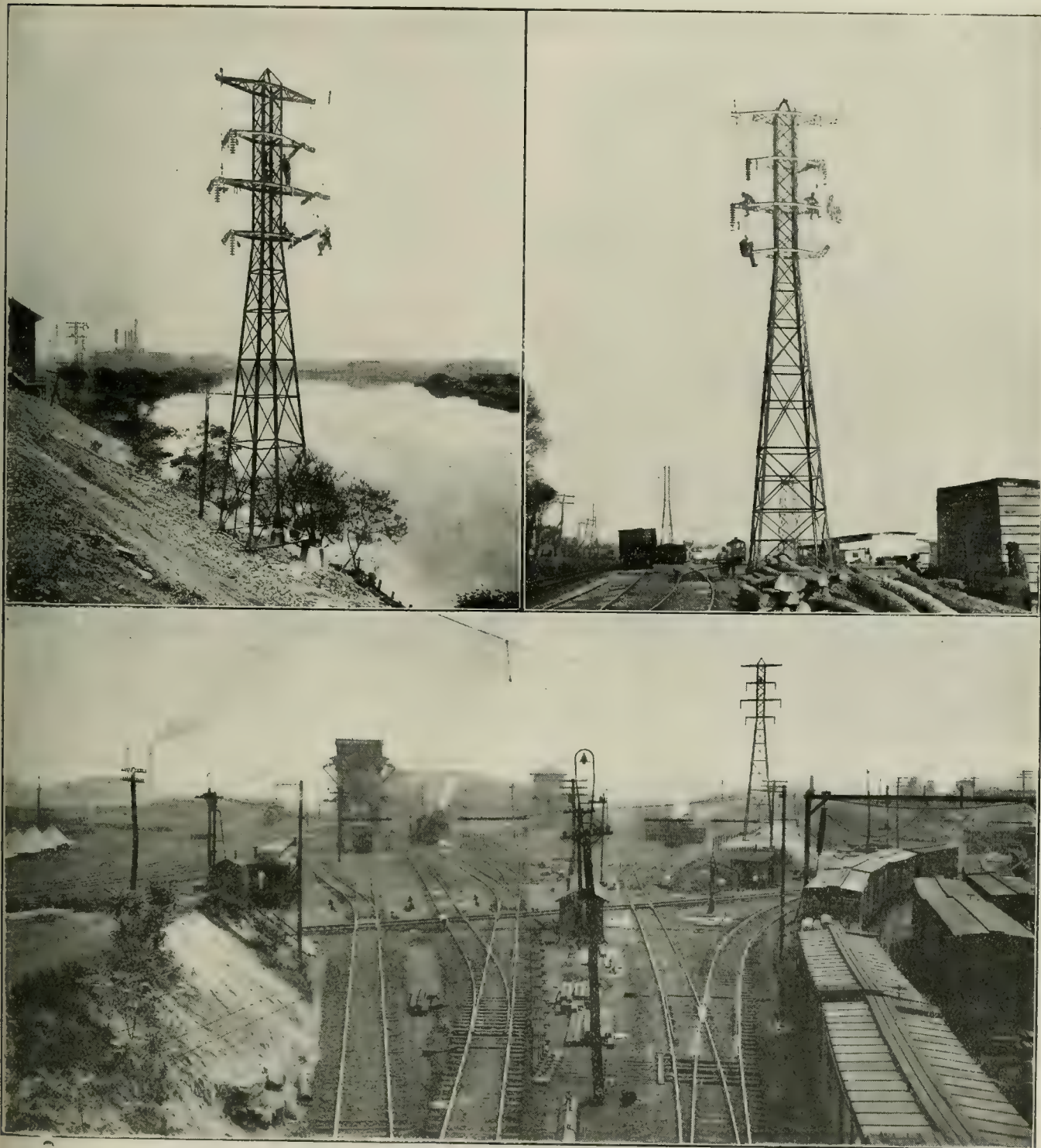
A very important link in the distribution chain and one which insures adequate and reliable electric service to the numerous industries between Philadelphia and Chester is the new high-tension circuit interconnecting the two systems. This line follows for the most part the route of the Chester branch of the Philadelphia & Reading Railway and a part of the Washington branch of the Pennsylvania Railroad. Many difficulties were encountered in construction. Along the Schuylkill low swamplands and then steep, sloping rocks were met with. Further south in the lowlands, near the city line,

much of the land is under water in the spring, and it was necessary to keep pumps in continuous operation to carry on excavation work. In the short stretch of line 564 piles averaging 25 ft. (7.6 m.) in length were driven, and approximately 4700 yd. (4297.7 m.) of concrete were poured for tower footings.

The electricity is carried by six 2/0 hard-drawn bare

earth at each structure. The vertical separation between wires is 7 ft. 6 in. (2.28 m.); the normal horizontal distance between the two ground wires and between the two center conductors being 16 ft. (4.9 m.) and between the wires of the other conductors 11 ft. (3.4 m.).

The steel supporting structures, 156 in number, are



THESE ILLUSTRATIONS OF THE HIGH-TENSION LINE INDICATE CLEARLY SOME OF THE DIFFICULTIES ENCOUNTERED IN ITS CONSTRUCTION

stranded copper wires, one circuit of three wires on each side of the supporting steel structures, which are erected at average intervals of 476.5 ft. (145.24 m.) Each circuit is protected by a 7/16-in. (11.1 mm.) copper-clad seven-strand steel ground wire, extending the entire length of the line and effectually grounded to

divided into three general types—river-crossing towers, angle towers and poles—the characteristics of which are shown in Table II.

The highest structure is at the river front of Station A. It weighs 32.06 tons (29.1 t.) and measures, from base to tip, 190 ft. (57.9 m.), the columns sloping in a

graceful curve to the base, which is 28 ft. (8.5 m.) square. Wires are carried to a similar structure on the west bank of the river, a distance of 577 ft. (175.9 m.), the lowest wire clearing high water by 150 ft. (45.7 m.). Similar structures at Crum and Darby Rivers give clearance of 85 ft. (25.9 m.), while at the Chester River 100 ft. (30.4 m.) is allowed.

Angle towers taper to wide footings, and like the river-crossing towers rest on four separate foundations. The poles stand on one solid block of concrete, which

was designed. The steel deflected 7 in. (17.8 cm.) and the concrete foundation rose 0.075 in. (19.1 mm.), both returning to normal on release of the load.

The insulation consists of porcelain disk insulators, 10 in. (25.4 cm.) in diameter, as manufactured by the Ohio Brass Company. When a strain is developed due to bends in the line or decided changes in elevation and where foreign wires or railroads are crossed nine disks or units are hung in a string in tension. With this arrangement two strings are used for each conductor at every cross-arm, the insulators lying in the same plane as the wire in the spans and a loop of the wire being made under the arm. For straight runs eight units are suspended in a string hanging vertically from the cross-arm. This distance from the cross-arm to the clamp for the strain string is 4 ft. (1.2 m.) and for the suspension string 3 ft. 8 15/16 in. (1.1 m.).

The line is suitably guyed throughout its length; 5/8-in. (15.9-mm.) S. M. stranded steel wire with a normal ultimate strength of 19,000 lb. (1335.7 kg. per sq. cm.) being used with a special Marchand clamp and attachments. The guy wire as well as the conductors and ground wire was also tested by the Electrical Testing Laboratories before delivery. Data for line:

Total length from substation to substation..14.08 miles (22.6 km.)
Average span475.5 ft. (144.93 m.)
Average clearance low wire to ground.....49.18 ft. (15 m.)
Normal average tension in conductor.....1,165 lb. (528.4 kg.)
Normal average tension in ground wire.....1,780 lb. (807 kg.)
Strings of suspension insulators.....462
Strings of strain insulators.....936
Number of insulator units.....12,120
Total tonnage of steel erected769.11 (697.6 t.)

CHESTER SUBSTATION

At Chester, adjoining the site of the new waterside station under construction, is an outdoor substation receiving energy at present from the high-tension line from Philadelphia. There are six 5000-kva. single-phase, outdoor-type oil-cooled transformers installed for stepping down the potential from 66,000 volts to 13,200 volts. They operate in banks of three.

TABLE II—DATA ON STEEL SUPPORTING STRUCTURES

	RIVER CROSS- ING TOWERS	ANGLE TOWERS	POLES, STRAIN	POLES, SUSPENSION
Estimated Maximum Load	All wires down on one side plus 60-mile wind and 1/2 in. recon struc- ture and remaining wires	All wires and struc- ture covered with 1/2-in. ice and supporting 60- mile wind to turn 1 of 20 deg.	All wires and struc- ture covered with 1/2-in. ice and supporting 60- mile wind, L=5 deg.	All wires and struc- ture covered with 1/2-in. ice and supporting 60- mile wind, L=1 deg.
Factor of safety.....	3	3	3	3
Size of main angles....	8x8x3/4 in.	6x6x3/8 in.	4x4x 1/8 in.	4x4x 1/8 in.
Maximum distance to low wire	162 ft.	83 ft.	73 ft.	88 ft.
Minimum distance to low wire	91 ft.	43 ft.	48 ft.	48 ft.
Diameter foundation bolts (inches).....	2 1/4	1 3/4	1 3/8 to 1 3/8	1 5/8 to 1 3/8
Number of type used..	8	35	35	78
Tonnage of each type..	165.63	204.93	122.65	275.9

averages about 6 ft. (1.8 m.) square, extending about 1 ft. (0.3 m.) from the ground, and varies in depth from 10 ft. to 12 ft. (3 to 3.7 m.), dependent on the height of the pole and the nature of the soil. One pole, the foundation of which was installed under the most adverse conditions, was tested by applying a pull near the top equal to a horizontal stress of 5000 lb. (2.268 kg.), which is equivalent to the load for which this type



THIS NEW 120,000-KW. STATION AT CHESTER, PA., WILL BE INTERCONNECTED WITH THE PHILADELPHIA STATION

Serving Cantonment Tests Resourcefulness of Electric Company

How Some Problems Involved in Supplying an Encampment of 40,000 Men with Electricity Were Solved in Short Order by the Public Service Electric Company of New Jersey

BY E. B. MEYER

Assistant to Chief Engineer Public Service Electric Company of New Jersey

THE supplying of electric service for interior lighting, street lighting, motors and various other uses for the United States Army cantonment involves a number of problems which put to the test the ability of the utility company to meet in a short period of time the requirements of a city of 35,000 to 40,000 men. The site for the New Jersey camp is in the vicinity of Wrightstown, a small village in the midst of a farming

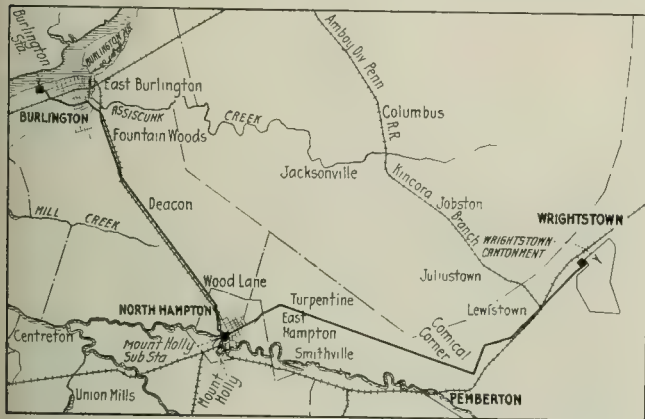


FIG. 1—ROUTE OF TRANSMISSION LINE ERECTED TO SERVE CAMP DIX

community about midway between Trenton and Camden. The decision of the War Department to construct a camp in this location has resulted in the very rapid transformation of Wrightstown from a small village to a town of about the population just mentioned.

The first step after the camp site was definitely determined was to provide a high-voltage line extension from the Public Service transmission system. Since the camp was beyond the reach of any of the existing lines, it was decided to run a No. 4 transmission line from the camp to the Mount Holly substation and to reinforce an existing line from Mount Holly back to the generating station at Burlington.

The line work was started on Aug. 13 and is now practically completed. Some difficulty was experienced on account of the fact that the pole line was located along an unimproved sand road which made hauling difficult. A gang of from thirty-five to forty men was engaged in pole setting, and on long sections where the right-of-way was free of obstructions as many as fifty poles were set per day. However, on part of the right-of-way where quicksand was encountered it was necessary to drive barrels into the holes during the digging process in order to reach the required depth. This additional work reduced the number of poles set, and where the soil was particularly bad the number set per day was only fifteen or twenty. The work of setting poles was greatly facilitated by the use of a pole-hoisting derrick as illustrated in Fig. 4.

The transmission line is of No. 4 copper wire, insulated for 26,400 volts but designed to operate at 13,200 volts. The insulators used on the line were tested by the company's laboratory under conditions of high voltage and high frequency before being set on the cross-arms. The poles are for the most part 40 ft. (12.19-m.) in height, but in some cases 50-ft. or 55-ft. (15.2-m. to 16.7-m.) poles were used in certain sections in order to clear trees or other obstructions.

In certain sections of Mount Holly both sides of the transmission line right-of-way are covered with heavy trees, some of which are more than 70 ft. (21.3 m.) in height. It was impossible to obtain tree-trimming privileges from the adjacent property owners, and as open-wire construction through the trees was undesirable, aerial transmission cable construction was decided upon. This is a special type of construction which has been used in a number of cases where the utility company has been confronted with new problems through rapid growth in commercial load, particularly where large power service is required for the operation of industrial plants. The tendency has been to supply such customers with high-voltage or primary service, necessitating in many cases the reconstruction of existing lines. By the use of the aerial cable run on poles and supported by messenger wire, a form of construction similar to that used in telephone work, it is possible to transmit high voltage where the installation of open wire would be out of the question and the cost of underground construction prohibitive.

In Fig. 3 is illustrated the method of making the connection by use of pot-heads between the open wires and the aerial cable. The cable consists of three copper conductors insulated for operating at 13,200 volts.

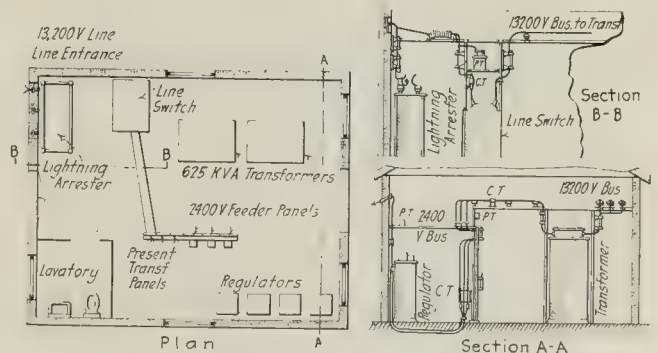


FIG. 2—ARRANGEMENT OF EQUIPMENT IN CANTONMENT SUBSTATION

It is of special construction for this class of service and consists of paper insulation on the individual conductors, a paper jacket and a reinforced rubber outer covering, the outer covering being similar in construction to that of the ordinary garden hose. The entire cable is cov-

ered with tape and saturated with rubber compound and a weatherproof braid thoroughly impregnated with waterproofing compound. For mechanical protection



FIG. 3—METHOD OF CONNECTING OPEN WIRE WITH AERIAL CABLE

the finished cable is incased in an armor made up of galvanized-steel tape.

A substation of 1250 kva. rating will be provided to take care of the camp requirements. The equipment will consist of two 625-kva., 13,200/2400-volt, 3/3 phase transformers, four 48-kva. potential regulators connected in V (the secondary distribution system being three-phase), and necessary switching and metering equipment. The estimated peak loads on the substation are as follows: Interior lighting, 500 kw.; street lighting, 70 kw.; miscellaneous small motors driving laundry machines, refrigerating machines, etc., 150 kw., making a total demand of 720 kw.

One of the problems was that of securing prompt de-

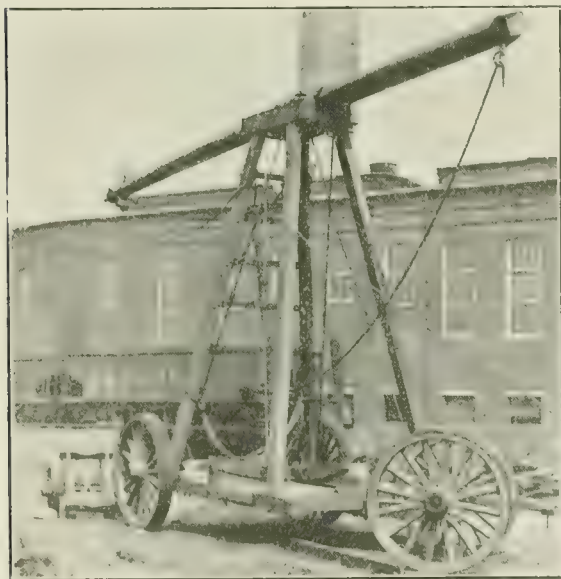


FIG. 4—PORTABLE DERRICK USED IN ERECTING POLES

livery on the electrical equipment for the substation. It was realized that it would be impossible under present conditions to obtain the necessary transformers unless

pressure could be brought to bear on the manufacturer. The company therefore decided to take the matter up with the government officials at Washington, and three transformers were located at the shops of one of the large manufacturing companies. These transformers were diverted by the government from the original purchaser to the camp, to insure service on the date set. A general arrangement of the electrical equipment is shown in Fig. 2.

The workmen engaged in construction work start at sunrise and work until dark. Some idea of the rapidity with which construction work is carried on may be gained from the fact that when one of the company's engineers discussed with contractors and army officers



FIG. 5—DURLINGTON STATION, FROM WHICH CAMP IS SERVED

the question of erecting the substation building he was informed that the building would be started at once and completed in about a day and a half.

Lamp with Renewable Filament

An incandescent lamp which can be readily recharged with gas and fitted with a new filament is disclosed in patent No. 1,232,741, issued to A. J. West of Winnipeg, Manitoba. In this lamp, which is of the gas-filled type, there is no need for a vacuum as it is only necessary to retain the gas in the globe under its own pressure. Accordingly, the lamp is so made that the globe can be removed to permit the renewal of the filament, and when the globe is attached to the head the joint is tight enough to retain the gas admitted. Further, in the head is provided an easy means for refilling the lamp with gas and retaining the gas.

Upon the filament being rendered useless the globe can readily be unscrewed from the head and the filament withdrawn through the neck of the globe. After a new filament has been substituted the globe can be replaced. At this time, however, it is necessary to recharge the globe with gas. This is done by removing a screw plug and recharging the globe with gas through a provided opening. Upon the globe being filled with the gas it is screwed tightly in and the plug is inserted.

The Power Problem of the Munition Plant

Two Years' Experience in One of the Largest Rifle and Cartridge Factories of the World Indicates the Necessity of Adequate Equipment and of Its Reliable and Efficient Operation

BY SYDNEY FISHER

ALTHOUGH power is an important factor in production, it receives very little consideration compared with other factors. Power must be available in sufficient quantity when required, and its supply must be unfailing. Production must never be held up for power; on the contrary, power must be ever ready for production. These exacting requirements can be met and are met in modern plants with electric service, and yet the cost of this vitally important factor in production does not amount, in many cases, to more than a few mills per unit of product. This has been made possible by the remarkable development of electrical equipment.

Not only in the supply of motive power and power for lighting has electricity simplified production, but also in its application to production processes. Temperature control, so important in delicate heat-treatment operations, is a reality, and losses due to radiation, etc., are very small. The electric welding machine is used not only for welding, where it has eliminated many operations, but also in delicate heat-treatment operations where high local heating is required. It is also used in heating and clinching rivets, these operations being performed at once. Electric plating and cleaning baths have greatly simplified operations which heretofore were difficult and expensive. The battery truck has made rapid transportation over short distances possible with economy in time and help. Scientific heat treatment has been made possible by the development of the thermo-electric couple for pyrometry. The telephone, the telecall, the fire alarm, all play a very important part in plant operation.

EFFICIENT OPERATION AND RELIABLE SERVICE CHIEF CONSIDERATIONS

Reliable equipment is only one part of the problem, however—a very important part, to be sure, but not the all-important part. Enough power and continuity of service is the prime consideration of the power engineer, but over-equipment in any part of the system will result in poor operation and unreliability when the plant is in full swing. Efficiency and continuity of service can only be obtained through scientific selection and arrangement, careful installation and operation, and proper maintenance of scientifically designed reliable equipment.

It is hoped that the following suggestions, based on two years' experience in power work at one of the largest munition plants in this country, if not the largest, will be helpful to those engaged in present and future power work. Suggestions will be offered under the following headings: (1) organization, (2) selection of equipment, (3) inspection, (4) installation, (5) operation, and (6) maintenance.

The power engineer and the production engineer of a munition plant, or, in fact, any manufacturing plant, should each be responsible to the chief engineer. On no

account should the power engineer be responsible to the production engineer. The production engineer is always afraid of an insufficiency of power. If allowed to have his way, complications will ensue.

SELECTION OF EQUIPMENT

Generating equipment rated at 2300 volts, three-phase, 60-cycle, with 440-volt power and 110-volt lighting equipment, is without question the best system for industrial plants, in the writer's opinion. This is true from the initial-cost, operating and maintenance standpoints. The selection of generating, controlling, transmission, transforming and distributing equipment should be based on the assumption that a high motor load factor (90 per cent) will be maintained where possible and that the necessary synchronous apparatus will be installed at the load to bring the power factor up to 80 per cent at the transformer stations. This will result in the correct design of all branches of the system, insure subsequent efficient operation, reduce the possibility of breakdown to a minimum and reduce the cost of equipment.

Careful selection of motor equipment can be made without a large expenditure of time and money. Elaborate test equipment is not necessary. A young electrician carefully instructed and provided with several ammeters (0-15 amp., 0-75 amp. and 0-150 amp.) and with a suitable voltmeter can do all that is necessary. Records should be made of the minimum, average and maximum currents and the order and frequency of their occurrence. All peculiarities of the work cycle can be expressed in terms of current. The corresponding power output values can be obtained from a current-horsepower output curve plotted from manufacturer's data on efficiency and power factor at various loads.

The rated output of the motor should equal the average load demand. Peak loads not exceeding 150 per cent rated load and occurring at intervals for short periods may be taken as an overload. This apportionment of motor to load will insure a power factor of 80 per cent. The first two or three motors will have to be selected by well-based guesses. After tests have been made on these units the results can be used in making more scientific selections of the other units. At the plant on which the writer bases most of his opinions 400 motors aggregating 6000 brake-hp. were selected in this way. Careful study of the work cycle often results in the coupling of two drives on one motor with resulting adequate power for each and a high motor load factor.

When the load is intermittent and fluctuates, as in the case of drop hammer and heavy press drives, a high average load and consequent high power factor is unobtainable. In such cases a synchronous motor exhaustor fan or blower drive should be used, it being advisable to select a motor which will have sufficient

reactive power capacity to raise the power factor of the load to 80 per cent. Where possible reactive power should be supplied at the load, thus increasing the generator, transmission-line and transformer capacity for useful average power and reducing equipment and transmission losses. The 2000-kw. turbo-generator unit is a good unit for industrial plants. Where the space is not too limited two such units are advisable, one of the bleeder type and the other of the mixed-pressure type, as they make the best use of low-pressure steam during winter and summer months respectively.

Control apparatus is pretty well standardized. In addition to standard exciter, generator and feeder panels, a station recording voltmeter, a power-factor meter, a voltage regulator and a ground detector (three-phase) will be found necessary. Power-limiting reactances are not a necessity even with time-limit relays, as the reactance of modern generators is sufficient to limit the current of the usual short circuit.

Combined turbine, motor-driven exciters are to be recommended for munition plants. Under normal conditions of operation the exciter is motor-driven. Should the speed of the motor drop below 95 per cent synchronous speed, the turbine automatically takes the load. This insures sufficient power for the station lighting in the event of a shut-down.

Fiber duct gives very good results for underground transmission. Manholes should not have perforated covers, should be shaped to the lay of the cable and should be made thoroughly waterproof. Should a circuit pass near furnaces or heated area, it should be run through a tunnel opening into a well-ventilated manhole at each end. Overhead transmission is less expensive and quickly installed but is easily tampered with.

VALUE OF SEVERAL MOTORS TO EACH MACHINERY GROUP

Motor equipment should be selected on the basis of two or more to each group of machinery. This arrangement is more expensive, but is preferable for several reasons. For instance, a high motor-load factor is more easily obtained, a 42-hp. average load being better supplied by three 15-hp. motors, or one 20-hp. and one 25-hp. unit, than by one 50-hp. motor. Obviously when power requirements are uncertain and quick deliveries of small sizes are possible, a number of smaller sizes is better than a few large sizes. Furthermore, if the motor equipment is reduced to a few standard sizes (5 hp., 10 hp., 15 hp., 20 hp. and 25 hp.) fewer "spares" are required and the expense is less, the units being smaller.

With this arrangement, if many machines are idle or the duty is light, whole sections can be run on one of the motors, the others being disconnected. Another advantage of this arrangement, especially in a plant just being built or extended, is that operation does not have to be delayed by deliveries of equipment. If the generator capacity is small owing to slow delivery of units, loading up one motor in the section instead of having two or three running lightly loaded will relieve the station units of unnecessary reaction power load and hence increase the station capacity for the average power load. In the writer's experience a 20-hp. motor has taken the load of an entire group (33 hp.) for two hours, with the aid of an ordinary desk fan to keep it cool, while the other motor in the section was being replaced. This is another reason why

there should be more than one motor driving the group.

Money spent on circuit breakers to isolate circuits is by no means wasted. A short circuit at some remote point will shut down an entire feeder, perhaps the plant, unless some precautionary measure is taken. Overload relays are not desirable on individual motor circuits, however, unless steps are taken to study the work cycle and set them for the maximum current. Furthermore, they also must be inspected frequently, otherwise they will trip and shut down a group of machines, causing unnecessary delay. If a motor is carefully selected and fused for the maximum current, there should be no trouble. A 440-volt circuit is advisable for motor applications, as the copper for a 220-volt circuit is expensive.

In the opinion of the writer the incandescent lamp is best for lighting, 60-watt and 100-watt units providing general illumination being preferable for production work and 25-watt or 60-watt individual lamps for tool and assembly work. Vapor lamps, while they possess advantages as regards quality of light, are easily damaged and the maintenance is high.

INSPECTION AND INSTALLATION OF EQUIPMENT

Standard apparatus, such as motors, transformers, control equipment, etc., as supplied by reliable firms, are carefully inspected at the shop. Frequently, however, machines built to supply a less urgent order are supplied, and while they may be identical in design, they have different characteristics. In the writer's experience, three exciters specified for parallel operation were subsequently found to be over-compounded, flat-compounded and under-compounded respectively. The adjustment could have been made very easily at the shop but involved considerable time and expense after installation.

Tests for grounds in the fields of generators should be conducted. If the system is installed on contract, the layouts should be studied carefully and the sizes of bus copper and cable from generator through to motor should be checked. It is surprising how errors creep into a mass of detail. Connections for 300-kva. transformers may be installed for 500-kva. transformers. Such errors do not come to light until the plant is in "full swing"; then the tar begins to drop and the bus copper changes color. Contacts of circuit breakers should be inspected with a thickness gage to detect poor contacts before they cause trouble.

While cable purchased from a reliable firm is guaranteed for a year, the reels should be meggered before and after being drawn through ducts. A megger test set is expensive, but it will be found invaluable in locating defects and ascertaining the condition of equipment. Transformer taps should be carefully checked, as phase reversal may cause considerable trouble when two transformer houses are tied together. While awaiting installation do not allow transformers to remain in the rain uncovered. The air gap and oil rings of motors should be inspected and the rotor should be tested to see if it binds. Compensator contacts should be inspected, as three-phase starting and single-phase running, due to a bad contact on the running side, is by no means uncommon.

The installation of generating, transmission and transforming equipment is usually and preferably placed in the hands of contractors. Curves showing

daily progress in all branches of work should be plotted on one sheet and the contractor consulted to ascertain the cause of delay in any branch of the work. Installation should be constantly checked from drawings as defects do not come to light until the plant is in full operation, by which time the bills may be paid.

The power engineer should consult with the machinery lay-out department to determine the best grouping of machines from a power standpoint, and to eliminate short double-cross belts where possible and the arrangements which require excessive starting currents and needless constant expenditure of energy in overcoming friction. He should recommend chain drives, as they will transmit overloads. Motors are frequently regarded as underrated because the main drive of a belt, particularly on a damp day, is very inefficient. Excessive belt tension is frequently the cause of a seized motor bearing. A motor should be given a central position relative to the group of machines it drives, and the motor pulley should be placed under a girder.

OPERATION OF EQUIPMENT

Instruction cards should cover the operation and maintenance of every piece of equipment in the plant. No doubt should be left in the mind of the operator. Rules for starting, stopping and oiling should be very complete. Rules giving the method of procedure in case of shut-down can be drawn up to cover nearly every possible condition. A complete set of instruction cards will prevent shut-down, shorten the period of shut-down and place responsibility on the right person. A comprehensive set of signals (whistles and colored lights) should be in operation in the station, covering the starting and stopping of the main units and auxiliary apparatus.

Voltage regulators are a boon, but they fail sometimes. They may operate satisfactorily twenty-four hours a day for six months and then fail, causing the station to lose the load. Once in six months is once too often when a 10,000-hp. load is dropped and about 25,000 men are forced to be idle. At the plant where the writer is engaged periodic shut-downs were experienced until the regulator was made semi-automatic. If the regulator fails as now adjusted, the station voltage drops only to a certain value, which insures against dropping the load. This is done at a sacrifice of the automatic feature whereby the voltage is maintained constant under all conditions of load; hence the operator must adjust the generator and exciter fields when the load "goes off" and "comes on" at recess periods to keep the regulator on the line.

The field excitation of each generator should be adjusted so as to maintain the same power factor in each unit, as under this condition the station capacity will be a maximum. In some cases machines operate better at a lower or higher power factor. Sometimes it is desirable to raise the average power load of a bleeder turbine in order to obtain as much low-pressure steam as possible. Another precaution to take is to keep tie switches open when it is not necessary to have them closed, as the fuse capacity is doubled and the damage due to short circuits is thereby increased when they are closed.

Operators should be instructed to start motors with quick decisive motion. "Hobbing" should be discouraged, especially when belts are being put on. If the

proper compensator taps are used, the acceleration will be such as to permit applying any belt without danger to the operator.

Where there are several motors on a floor one man should be detailed to start all of them so excessive starting current will be avoided. In addition, the man on the first floor should be instructed to begin starting motors at ten minutes before the starting time, the man on the second floor at eight minutes before, etc. Where the plant is all on one floor the same effect can be produced by starting the departments in succession with small intervals between. The station switchboard operator should be notified when synchronous motors are either started or stopped, as reactive power load suddenly thrown on the station may cause trouble.

MAINTENANCE OF EQUIPMENT

Maintenance men should be assigned to inspection when not employed in actual breakdown service. The importance of adequate inspection cannot be over-emphasized. Systematic inspection brings defects to light before they reach the danger point.

Ground detectors should be installed in the generator field circuits and a three-phase ground detector in the main circuit. The station equipment should undergo a thorough inspection at short intervals which should include the inspection of oil-switch contacts and the timing of relays.

Duct lines should be inspected frequently, at which time manhole conditions should be observed and cables tested with a megger. Every feeder should be tagged in every manhole with a waterproof label. In addition there should be a diagram of each manhole showing the position of each feeder. A cable test set is not expensive and will be found very useful not only for locating grounds or other defects in cable but also for determining resistances all over the plant—magnetic chuck repair, pyrometric work, telephone work, etc.

Transformer houses should be roomy, well lighted, well ventilated and clean. The cause of water condensation anywhere should be investigated immediately. Transformer oil should be tested for water content at frequent intervals.

Motor inspection should be very thorough. Slip rings should be inspected for pitting and oil rings should be tested to see that they turn. More motors shut down because of seized bearings owing to the lack of oil and also to stationary oil rings than from any other cause. The adjustment of overload relays and circuit breakers at frequent intervals should also be checked periodically. Compensator contacts should be inspected and replaced when badly burned. When a motor has the appearance of being heavily overloaded, a search should be made for bad contacts on the running side of the compensator. The maintenance of compensators is usually very high but can be reduced by careful instruction regarding the proper method of starting and by systematic inspection.

The power engineer and his assistants, even though well organized and well fortified with departmental rules and comprehensive instruction cards, would do well to leave the office and stroll through the plant quite frequently. The power engineer should trust his assistants to the point of supporting them in a controversy. He should hand a problem to an assistant and then forget about it until the latter makes his report.



Street Lighting for Small Cities and Towns

The First of a Series of Articles, in Which General Principles Are Discussed, Including Brightness, Silhouette Effect, Shadows, Glint, Glare, Spacing and Shade-Tree Interference

BY JAMES R. CRAVATH

The series of articles on the street lighting of cities of 50,000 and less of which this is the first installment will probably contain little on the subject that has not appeared already in the transactions of our engineering societies under the authorship of leaders in this line. The function of these articles will be to bring together in convenient shape for the central station man who is taking up the subject with his municipality some of the best current thought and information on the subject. The field is one in which rapid progress has been made, and it is not always easy for the man engaged in miscellaneous light and power work to keep track of the advances in this special line, which he is only called upon to consider at rare intervals. The present installment will take up general principles, discussing production of roadway and sidewalk brightness, seeing by silhouette effect, seeing by illumination on objects, shadows of road obstructions and irregularities, glint, glare and interference with seeing, relation of spacing to street illumination and glare, shading to avoid glare, and the avoidance of interference caused by shade trees.

BEFORE street lighting can be intelligently planned it is necessary to have a clear idea of just what is to be accomplished by the lighting. While the general objects can be stated in a few words, an analysis of these soon leads one into a rather complicated situation which can be only briefly reviewed in this article.

Stated in very general and popular terms, the ob-

jects of lighting streets can be summed up as follows:

1. In all classes of streets the least that can be expected of street lighting is to enable a person to see his way about at night.

2. On some classes of streets the production of an especially well-lighted effect, either on account of congested traffic or because of the ornamental and advertising features, is desired in addition to the first object named.

On a large majority of streets lighting for purposes of seeing, without much regard to producing enough light for advertising or ornamental effect, is all that can be expected. Even on such streets, however, there will naturally be some difference in the severity of the requirements. The more traffic on a street the greater is the amount of outlay justified for street lighting and the greater is the necessity for safeguarding users of the street from collisions and attack.

As to the things it is especially necessary to see on a street at night in order to see one's way about, one might elaborate at length and in great detail, but to mention a few of the principal ones will suffice. For both pedestrians and drivers irregularities and obstructions of the street surface must be seen. Likewise, other persons using the street must be seen in order to avoid collision. The value of street lighting

in preventing crime is probably about in proportion to the quantity of such lighting. On some of our worst-lighted streets it is of little value, while on the most brightly lighted downtown streets conditions as to crime prevention are virtually equivalent to daylight.

Technically the object of street lighting is to produce a certain amount of brightness on street surfaces and upon users of the street. In the daytime there is such a superabundance of light that the distribution of brightness on street surfaces and various objects need not be analyzed very closely; but where the amount of artificial light must be as meager as it is in a majority of streets in small cities a much closer analysis is needed.

DISTINCTION BETWEEN INCIDENT ILLUMINATION AND SURFACE BRIGHTNESS

The distinction between the illumination incident upon a surface (such as a pavement, sidewalk, tree, vehicle or person) and the surface brightness of such objects must always be kept in mind. It is brightness that we see, that produces the effect on the eye. The illumination on a surface produces the brightness we see, but it does this only by virtue of the light reflected from the surface. That is, the brightness is always

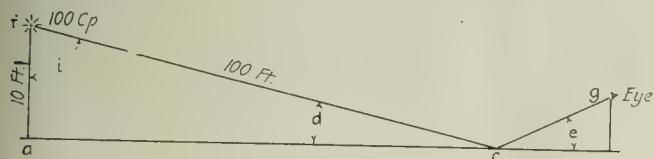


FIG. 1—DIAGRAM FOR BRIGHTNESS AT DIFFERENT POINTS

proportional to the incident illumination minus the loss by reflection. Since the reflecting power of various surfaces differs greatly, their brightness under a given illumination differs in like proportion.

Between a very new macadam or concrete surface and black mud there may easily be a difference of ten to one in diffuse reflecting power. To produce equal brightness, therefore, the illumination would have to be ten times greater on the black mud than on the light macadam, and the unfortunate thing about this is that there is usually less money available to illuminate the mud than to illuminate the macadam. By daylight a considerable portion of our seeing is by virtue of the different color and reflecting power of various surfaces, although differences in illumination, commonly known as light and shade effect, also have their influence. At night, with street lighting, differences in illumination from different directions causing light and shade have a much greater effect.

SILHOUETTE EFFECT

How important they are was probably not realized until 1910, when Preston S. Millar pointed out that a considerable portion of our seeing on the streets at night is by virtue of the silhouette effect. That is, we see many upright objects, such as persons and automobiles, at a distance not so much by the light reflected from them as by the light background against which they appear as silhouettes. This is especially true in large cities where the background consists almost entirely of pavement, sidewalks and buildings, which are better reflectors and consequently appear brighter than vehicles and persons in dark clothing. Fig. 2, taken from Mr. Millar's original paper before the Illuminating

Engineering Society dealing with silhouette effect, shows the latter very clearly.

On dirt streets or where oiling has rendered the pavement a very dark color the effect is not so pronounced. However, even oiled streets, if so well traveled by automobiles as to take on a kind of glint or polish, reflect considerable light by what is known as specular reflection in distinction to diffuse reflection. Specular reflection is the same as that which takes place from a mirror. It makes these oil-polished street surfaces appear quite bright at certain angles.

If the background is not brighter than the object, the only way the object can be seen is by having sufficient illumination upon it to make it enough brighter than its background to be recognized. An example of this is the street name post seen in Fig. 2. Sometimes the same object is seen partly by silhouette and partly by illumination upon it, as in the case where part of the object is seen against a bright background and part against a dark background. The bearing of these silhouette and illumination effects on the spacing and equipment of street lamps is taken up later.

Road obstructions, such as stones and bricks, for example, may be seen either by illumination or silhouette, but are usually recognized fully as much by the shadows they cast as by any reflection from their own surfaces. Holes and depressions in sidewalks and pavements are usually also recognized by shadows, except when close under a street lamp.

EFFECT OF SHADOWS

The National Electric Light Association committee on street lighting for 1914 made some elaborate experiments on a street in New York City to determine the merits of various lamp spacings and mounting heights and various types of light distribution from the lamp. Considerable attention was given to tests in which a number of observers were required to locate obstructions or targets placed in the street as they walked or drove along. The principal result of this investigation showed that obstructions such as stones in the street could be better seen with lamps so spaced as to give some shadows behind these obstructions than with the lamps placed at such frequent intervals and so equipped as to produce a more uniform illumination with less pronounced shadows. In all of these experiments, however, the lamp spacing was relatively short as compared with common practice in smaller cities. As uniformity of illumination comes high in first cost on account of the large number of lamps and lamp supports required per mile of street, there is no great danger that streets will be lighted too uniformly for best results in the smaller cities.

Seeing by glint effect is a term used among engineers to apply to effects obtained when surfaces are wet or where they are highly polished so that there is specular reflection from small portions of them. On rainy nights glint from the wet sidewalks and pavements takes the place of the partially diffuse reflection ordinarily received. Many images are then seen of the street lamp reflected from the wet pavement and pools of water. Glint is also especially useful in locating mudpuddles with the aid of rather distant street lamps.

In connection with seeing by silhouette, the value of this effect is in many cases greatly increased by the

fact that there is just enough glint or specular reflection from the paving or sidewalk for the illumination at points midway between street lamps to produce much greater brightness in the direction of the eye than if the whole of the street were a purely diffuse reflecting surface.

Referring to the diagram of Fig. 1, F is a street lamp 10 ft. (3 m.) above the ground and G is the eye of an observer. What is the brightness of the street surface at points A and C to the observer? We will assume first that the street surface is a new, white, dusty macadam which will approach a diffuse reflector in its characteristics. Now a diffuse reflector will appear equally bright from all directions, no matter from what direction illuminated. Consequently the brightness at various points along the street will always be directly proportional to the illumination. Thus, at point A if the lamp is of 100 cp., the illumination will be 100 cp. divided by 100 (which is the square of the

and if point C were a mirror, the brightness entering the eye from point C would be practically the brightness of the source of light at F . If the point C is a piece of glossy oiled street surface, it will not behave exactly like a mirror, nor will it act as a diffuse reflector, but its action will be intermediate between the two. It will appear very much brighter when viewed from a direction approximating CG than from other angles. The point A , on the other hand, will appear considerably less bright than if it were a diffuse reflector. This tends to counteract the enormous difference in illumination falling upon these two points. The practical effect of this as brought out by Millar in various tests is that even on an asphalt street which does not have the polish common to heavy automobile traffic the brightness varied only at the ratio of 2.7 to 1 with lamps 260 ft. (79.25 m.) apart, while the horizontal illumination varied forty to one. Here again it may be noted that the polishing of a street pavement due to heavy traffic of any kind is more conducive to uniformity of brightness in spite of the non-uniformity of illumination than are the conditions prevailing in the smaller cities. However, these points must be recognized in all classes of street-lighting problems. It should be remembered in considering the illumination and values cited in Fig. 1 that no allowance is made for any illumination that may be obtained on point C from another lamp placed at the back of the observer.

RELATIVE VALUES OF HORIZONTAL AND VERTICAL ILLUMINATION

There has always been considerable discussion in street-lighting circles as to the relative value of vertical as against horizontal illumination for street-lighting purposes. It is now generally recognized that both the horizontal illumination on the street surface and the vertical illumination on vertical objects such as pedestrians and vehicles must be taken into account. The relative weight given to these two in making up a good street-lighting system will depend very much on the character of the street surface. The importance of the silhouette effect has already been enlarged upon. It is evident that in producing silhouette effect illumination of the street surface is the important thing. However, if the street surface is so dark that it is difficult to get a well-illuminated background, one must fall back upon vertical illumination of objects. It is largely a waste of time to discuss the relative importance of vertical and horizontal illumination, because with any practicable mounting heights of lamps the illumination midway between lamps by vertical illumination will be approximately a constant ratio to the horizontal illumination, and no amount of practicable shifting of lamp height and spacing is likely to change this constant enough to have much practical bearing on the subject under discussion at this time.

LAMP SPACING

We have seen that variations in intensity of illumination falling on the street surface from points immediately under lamps to points midway between are necessarily very large even with the most skillful use of appliances for directing the light of the lamp in directions where it is most needed. The figures given in connection with Fig. 1, already explained, where there



FIG. 2.—THE CAR IS SEEN BY SILHOUETTE EFFECT WHILE THE STREET-POST SIGN IS SEEN BY DIRECT ILLUMINATION

distance), or 1 ft.-candle (10.08 lumens per sq. m.). At point C , assuming that the lamp emits 100 cp. in that direction also, and that the distance F to C is 100 ft. (30.48 m.), the illumination on the street surface at C will be by the same process of figuring 0.01 ft.-candle (0.108 lumen per sq. m.) multiplied by the cosine of the angle I , or in other words by the ratio of 10 ft. (3 m.) height to 100 ft. (30.48 m.) distance, thus making the actual horizontal illumination at C 0.01 ft.-candle multiplied by 0.1 or 0.001 ft.-candle (0.0108 lumen per sq. m.). The illuminations and brightnesses would therefore be in the ratio of 1 at the point A to 0.001 at the point C . Evidently with an object between the eye and point C as a background there could be very little silhouette effect, while between the eye and point A there would be considerable.

If, however, the street surface is glossed with oil or moisture, the character of reflection from it is entirely changed. Instead of appearing equally bright in all directions about any given illuminated spot, it will appear very much brighter when viewed from an angle equal to the angle of incident light. Consider the light which falls on point C from the lamp at F and is reflected to the eye at G . If angles D and E are equal,

is shown a variation of a thousand to one within 100 ft. (30.48 m.) for the horizontal illumination, illustrate this forcibly. However, with more frequent spacing and by figuring in the effect of neighboring lamps these differences are rapidly reduced. For brightly lighted city streets a variation of ten to one between lamps at points on the street surface is not likely to be noted. Where lamps are as frequently spaced as on business streets the question of improving the uniformity of illumination does not offer itself. This applies to the present-day common spacing of ornamental systems, which are from 60 ft. to 150 ft. (18.29 m. to 45.72 m.). With special care this distance can be exceeded and still produce satisfactory uniformity, although the ornamental effect may not be what is desired. In outlying streets where first cost tempts the designer to space lamps at long intervals the poorly illuminated spaces midway between lamps come in for first consideration. On such streets chief interest centers on the points of minimum illumination between lamps. Anything and everything which will bring up this minimum between lamps is desirable if it can be obtained for a reasonable outlay. With a given lamp equipment the illumination midway between lamps will fall off approximately inversely to the square of the distance. That is, doubling the distance between lamps reduces the minimum illumination to one-fourth. Add to this the fact that the longer the interval between lamps the less the amount of brightly lighted background against which things can be seen by silhouette effect and difficulties are further increased. Lamp spacings of 600 ft. to 1000 ft. (182.88 m. to 304.8 m.), which in years past have been so common among smaller cities, are entirely inadequate and inefficient. Furthermore, under modern conditions they are unnecessary from the economy standpoint.

AVOIDANCE OF GLARE

The avoidance of glare has long been recognized among experts as desirable in street-lighting practice, because it has been known that the existence of glare from lamps near the line of vision causes a decrease in the seeing ability of the eye—or, in other words, in the visibility of objects—so that to all practical intents and purposes more light is required on objects in order to see them clearly than if the source of glare were removed. Quantitative investigation of this subject has been made at considerable length by A. J. Sweet, some of whose results have been checked by Preston S. Millar. All of these results show that there is considerable disturbance of vision when a bright lamp is brought within 15 angular degrees of the center line of vision. As the effect of glare increases rapidly as the lamp is brought nearer to the center line of vision, especially within 6 deg. to 8 deg., there is considerable to be gained in efficiency of illumination as measured from the ocular standpoint by hanging the lamp as high, and consequently as far out of the ordinary line of vision, as possible. While no very exact figures can be given, it may be said in a general way that unnecessarily low hanging of lamps may often be the equivalent of throwing away half of the light generated because of the depressing effect on vision of objects which must be seen past a bright street lamp. The use or non-use of a diffusing globe in a lamp apparently has very little effect on the glare, the glare effect being dependent upon the candle-power; or, to be more exact,

it depends according to the best information obtainable, upon the square root of the candle-power of the lamp used as emitted in the direction of the eye. The only feasible remedy for street-lighting glare yet evolved is the increase in mounting height of the lamps, and this is well worth while, especially in the range from 10 ft. to 15 ft. (3 m. to 4.5 m.). According to Sweet's investigation, if the glare effect be taken as 1 at a height of 32 ft. (9.7 m.), it becomes about 1.9 at the height of 22 ft. (6.7 m.), about 3 at a height of 16 ft. (4.8 m.), 4.3 at 15 ft. (4.5 m.), and 8.4 at 12 ft. (3.6 m.).

DIRECTING DEVICES AND SHADE-TREE INTERFERENCE

Of course, with lamps at greater heights, to avoid glare the necessity of directing devices to bring down to earth the light flux which would otherwise be wasted in the upper region becomes greater and the cost of posts is increased. On the other hand, greater height permits longer spacing between lamps without too much loss of uniformity. The question of increased cost of high poles will be taken up in a later installment. The use of directing devices to save light will also be taken up under its proper heading. The shading of street lamps to avoid glare, which at first thought would seem one of the simplest solutions of the glare portion of the problem, has never been practiced to much extent, and its uses are confined principally to drawbridges, where exposed street lamps would interfere with navigation signals. The effective shading of lamps to prevent glare would mean the cutting off of all light above an angle of 20 deg. to 25 deg. below the horizontal. If a shading reflector or other device is to be used which cuts off light above 25 deg. from the horizontal, the lamp would have to be mounted 42 ft. (12.8 m.) above the ground in order to light the ground 100 ft. (30.4 m.) away from a point under the lamp. This sufficiently illustrates the difficulties.

Interference with street lighting by shade trees is a very live subject in the majority of cities, and especially in the smaller cities and towns under consideration. While the majority of such towns have many shade trees, there is considerable difference in the proper method of treatment. In some streets the trees are very large and permit of trimming high to prevent interference with lighting. In other places the trees are of an age where trimming high enough to prevent interference with the lighting is out of the question. Where the trees are too small to admit of high trimming center-lamp suspension will usually be necessary to prevent undue shadows. In such a street no locations can be found except in the center which will not involve considerable obstruction of the light by shade trees. On the other hand, where the trees are very large so that they can be trimmed high to form a high arch over the street the principal trouble with shadows is not from the boughs and leaves but from the large trunks, which standing in line along the parkway form an effective light barrier for the sidewalk. On such streets the location of lamps in line with one of the row of tree trunks permits the complete lighting of the roadway and of the sidewalk on the side on which the lamp is located, and causes light to shine through the row of trunks on the opposite side of the street at an angle sufficiently oblique to permit the location of the sidewalk always to be seen, and the area of the sidewalk in the shadow is reduced to a minimum.

MODERN STREET LIGHTING AN ASSET TO SPOKANE

Aspect of Streets, Appearance of Crowds and Morality, Peace and Order Improved by New Lighting System in Business Section

BY REN H. RICE

How a modern system of illumination makes a good street a better street and makes a good city a better city has been well illustrated in Spokane, Wash., where the principal business thoroughfares in a district half a mile (0.8 km.) long and a quarter of a mile (0.4 km.) wide are now brilliantly lighted. From dusk until daylight 400 luminous arcs of the latest pattern diffuse white light so thoroughly that fine print may be read with ease at any point in the illuminated section. Shadows are banished, there are no dark corners, and the distribution is so unobtrusive that one does not look for the lamps which cause it, accepting the condition without a thought of its source.

Along with the new illumination has come a change in the aspect of the streets. Buildings which formerly had relatively good "store fronts" have been remodeled and provided with more attractive street faces. Signs have been reduced in size and made more uniform. Window lettering is neater and more artistic. Displays are arranged more attractively. The streets are better kept.

All this improvement has resulted because the strong white light at night brings out pitilessly every detail. Disarray, if permitted in a window, seems emphasized. Dirt cannot be hidden. An inartistic sign is hideous. These things are not so noticeable during the daylight hours when every one is in a hurry and the rush of traffic keeps persons watching their step for safety. But at night travel slows up. Citizens take time to study window showings. Displays draw more attention.

Salespeople frequently are greeted in the morning with "I saw in your window last night an article," etc., indicating that the shopping trips are frequently induced by a stroll past well-lighted windows on the previous evening. Another effect of the illumination is

affected the same way. Furthermore, the oldtime corner loafers and parasites are seeking shadows and obscurity for their comfort. The chief of police has summed the situation up thus:

"Few people realize how much peace and order depend upon lights. We have fewer and fewer calls from the downtown district since the installation of the



ELECTROLIER CURB LIGHTING ON FIRST AVENUE

illuminating system. Disorder, crime, immorality and darkness go together."

The first test of the new illumination began four years ago, when curb electroliers were installed at intervals of 100 ft. (30.5 m.) along the east end of Riverside Avenue for a distance of four blocks. Since then the whole length of Riverside in the business section and all of First, Main, Sprague and Trent Streets have been included. Now the merchants on cross streets are demanding similar improvements.

The illumination is provided by General Electric luminous magnetite arc lamps rated at 6.6 amp. A soft white light is produced with no sputtering. The system has been a complete success from the start. The cost is \$75 per year for each electrolier, covering installation, energy and maintenance. Property owners pay three-fourths and the city one-fourth of the expense. At the end of ten years the city will assume the title



RIVERSIDE AVENUE AT 3 A. M. NEWSPAPERS MAY BE READ WITH EASE AT ANY POINT

noted in the appearance of the night crowds. Women feel secure from annoyance and promenade the business district in greater numbers than before the new lighting was adopted. Feeling more on exhibition than formerly, they are more careful of attire. Men are

to the equipment. Power for the lighting, also for street car service, manufacturing and domestic use, is obtained from the falls of the Spokane River through the Washington Water Power Company, of which John B. Fiske is superintendent of light and power.

Characteristics and Testing of War Searchlamps

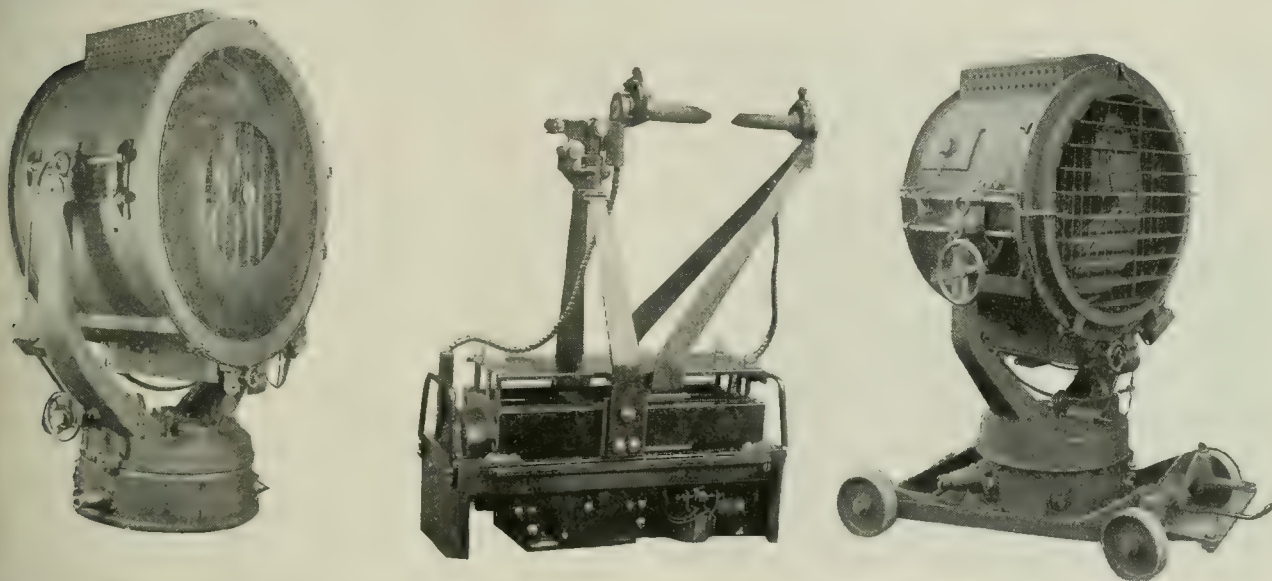
Sizes of Electrodes for Different-Diameter Projectors, Relation of Focal Length to Diameter of Mirror, Difficulties in Measuring Beam Candle-power, and Other Points of Interest

BY LIEUT. SAMUEL G. HIBBEN

SINCE the beginning of the war great forward steps have been taken by American manufacturers in the detailed development and manufacture of searchlamps for use in foreign countries as well as in the United States. Higher efficiencies have been gained by using higher current densities in cored carbons, and the accessories and control mechanisms have been developed at a very rapid rate. Shown in the accompanying illustrations are views of semi-portable searchlamps, one representing the type most common on the United States battleships and the other the kind used

tained generator set such as shown herewith is provided. A control box is located at some convenient point between the generator and the projector so that the back-glare from the moisture and dust in the atmosphere will not interfere with the operator's view of the distant target.

Owing to the operating conditions to which searchlamps are subjected, it is more important that they be reliable in operation than that they be efficient. In the first place the generator units are subject to rough operating conditions and must start readily in rain and



FIGS. 1, 2 AND 3—SEARCHLAMP (60-IN.) WITH IRIS SHUTTER PARTLY OPENED; MOTOR-DRIVEN ARC-FEED MECHANISM, AND 36-IN. SEARCHLAMP MOUNTED ON TRUCK

in coast defense work. The latter is equipped with a 60-in. (1.52-m.) reflector and stands 12 ft. (3.7 m.) high. Operating at the usual 20,000 watts demand, it will project a beam of a possible 200,000,000 cp. Motors with distant control are geared to elevate and depress the projector or revolve the barrel about the vertical axis. Hand-wheels are provided to perform the same operation and to set the electrodes in the proper relative positions.

The arc mechanism is particularly interesting in that it maintains the carbon electrodes in proper alignment and keeps the arc crater at the exact focal point of the mirror. Carbon electrodes with hard casings and soft carbon cores are employed, the materials being selected so that they burn at the same rate without slagging. The sizes approved by the United States Navy for different diameter projectors are indicated in the table. The average life of the carbon electrodes used in the 60-in. (1.5-m.) projectors is about six hours.

Searchlamps used on the battleships are connected directly with the direct-current service lines, with the proper balancing resistance in series, but for coast defense and semi-permanent fortifications a self-con-

cold weather, or operate in hot places without excessive attention. A 25-kw. unit will consume about 6 gal. (22.7 l.) of gasoline per hour.

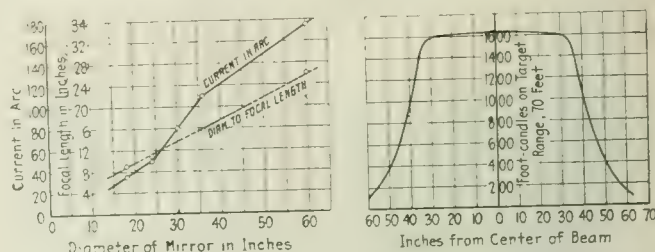
Certain relations usually exist between the arc current and the size of the mirror used with that arc. The practical relationship so far used in the projectors manufactured in this country is shown in Fig. 5. Of course, the arc voltage remains practically constant, according to the characteristic of the direct-current arc, so that for the arcs of greater candle-power or of greater wattage the amperes will be increased. In a typical 60-in. (1.5-m.) projector the arc voltage is about 55 and the current nearly 180 amp. As with any other direct-current arc, an automatic balancing resistance is used in the circuit to maintain a constant arc voltage.

The ratio of diameter of mirror to focal length is practically a straight-line function, as shown by the dotted line in Fig. 5. The simplest practical way of determining the focal length is to place the mirror with the plane of its opening normal to the sun's rays. Then, if the atmosphere is slightly foggy or clouded with smoke or dust, the rays concentrate at the focal point.

The present state of glass manufacture is such that the size of the Mangin mirrors for large projectors is limited by the prohibitive cost and liability to breakage of anything in excess of 60-in. (1.5-m.) diameter. The focal length cannot be too short, otherwise the mirror will be endangered by heat of the arc. The greater the focal length the less the dispersion, but opposing this is the fact that with greater focal length less light from the arc strikes the mirror. Without going into the theory of the problem of the best mirrors, it is sufficient to note that the dispersion is greatest when the ratio of crater area to focal length is greatest: hence to secure a long-range beam from a large candlepower arc it is necessary to use a correspondingly large mirror. Thus for a $\frac{3}{4}$ -in. (19-mm.) diameter arc crater, a 36-in. (0.9-m.) mirror with a 15-in. (38.1-cm.) focal length is used, and the minimum dispersion either side of the axis of the beam will be the angle whose tangent is $\frac{3}{8} \div 15$, or 1.5 deg.

There will, of course, be some dispersion caused by the front glass. The absorption loss in the mirror and

practice is caused by the considerable size of the light source and by inaccuracies of the mirror, and if atmospheric absorption were negligible, then the measurement of the beam candlepower would be a simple matter, as it could be determined by reading the candle-



FIGS. 5 AND 6—RELATIONS BETWEEN MIRROR CHARACTERISTICS AND ARC CURRENT; TARGET ILLUMINATION PRODUCED AT 70 FT. WITH 60-IN. PROJECTOR

power at any convenient distance. However, these factors cannot be eliminated and the law of inverse squares will not apply. Approximate values of beam candlepower can be obtained, however, without taking into account the magnifying power of the mirror or the atmospheric and glassware absorption by the following formula:

$$I = X \frac{(d^2)}{(c^2)}$$

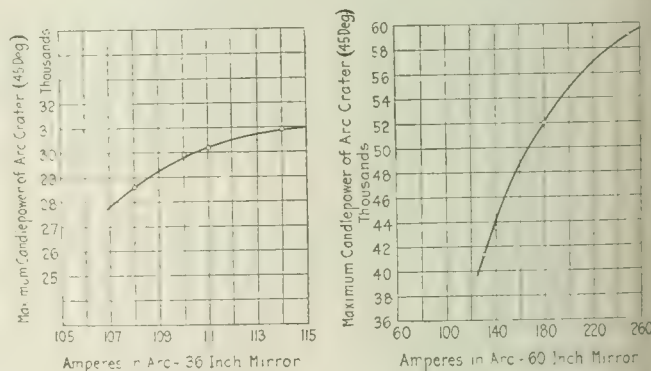
where

I = intensity of projected beam of light,
 X = intensity of light striking mirror,
 d = diameter of mirror in feet,
 c = diameter of arc crater in feet.

If this formula be applied to the 60-in. (1.5-m.) projector with an arc crater of 1.1 in. (2.8 cm.), and the average intensity of light incident on the mirror be taken as approximately 49,000 cp., then the beam candlepower would be about 151,000,000.

A much better way of comparing searchlamp efficiencies is to measure the foot-candles on a target at some standard distance and under similar atmospheric conditions. The arc, of course, should be focused to have the illuminated area of the target the same as the area of the mirror. The results of one set of measurements of this kind are given in Fig. 6.

The quantity of light is directly proportional to the



FIGS. 7 AND 8—RELATION OF ARC CURRENT TO CANDLEPOWER IN 36-IN. AND 60-IN. PROJECTORS

the front glass taken together is somewhere in the neighborhood of 20 per cent.

ARC AND BEAM CANDLEPOWER

The final criterion of the efficiency of a searchlamp is the candlepower and homogeneity of the projected beam, and these values are difficult to determine. Considering only the arc it is possible to photometer the light source and secure results as shown by Figs. 7 and 8. The crater of the positive carbon is the light source, and this for the 60-in. (1.5-m.) projector measures 0.9 in. to 1.2 in. (2.29 cm. to 3.04 cm.) diameter. The maximum candlepower is at about the 45-deg. angle to the negative carbon, just before the point where the tip of the negative carbon begins to cut off the full view of the crater. Under normal operations the arc current lies between 160 amp. and 180 amp. for the largest units; hence the maximum effective crater candlepower is, say, 50,000. This is equivalent to more than 80,000 cp. per sq. in. (12,400 cp. per sq. cm.) of light source—much the brightest of all sources of light yet produced by man.

If there were no dispersion of the beam, which in

area of the crater, and this area, or the diameter of the carbon, is governed by the current. The temperature of the positive arc crater is from 4000 deg. to 6000 deg. C., and for excessive current densities the carbon holders must be specially cooled.

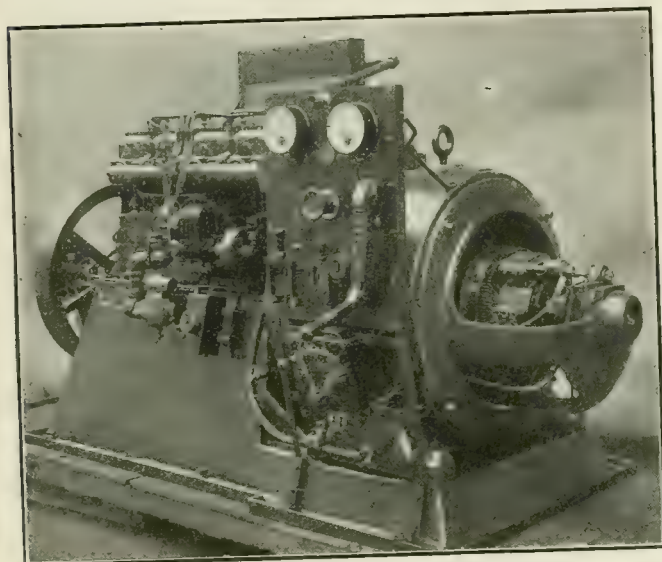


FIG. 4—GASOLINE-ENGINE-DRIVEN GENERATOR FOR SEMI-PERMANENT SEARCHLAMPS

In naval service particularly, and to a lesser degree in field operations, the loss of light in atmospheric absorption is great, usually sufficient to make the searchlamp ineffective at ranges of much over 6000 yd. (5486.4 m.). The ranges at which targets of gray or

SIZES OF ELECTRODES FOR DIFFERENT DIAMETER PROJECTORS

Projector, inches	Negative Carbon, inches	Positive Carbon, inches
18	$\frac{5}{8}$, solid	$1\frac{1}{8}$, cored
24	$\frac{3}{4}$, cored	1, cored
30	$\frac{7}{8}$, cored	$1\frac{1}{8}$, cored
36	1, cored	$1\frac{1}{4}$, cored
60	$1\frac{3}{8}$ cored	2, cored

medium light colors may be satisfactorily illuminated by a 60-in. (1.5-m.) searchlamp are as follows:

	Yards	
With very clear atmosphere.....	10,000 or more (9144 m.)	
With average atmosphere.....	6,000 to 8,000 (5,486 to 7,315 m.)	
Through slight haze or rain.....	3,000 to 4,000 (2,743 to 3,657 m.)	
Fog or early dawn.....	1,000 to 2,000 (914 to 1,828 m.)	

Cases are known, however, where vessels have been observed at a distance of 9 miles (14.5 km.), and on slightly foggy nights the beams may be seen in the sky at still greater distances. No definite values are set for target illumination. If a small projector, say one with an 18.4-in. (45.7-cm.) mirror, is used in sweeping the sky for aircraft, the object may be detected with less than 1 ft.-candle (10.8 lumens per sq. m.) of illumination. For a range of 2730 ft. (892 m.) the arc current and corresponding illumination intensities on the target are as follows:

Current in Arc (amp.)	INTENSITY ON TARGET	
	Foot-Candles	Lumens per Sq. M.
20	0.4	4.3
25	0.7	7.5
40	0.9	9.7
60	1.0	10.8
90	1.0	10.8

From experience it has been found that it is best to illuminate as little of the foreground and surroundings as possible to minimize back glare and avoid disclosing to the enemy even the smallest portion of the searchlamp location. Gun lights—that is, lamps used in illuminating targets on which guns are being trained—should be mounted 90 ft. to 100 ft. (27.4 m. to 30.5 m.) above the water and searching lamps at not less than 25 ft. (7.6 m.). The most favorable direction of the beam of light is found to be 30 deg. with the line of fire.

It is interesting to note that the searchlamp may be used effectively both on sea and land for signaling, using the Morse telegraphic code interpreted by flashes of light. The beam is turned toward the receiving station and cannot be observed a few degrees either side of the object upon which it is trained. The signaling is done in much the same manner as with a heliograph, and in daytime can be performed at a range of 6 miles to 8 miles (9.7 km. to 12.9 km.).

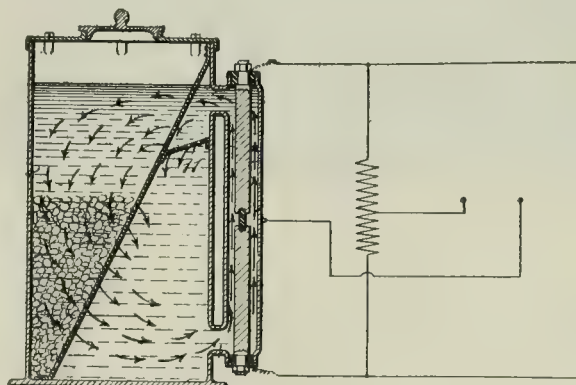
In the opinion of the writer even the exigencies of

the present war will scarcely call forth any very radical improvements in searchlamp construction, except of the arc and its mechanism. Developments are under way to increase the current density of the carbon tips and arc stream, and these promise to increase the efficiency by decreasing dispersion; that is, securing more nearly the ideal point of light source.

ELECTROLYTIC RECTIFIER

Solution Kept Saturated at All Times and Maximum Conductivity Retained

To overcome the objections raised to the use of mechanical rectifiers it is contemplated by Charles C. Ruprecht of Midway, Fla., in patent No. 1,223,114, to use means whereby the salts or chemicals in excess of the saturation point will be disposed in the circulatory current in the electrolyte. This will cause the solution to be kept saturated at all times and maintain its maximum conductivity both of heat and electricity. The



PLAN OF ELECTROLYTIC RECEIVER SHOWING CIRCULATORY PATH OF SOLUTION

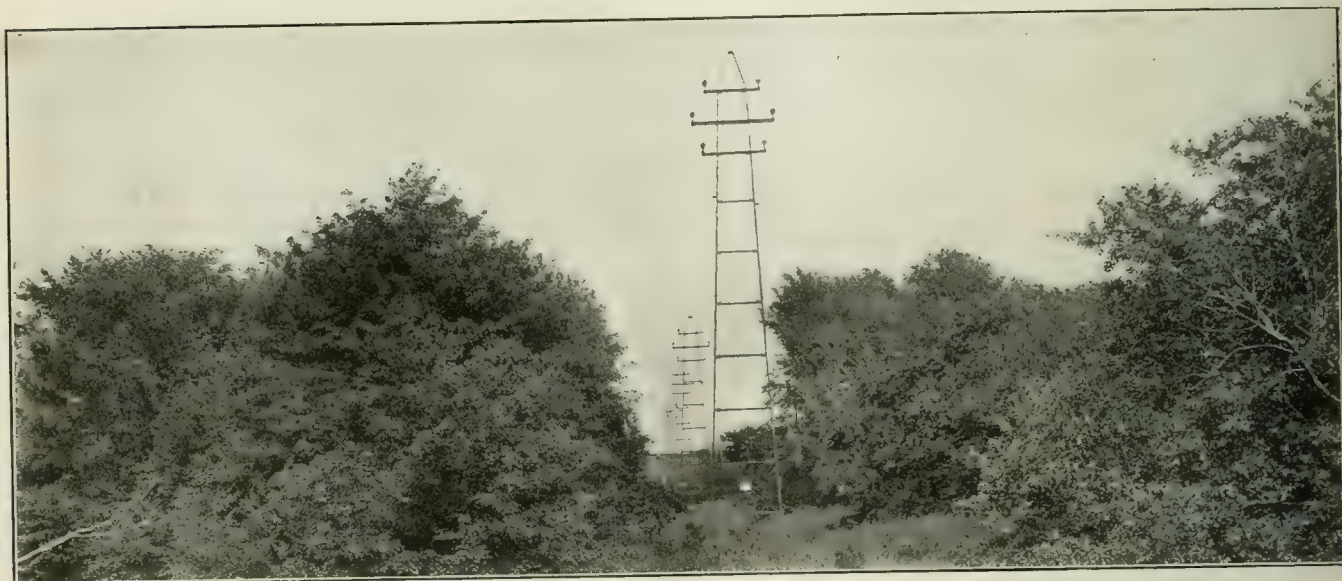
rectification is also maintained practically at a constant efficiency, and a constant combination of the salts with the solvent tends to cool the solution. This helps to maintain the rectifier in its best working condition. The placing of the salts in the circulatory path of the solution and away from the active electrodes causes recrystallization of the salt on the mother crystals in the receptacle or retainer and not at the electrode or any other place where they would detrimentally affect the working of the instrument.

National Research Laboratory Recommended for France

The French Academy of Sciences recently passed unanimously the following resolution: "The Academy of Sciences, convinced of the necessity of organizing in France certain scientific researches in a systematic manner, recommends that a National Laboratory of Physics and Mechanics be created, especially devoted to scientific researches useful for the progress of industries. This laboratory should be under the direction and control of the Academy of Sciences, one-half of the council to consist of scientists designated by the Academy, one-quarter of representatives of government scientific bureaus, and the remaining quarter to represent the principal industrial associations."

Interconnection a Boon to New England Plants

How an Overloaded Plant, One That Had Ample Generating Facilities and One That Had a Poor Load Factor Were Mutually Benefited by a Tie Line



VIEW ALONG RIGHT-OF-WAY OF TIE LINE CONNECTING THREE MASSACHUSETTS PLANTS

WHILE the interconnection of generating plants has always been an advantage even in normal times, it is still more important right now because of the unusual necessity of operating economy which it permits. Foremost among the benefits of interconnection are the advantage which can be taken of the system diversity factor and the possibility of using all equipment to the maximum extent and with the best economy. A striking example of the benefits to be derived from co-ordinating generating facilities is afforded by a group of New England companies which have been recently interconnected. This group comprises the Salem Electric Lighting Company, the Malden Electric Company and the Suburban Gas & Electric Company of Revere, which are among the most important suburban central stations in the Boston district. These companies are under the management of Charles H. Tenney & Company of Boston. The transmission tie line was constructed by the Eastern Massachusetts Electric Company, an organization affiliated with the Tenney interests.

The plant of the Salem company is most favorably located as regards coal delivery and condensing water supply. Situated on tidewater, near the center of the Salem business and manufacturing district, this plant has lately undergone a substantial development in the direction of capacity increase.

The Malden station is situated in a city district where expansion of the plant is virtually prohibited. Coal cannot be delivered by water and condensing water is expensive on this site. The plant is an inland station, with all the disadvantages implied by such a location. The station of the Revere company, on the other hand, is a relatively small plant, far removed from the important load centers of the Salem and Malden companies and not well located with respect to development into a

plant of great magnitude. This last plant serves an enormous summer resort patronage in addition to a wide area occupied by year-around residents.

Investigation of the best means of providing additional equipment to meet the growing demands upon these companies showed the engineers of the Tenney organization that the situation was peculiarly well suited to the construction of a tie line. It was decided to develop the Salem plant as the main source of supply, this station having practically unlimited development possibilities, with ample facilities for coal storage. The plan contemplated the sale of electricity to the Eastern Massachusetts Electric Company, which in turn markets

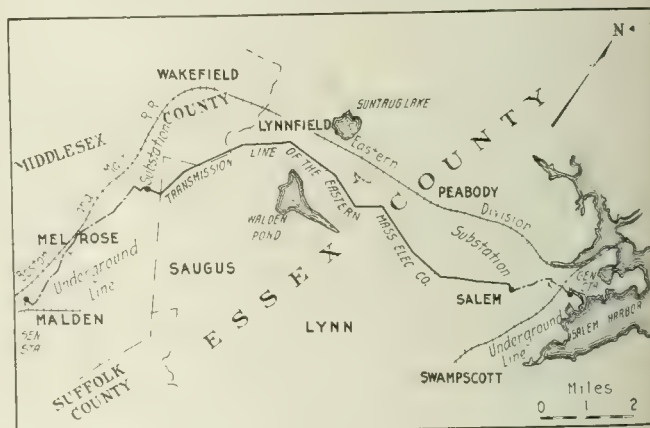


FIG. 1—ROUTE OF LINE FROM SALEM TO MALDEN

this energy to the Malden and Revere companies, enabling the latter to purchase energy at a price representing a saving over their present production cost, and permitting them to take on increased business without making further capital investment in their plants. Such an investment would otherwise have become neces-

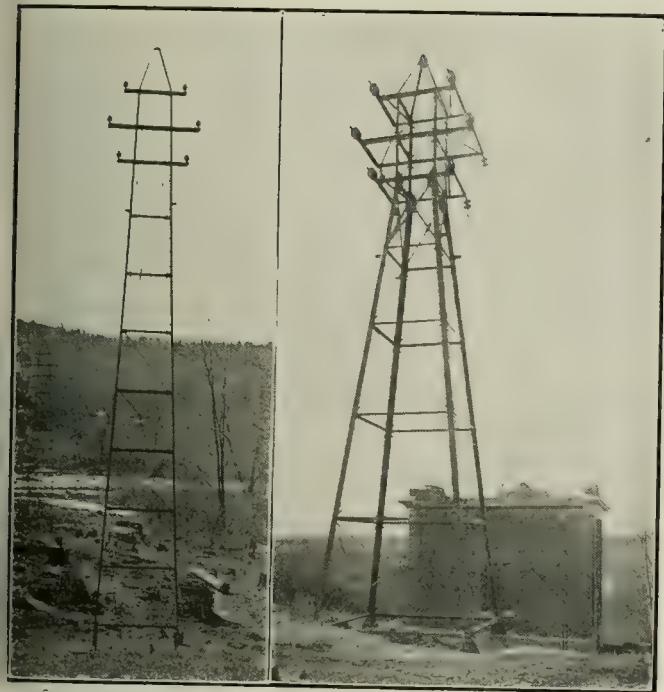
sary at a very early date if the tie line had not been installed.

The establishment of the tie line enables either the Malden or the Revere company to operate its present plant at an economical point at certain times during the year, and to sell energy to the Salem company if the load conditions warrant. The new line ties the three

On the overhead line between Melrose and Salem the average tower spacing is 450 ft. (137 m.). All buried portions of the towers are galvanized. The rating of the line is 10,000 kw. at 22,000 volts. One hundred and fifty steel towers were required.

Cost of construction and cost of fuel have both risen since the erection of the line was begun, but the economic justification of the line appears from the data published. On Dec. 23, 1915, the peak loads on these stations were 5200 kw. at Salem, 3430 kw. at Malden, and 1080 kw. at Revere. Since the generating capacity available was 17,000 kw. at Salem, 3400 kw. at Malden and 1400 kw. at Revere, the Salem plant was operating at less than one-third of its rating, the Malden station was slightly overloaded and the Revere plant was about three-quarters loaded. The peak load on the last-mentioned station, however, came at 8 p. m., whereas the peaks on the two other stations occurred at 5 p. m. The Salem plant had the poorest load factor of the three, although it is the most modern station. Typical summer load conditions also show the Salem plant at a disadvantage with respect to Malden, but the Revere station had the poorest load factor of the three.

The inability of the Malden station to meet the estimated 1916 load requirements and the close approach of the Revere load to the capacity of the plant are indicated in Fig. 6, the typical summer conditions for 1916 being shown in Fig. 7. It will be seen that the use of a tie line permits handling the 1916 winter load (Fig. 6) on the Salem station alone if need be, whereas if the Malden plant had been forced to depend upon itself its rating would not have been sufficient to meet the demand upon it by about 1495 kw. Revere in 1916 came close to its rating, with little or no reserve. The influence of the power load on Salem and Malden is apparent from Fig. 7, the peak occurring at 11 a. m. in these stations. This means that advantage can be taken of the diversity factor with respect to Revere under the



FIGS. 2 AND 3—MALDEN-SALEM TIE LINE; MELROSE TERMINAL, EAST SIDE

plants together electrically, so that in a sense they constitute units of a single plant, with all the distinct advantages arising from the combination of diversity factors, resulting in much more economical operation for each individual plant. The line was placed in service May 1, 1917, and the results of its service have come very close to the estimated figures upon which its construction was based, and which are made available for the ELECTRICAL WORLD through the courtesy of A. B. Tenney, vice-president of Charles H. Tenney & Company.

The route followed by the line from Salem to Malden is shown in Fig. 1. Underground cables were laid from the Malden plant to a terminal house in Melrose. From hence the line is carried on Archbold-Brady A-frame towers over a 40-ft. (12-m.) right-of-way to a terminal house in Salem, the last part of the run from the latter point to the Salem generating station being underground. Two 22,000-volt circuits are carried from Malden to Salem. The overhead conductors are No. 2/0 copper, seven-strand cables, a 5/16-in. (7.9-mm.) Siemens-Martin stranded steel cable being used for the ground wire. The length of the tower line is 9.54 miles (15.35 km.). From the Malden station to the Melrose terminal house 43,000 ft. (13,106 m.) of three-conductor, lead-covered cable is installed, the lead sheath being $\frac{1}{8}$ in. (3.2 mm.) thick and varnished-cambric insulation $\frac{9}{32}$ in. (7.2 mm.) thick. In Salem 17,000 ft. (5181 m.) of cable were installed, and between Malden and Revere 45,950 ft. (14,000 m.) of cable are in service, this entire line being underground and supplementing a tie line between Malden and Revere which has been in service for several years.

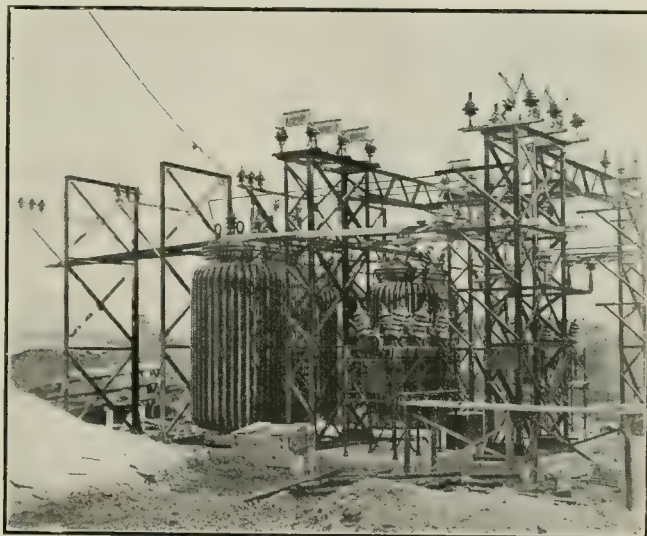


FIG. 4—SALEM OUTDOOR SUBSTATION

operation of the tie line, and this is done. Full benefit of the tie line, of course, requires the installation of sufficient transformer capacity at the step-up and step-down ends of the line. A chart of the kilowatt-hours produced each month in 1915 by the three stations, and including a totalizing curve assuming all the output handled by the Salem plant, is shown in Fig. 8.

The following data and analysis give the basis for establishing a selling price for the energy supplied to and sold by the transmission company, and show the

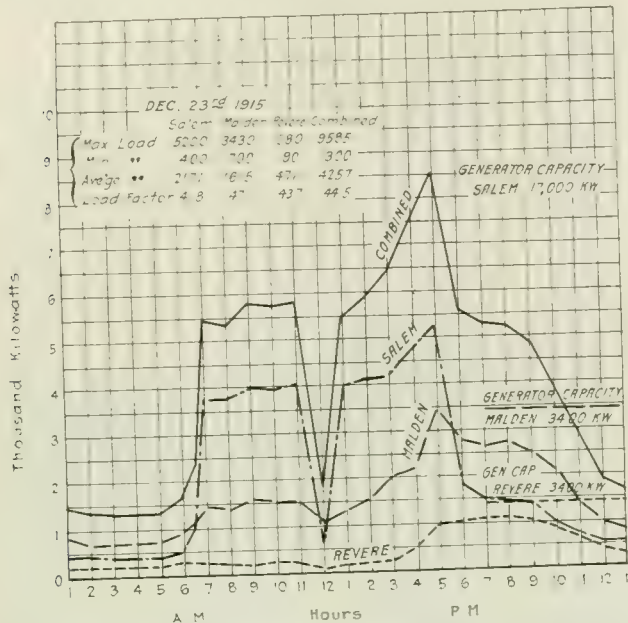


FIG. 5—RELATION OF LOADS IN SALEM, MALDEN AND REVERE STATIONS TO GENERATING CAPACITY IN WINTER OF 1917

saving realized by each company by interconnection:

PRODUCTION COST* OF SALEM COMPANY, 1916 BASIS

	Per Kw.-hr.
Fuel	\$0.005000
Fuel handling	0.000095
Water	0.000240
Lubricants	0.000100
Total	\$0.005435
Plus 10 per cent profit	0.000543
Total	\$0.005978

This establishes a selling price to the transmission company of \$0.006. Annual output of Malden company at switchboard (salable) = 10,000,000 kw.-hr. Assuming a line and transfer loss of 8 per cent, the transmission company is obliged to purchase for the Malden company 10,800,000 kw.-hr.

The Revere company's output at its switchboard is 3,500,000 kw.-hr. yearly. Assuming a line and transformer loss of 10 per cent, the transmission company must buy for the Revere company 3,850,000 kw.-hr.

	Kw.-hr.
Total energy purchased by transmission company.....	14,650,000
Total energy sold by transmission company.....	13,500,000

By purchasing all the above energy from the Salem company at \$0.006 per kw.-hr., it would pay the Salem company \$67,900 and the latter would make a profit on this of \$0.000565 per kw.-hr., or \$8,277.25.

MALDEN ELECTRIC COMPANY COSTS, 1915 BASIS

	Per Kw.-hr.
Total production cost of energy at Malden.....	\$0.01050
Estimated† cost of purchased energy	0.00985
Saving per kilowatt-hour	\$0.00065
Or \$7,200 per year.	

*Fixed charges were not included in establishing the billing price of energy generated at Salem because it was unnecessary to make any additional investment in generating apparatus or to increase the payroll in order to supply the tie line.

†The estimated cost of purchased energy is the amount paid the transmission company plus expense of running distributing station.

The estimated† cost of purchased energy included the following items of station operation at Malden:

Station superintendence and care.....	\$2,000
Three switchboard men	3,120
Two extra men	1,560
Fuel	500
Light and miscellaneous expenses.....	500
Repairs	1,500
Total	\$9,180
Unit cost per kw.-hr. on production of 10,800,000 kw.-hr.....	\$0.00085
Cost of purchased energy.....	0.00900
Total, as above	\$0.00985

At the time of the investigation the Malden company had signed a contract for nearly 1000 kw. additional load, which necessitated either obtaining energy from some source or adding considerable capital account to its present plant. The latter course appeared very undesirable on account of the poor location of the plant with respect to fuel supply and condensing water.

SUBURBAN GAS & ELECTRIC COMPANY (REVERE) COSTS

	Per Kw.-hr.
Total cost of energy at Revere station, 1915 basis.....	\$0.01460
Estimated cost of purchased energy.....	0.01383
Cost of purchased energy	0.01150
Saving per kilowatt-hour	\$0.00077
Or an annual saving of \$2,695.	

The above estimated† cost of purchased energy is made up on the basis of figures used for the Malden Electric Company, with a deduction of \$250 for fuel used in heating and of \$750 for repairs, making a total

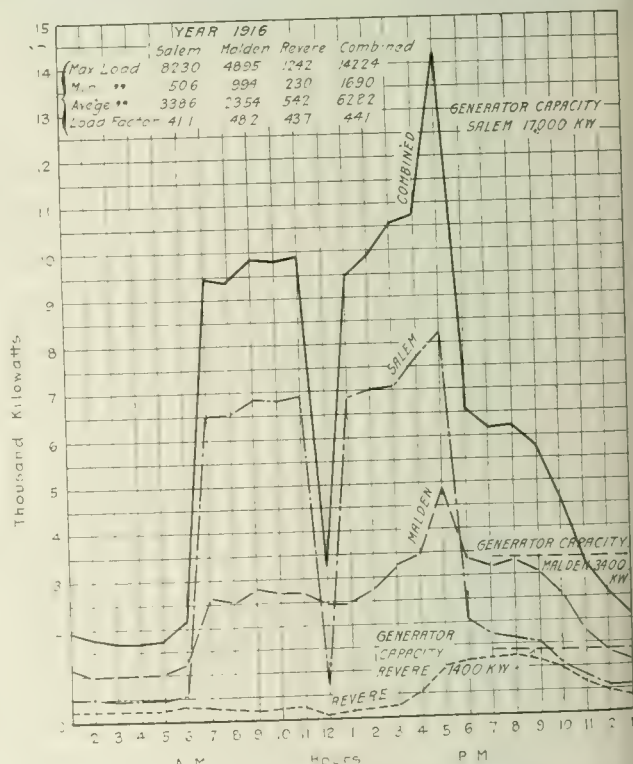


FIG. 6—RELATION OF LOAD AT EACH INTERCONNECTED STATION TO GENERATOR CAPACITY IN 1916

of \$8,170, which represents a part of the production cost at Revere when energy is purchased.

	Per Kw.-hr.
For a production of 3,500,000 kw.-hr., at \$8,180, the unit cost comes to	\$0.0023
Total	\$0.0138

The load conditions at the Revere station were approximately 1900 kw. and its normal rating 1440 kw.

Prior to the construction of the transmission tie line between Malden and Salem energy was purchased from the Malden company by the Revere company to take

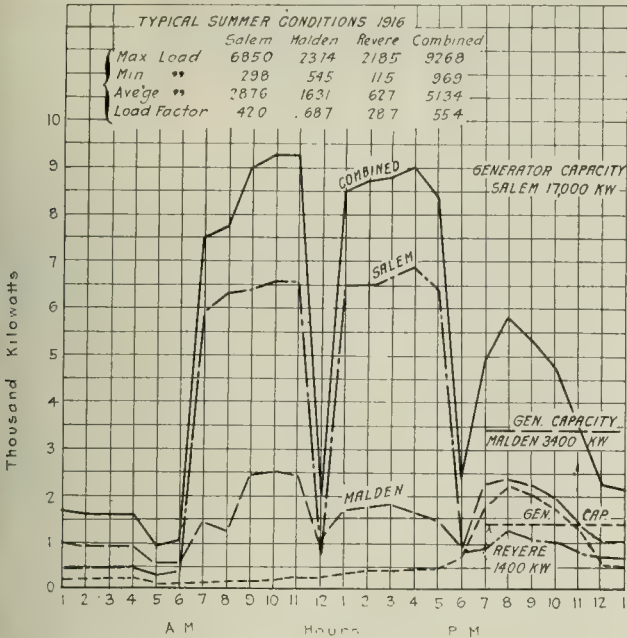


FIG. 7—RELATION OF LOADS TO GENERATING CAPACITY IN SUMMER OF 1916

care of the overload conditions during the summer months; but, as stated under the Malden conditions, the load of the Malden company would shortly have made it impossible for it to continue to assist the Revere company in this way. As the Salem company during the summer has surplus capacity, it is in an excellent position to relieve both the Revere and Malden plants at the same time, eliminating the need of a large additional investment at the Revere plant no less than at Malden. At Revere an aqueduct would have had to be constructed had energy not been purchased from Salem or an equivalent source of large capacity.

As the contracts for line material were placed some time before the present extreme prices were in force, steel towers, for example, being bought at 3.65 cents per pound (8.03 cents per kg.), the cost of the line was far below the cost of present construction. Copper was purchased for this line at the low figure of 18.47 cents per pound (40.63 cents per kg.), and the three-conductor, lead-covered transmission cable was purchased at a price of \$1.297 per foot (\$3.891 per m.). The main items of cost were:

COST OF LINE

Structural line material (towers, about 500,000 lb.)	\$18,250
Foundations (concrete or steel grid, according to location)	3,300
Labor of erection (towers and conductors)	8,800
Conductors and transmission material (overhead), including 800 insulators and stranded steel ground cable	29,000
Miscellaneous overhead fixtures, guys, disconnecting switches, etc.	3,300
Underground transmission line, including 25,000-volt cable on Malden-Salem route and 45,950 ft. 2/0 15,000-volt three-conductor cable on Malden-Revere route:	
Malden-Melrose terminal house cable (43,000 ft.)	\$55,771
Transportation and installation	6,000
	61,771
Salem-Highland Avenue terminal house cable (17,000 ft.)	\$22,049
Transportation and installation	3,000
	25,049

Malden-Revere cable (45,950 ft.)	\$48,053
Transportation and installation	9,143
	\$53,196
Contingencies and incidentals—5 per cent.	10,133
Engineering services—5 per cent.	10,639
Legal, drafting agreements, etc.	1,500
Rights-of-way	28,851
Total	\$253,791

NET INCOME† FROM TIE-LINE SERVICE

Revenue:	
Malden company, 10,000,000 kw.-hr. at \$0.009	\$90,000
Revere company, 3,500,000 kw.-hr. at \$0.0115	40,250
Total	\$130,250
Operating Expenses:	
Energy purchased by transmission company from Salem, 14,650,000 kw.-hr. at \$0.006	\$87,900
Labor	8,000
Repairs	1,000
Taxes, 2.5 per cent on \$200,000	5,000
Insurance—fire, employees, public	1,000
Depreciation on \$200,000 at 5 per cent.	10,000
Interest on \$250,000 at 6 per cent.	15,000
	127,900
Net income of transmission company	\$2,350

†Income based on taking transmission line investment at \$250,000.

From the foregoing analysis it appears that the profit to the Salem company on the sale of energy to the tie-line company (Eastern Massachusetts Electric Company) is \$8,277 per year; the Eastern Massachusetts company makes \$2,350; the Malden company saves \$7,200, and the Revere company saves \$2,695 over its costs on the basis of the expenses analyzed. At least \$20,522 per year is therefore made by the tie line, taking its entire cost into account. At present the

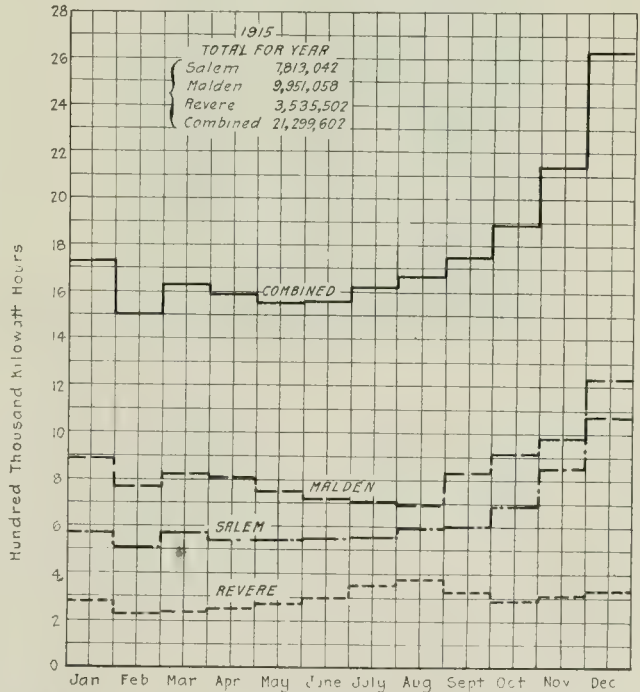


FIG. 8—ENERGY OUTPUT OF THE INTERCONNECTED STATIONS FOR YEAR OF 1915

Malden station is being operated at a fixed load of 750 kw. from Monday morning to 11 p. m. Saturdays. The Revere station is being run daily except Sunday from 4 to 11 p. m. at 550 kw. The Salem station is run continuously, and the June, 1917, peak was 8200 kw. The output at Salem in June was 2,500,000 kw.-hr., the load factor being 42.5 per cent and the fuel consumption 1.9 lb. per kilowatt-hour.

Testing Insulators to Assure Continuous Service

Portable Outfit Consisting of Gasoline-Engine-Driven Alternator Connected with Oscillator
Used by Pacific Coast Company for Weeding Out Defective Insulators—
Cracking Under Cap Found to Be Most Frequent Trouble

BY R. W. SORENSEN

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EXPERIENCES of power companies have indicated that the porcelain line insulator is by no means a permanently reliable piece of equipment. Since the failure of only a small percentage of the insulators along a line will lower very considerably the large factor of safety obtainable when the line is new, the possibility of service interruption will be greatly increased unless provision is made for periodic testing of the insulators and the renewal of the units found defective.

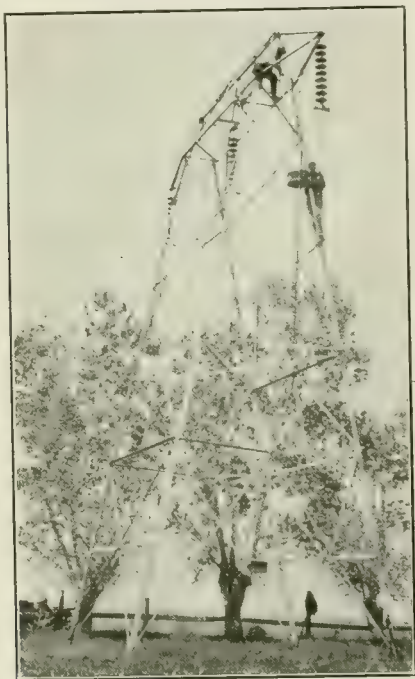


FIG. 1—FIVE-MAN CREW TESTING SUSPENSION INSULATORS

To forestall any trouble from insulator depreciation the engineering department of the Pacific Light & Power Corporation, in co-operation with the author, some time ago undertook the development of a system of testing and maintaining porcelain insulators. In developing the testing method finally adopted an analysis was made of the relative values of tests by megger, high potential and any other possible means which might be developed. Special attention was directed toward securing a field method more rigorous than that utilizing the megger and permitting the use of equipment more portable than required for low-frequency, high-potential arc-over tests. One apparent method of accomplishing the desired results was to develop a portable high-frequency testing outfit which could be used in conjunction with an induction coil.

To determine the relative values of the available test methods a station was established near one of the transmission lines to be studied and a number of insulators were brought in from the lines for test. These insulators, all of which were suspension units of a well-known

make, were divided into four groups according to the tests which they were to receive. The units of group I were tested by megger, oscillator and high potential; those of group II by megger, induction coil and high potential; group III by megger, oscillator, induction

TABLE I—DATA ON INSULATOR TESTS

Group No.	Units Tested		Units Defective by Megger Test		Units Defective by Oscillator		Induction Coi		50 Cycle 55 Kv. Applied 1 Min.	
	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
I	577	100	47	8.2	62	10.8			88	15.2
II	676	100	83	12.2			136	20.1	160	24.0
III	143	100	0	.0	2	1.4	3	2.1	3	2.1
IV	150	100	.0	.0	3	2.0	2	1.3	3	2.0
V	1048	100	100	9.5	142	13.5			*167	*15.9

*50-cycle arc-over voltage.

coil and high potential; group IV by megger, induction coil, oscillator and high potential.

A study of the results obtained, combined with the knowledge that a much more efficient high-frequency oscillator than the one used in these tests (which was the simplest kind of a Tesla coil) could be built, led to the construction of a portable oscillator (Fig. 2) for testing insulators along the line. With this apparatus another lot of insulators designated as group V in Table I were tested in the same manner as those of group I. In testing group V it was noted that there were no immediate failures of insulators which passed the perfected oscillator when subjected to the arc-over voltage at 50 cycles. Furthermore, the failures oc-

TABLE II—RESULTS OF TESTS ON THREE WOOD-POLE LINES

Total length of lines.....	\$8.8 miles
Type of insulator.....	Suspension
Character of country in which insulators were installed....	Low rolling hills, dry and sandy, free from lightning, but subject to some fog and rain; no snow, sleet or high wind.
Total number of units in lines.....	25,234
Number of units found defective with megger at end of first year's operation	1,633
Number of units found defective after three years' operation by megger, oscillator and high-potential tests.....	4,045
Total number of units defective since building of line.....	5,678
Percentage of units found defective by megger at end of first year's operation.....	6.5
Total percentage of units defective after three years of operation	22.4
Average loss per year in per cent.....	7.5

curing under this test within a minute were not greatly in excess of those obtained with the oscillator.

The oscillator was therefore adopted as a standard means of testing and the insulators on three wood-pole lines were taken down and tested, with the results shown in Table II. Two of these lines had four units in sus-

sension strings and five units on dead-ends and had operated about three and a half years at 60,000 volts. The other line had three units in suspension strings and four units on dead-ends and had been operating two and a half years at 15,000 volts. The results of these tests have been grouped together in Table II, because they were practically the same for all three lines and no advantage is gained by segregating them.

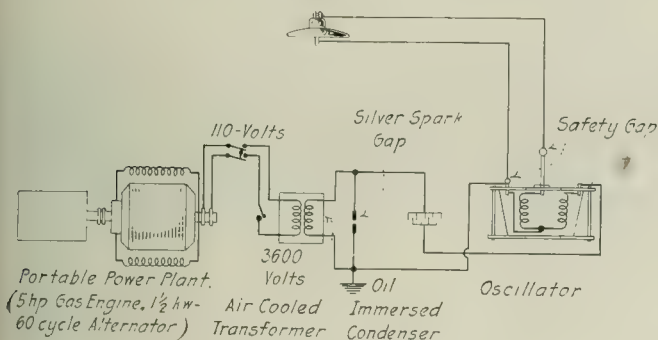


FIG. 2—CONNECTIONS OF PORTABLE HIGH-FREQUENCY INSULATOR TESTER

The testing plant consisted of an oscillator set developed and made in the shops of the Pacific Light & Power Corporation, according to plans of the author, and a portable power plant for furnishing energy when away from stations where electric energy at a potential of 110 volts was readily obtained. The entire equipment, including portable power plant as connected for operation, is shown diagrammatically in Fig. 2.

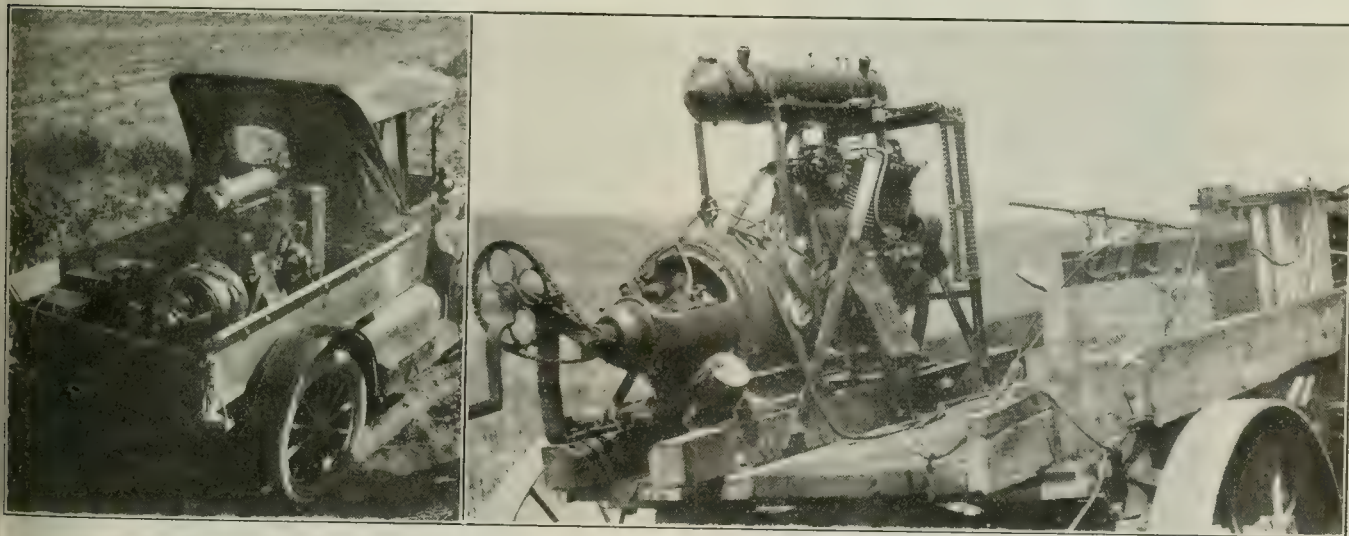
The oscillator was wound with many layers having a few turns per layer to give efficient coupling between the primary and secondary coils and is immersed in a small tub called a "keeler," which is filled with transformer oil. The condenser is made of pressboard and sheet copper or steel, according to which is available, and is inclosed in a tank filled with transformer oil. The spark gap is a stationary gap consisting of two

consists of a twin motorcycle engine directly connected to an alternator made by equipping a 3-hp., 220-volt direct-current motor with collector rings, the commutator being left on the machine to furnish excitation.

The entire testing outfit was developed along lines which would permit its being used for testing insulators without removing them from the line towers or poles. At present it is being used in this manner, as will be seen from the self-explanatory photographs shown in Figs. 1, 5, 6, 7 and 8. It was not so used on the wood-pole lines for which data are given in Table II, because it was easy to change the comparatively few units on a pole, and also because it was necessary to change one or more units in so many of the strings that there was a gain in economy in taking down all units. This condition could not exist on the tower lines.

In using the testing outfit without removing the insulators from the line the oscillator, which weighs about 60 lb. (27 kg.), is raised to the top of the tower so all of the high-potential, high-frequency energy will be available for testing the insulator. If the oscillator were left on the ground, considerable of the energy would be radiated from the long lead reaching from the ground to the top of the tower. The rest of the equipment remains on the truck or wagon, where it is easy to handle and operate.

While sufficient data have not yet been obtained from tests on the tower line shown for complete conclusions, the evidence so far indicates a much smaller percentage of defective units on this line than was obtained on the wood-pole lines. However, even in the very best sections of line the percentage of defective units found is sufficient to show that frequent testing is necessary to prevent interruption of service. As evidence that such precautions are effective as insurance for continuous operation, it may be pointed out that the operating records of the three lines tested show after a year's operation just one case of shutdown due to insulator



FIGS. 3 AND 4—TWO METHODS OF TRANSPORTING PORTABLE TEST SET, ONE ON AUTOMOBILE, THE OTHER ON A TRAILER

silver bars 1 in. (2.54 cm.) long and 1/16 in. (15.9 mm.) thick. The transformer is of the natural-cooled, air-insulated type wound to have a very high reactance so as to limit the current at short circuit. On the high-tension side it is equipped with air-core reactors to protect the windings from the surges set up during the operation of the oscillator. The portable power plant

trouble. That interruption lasted only a few seconds, it being necessary to "kill" the line only long enough for the arc to be broken. The line was immediately put in service again without the damaged string of insulators. They were replaced later, when the line could be cut out without interrupting service.

During the time these tests were being conducted

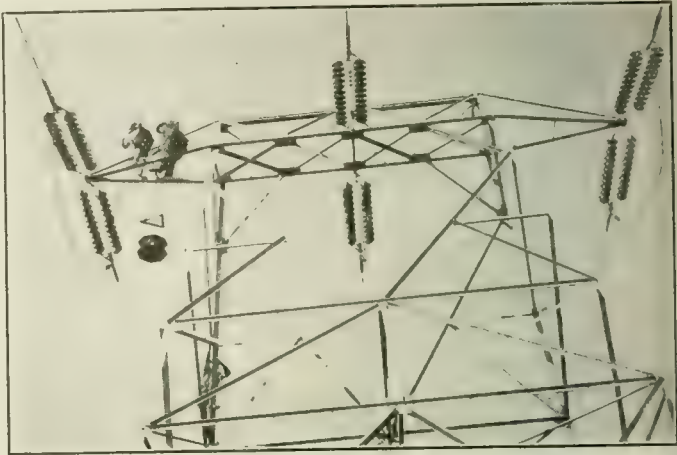
careful observation was made of the location of the defects in the insulators and probable cause of each defect. A careful record was also kept of the conditions under which each insulator had been operating—such as voltage of line, average voltage per unit, kind of string (dead-end or suspension), its position in the

relatively more numerous in fog belts than in districts where fog does not occur, and also in places like the

TABLE III—TESTS ON STOCK INSULATORS STORED IN SHEDS

Number tested	493
Number defective	53
Per cent defective	10.7

boundary line between hills and plains where hot winds may sweep up from the valley during the day and cold



FIGS. 5 AND 7—OSCILLATOR, WITH TEST STICKS ATTACHED, BEING RAISED TO TOP OF TOWER; HIGH-FREQUENCY OSCILLATOR IN USE ON DEAD-END TOWER

string, etc.—and no evidence could be secured to indicate that any of these things had any pronounced effect upon the rate of failure.

As a result of these observations it was concluded that the failures, which were so predominately of one type—viz., a crack in the porcelain under the base

winds down from the hill canyons at night. For further confirmation of the temperature-change theory tests were made on insulators purchased at the same time as those on the lines but which had been stored in sheds for future use. The results of these tests, which are given in Table III, show a percentage of



FIGS. 6 AND 8—CLOSE VIEWS OF OSCILLATOR IN USE ON SUSPENSION TOWER; ARC-OVER STREAMERS CAN BE SEEN IN THIRD UNIT FROM TOP

of the cap—must be due to stresses produced by temperature changes, assisted possibly by moisture absorption in the cement joining the cap and pin. This conclusion was reached because the failures were

failures equal to that observed on those parts of the line situated in what might be called locations of favorable climate. This appears to indicate that the failure is due chiefly to mechanical causes, not electrical ones



Using Low-Grade Fuels with Existing Equipment

Some of the Problems Involved in Burning High-Ash Coals, with Discussions Regarding Effect on Rating of Stoker, Air Requirements, Efficiency of Combustion, Operating Methods and Maintenance

BY R. J. S. PIGOTT
Consulting Engineer, Sanford-Riley Stoker Company

PRESENT high prices of coal of all kinds, and deterioration in quality and calorific value due to shortage of labor for cleaning at the breakers, confront the users of coal with a serious problem. The desire to reduce expenses results in the purchase of lower-grade fuels, but the use of such material brings up the question of whether the stoker will handle it. In this article some of the problems involved in burning high-ash coals will be discussed and the performance of stokers with low-grade and high-grade fuels will be compared.

EFFECT ON RATING OF STOKER

Fuel with a low calorific value has the effect of cutting down the forcing capacity of the fire, since the fact has been established that combustion cannot be carried on satisfactorily above fairly definite rates. As much as 100 lb. of coal has been burned per square foot (488

TABLE I—QUANTITY* OF AIR REQUIRED PER POUND OF FUEL AND COMBUSTIBLE AND PER B. T. U.

	Air/ Pounds Fuel (lb.)	Air/ Pounds Com- bustible (lb.)	Air/ 10,000 B.t.u. in Fuel (lb.)
North Dakota lignite.....	5.0	9.2	7.54
Colorado lignite.....	7.5	9.9	7.53
Illinois bituminous.....	8.4	10.8	7.66
Ohio bituminous.....	9.7	11.2	7.63
Pennsylvania bituminous.....	10.3	11.3	7.50
Pennsylvania semi-bituminous.....	10.8	12.0	7.65
West Virginia semi-bituminous.....	11.2	12.1	7.65
Pennsylvania anthracite.....	9.6	11.9	7.66
California crude oil.....	14.1	14.2	7.59
Average.....			7.60

*Data obtained with the Edge-Moor boiler

kg. per sq. m.) of projected grate surface† per hour, but the maintenance of brickwork and stoker parts is high and the ejection of considerable quantities of fine sinder through the boiler into the flues and out of the stack is the inevitable result unless excessively large furnaces are provided. Seventy pounds per square foot (342 kg. per sq. m.) per hour is about the maximum

rate that will give good operating conditions over long periods of forcing. A stoker installation should not be designed for regular operation at a higher rate. With 14,500-B.t.u. (3650-cal.) coal, the desirable maximum B.t.u. input per square foot per hour would therefore be 1,015,000 (2,750,000 cal. per sq. m.); for a 10,000-B.t.u. (2520-cal.) coal it would be 700,000 (1,900,000 cal. per sq. m.) or 69 per cent of the high B.t.u. coal input. The maximum boiler-horsepower output would be reduced in the same ratio. To use the low-grade fuel at the same maximum output from the boiler would consequently require about 45 per cent more stoker grate surface for 10,000-B.t.u. (2520-cal.) coal, 16 per cent more for 12,500-B.t.u. (2900-cal.) fuels and 7.5 per cent more for 13,500 B.t.u. (3400-cal.) fuel, as compared with 14,500 B.t.u. (3650-cal.) coal. If the reduction in maximum rating by the use of lower B.t.u. coal is large, it would probably be necessary to install more stokers to meet the steam demand, unless the owners are willing to accept excessively high maintenance and consequent reduction in reliability.†

AIR REQUIREMENTS

Contrary to the very general belief, very little difference in amount or pressure of blast air is required with various kinds of coal provided the horsepower output is the same. If the air required for coals of various characters is figured by the usual formula $X = \frac{(8/3 C + 8H - O + S)}{0.23}$, it will be found that the high B.t.u. coals require more air. But if the quantity of air

†In the figures mentioned above the grate surface is figured as the whole projected area of the stoker, including dump grates. All underfeed stokers supply enough air through the overfeed portion or extension grates to carry on a lively combustion clear to the bridgewall, and if these grates are kept in continuous motion the air has an opportunity to strike all combustible. The method of figuring grate surface as the whole area of the stoker, therefore, seems to be a more nearly rational standard. It is not at present possible to give an absolutely basic unit, since the volume undergoing distillation as well as grate surface has an important bearing on efficiency.

required per pound of combustible is divided in each case by the B.t.u. per pound, it will be found that the quantity required per 10,000 B.t.u. (2520 cal.) is substantially constant. The accompanying table contains examples which demonstrate this fact. In other words, the air required will depend only upon the B.t.u. input

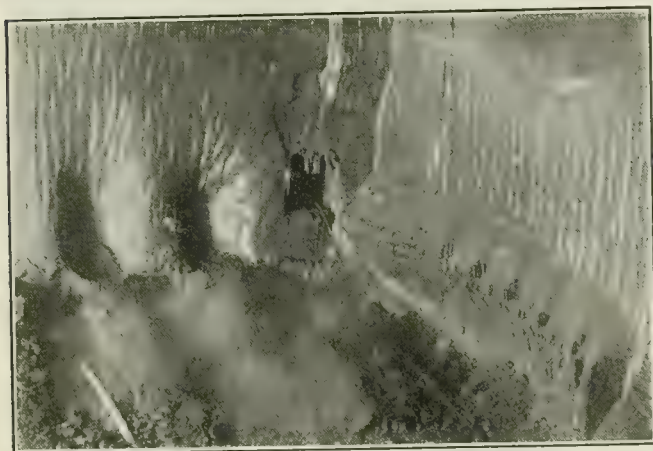


FIG. 1—INTERIOR OF UNDERFEED STOKER, SHOWING HOW FIREBRICK OVER RETORTS HAS BEEN ERODED

to the fire, and therefore upon the boiler-horsepower output and the efficiency only.

As far as rating is concerned, then, the fans will be unaffected by any change in the B.t.u. content of the coal, except as the efficiency is affected. The air required by any boiler at any rating is derived as follows:

Pounds air per 10,000 B.t.u. = 7.60.

At 65 deg. Fahr. 1 lb. air = 13.75 cu. ft.

Theoretical cubic feet of air per minute per 10,000

$$\text{B.t.u. per hour} = \frac{7.60 \times 13.75}{60} = 1.74.$$

Actual cubic feet of air per minute per boiler-horsepower at 100 per cent efficiency, 55 per cent excess air =

$$\frac{7.60 \times 13.75 \times 3.348 \times 1.55}{60} = 9.02.$$

Therefore, the actual quantity of air required per minute for any horsepower output will be

$$Q = \frac{\text{B.-hp.} \times 9}{\text{Efficiency}}$$

For 50 per cent excess air, constant = 8.70.

For 40 per cent excess air, constant = 8.14.

It is very easy to see why the air per 10,000 B.t.u. (2520 cal.) should be constant, when it is considered that the ratio of air required by hydrogen and by carbon is

$$\frac{34.6}{11.5} = 3, \text{ and the heat developed is } \frac{62,030}{14,540} =$$

4.27. The latter ratio is cut down by the presence of oxygen, so that the two ratios move very nearly parallel. It is better to use the higher constant in order to provide ample margin for keeping up capacity during recovery after a period of bad operation. It is a risk to reliability to figure too closely on fan sizes.

From examination of a large number of tests, it has been found that, with the exception of extreme cases, the blast pressure required is very little greater for low-grade than high-grade fuel at the same output and handled in the same manner. The most important cause of variation is the handling of the fire, variation in depth of bed, prevention of heavy clinker formation

and holes. The air pressure, like the air quantity, seems to be a function of B.t.u. input to the fire only. Apparently then, unless the fans were designed with a very snug margin of overload so that no increase could be obtained, the forced-draft equipment would be practically unaffected by a change to low-grade fuel.

EFFICIENCY OF OPERATION

The efficiency at which stokers will operate is lowered somewhat by the use of low-grade fuel. As far as can be discovered, however, the amount is not very great for reasons which will be discussed under operation and maintenance. When burning coal with a calorific value between 13,500 and 14,500 B.t.u. (3400 and 3650 cal.) there is hardly a detectable difference; lower than 13,500 B.t.u. (3400 cal.) the reduction appears to be about 1 per cent for every 1000 B.t.u. less per pound (556 cal. per kg.).

The reasons for the reduction are: First, the higher ash content carries off a higher amount of combustible entangled with the incombustible refuse, thus increasing the percentage of loss by way of the ashpit. Further, with the higher percentage of incombustible a larger amount of fine ash is carried out through the boiler, tending to foul the heating surface more rapidly and slightly reducing the efficiency in this way. From the principles of underfeed firing, however, it appears improbable that the actual combustion efficiency in the furnace is any poorer than with the high-grade coals.

Operating methods have a considerable effect on the efficiency that can be obtained too. With the high percentages of ash in the low-grade coals and the usual increase in sulphur and pyrites, especially, the tendency to clinker is excessive. If the fires are not properly handled, clinkers may be formed which seal over parts of the fire, causing imperfect distribution of air and unbalanced relations between air and volatile matter, besides cutting down the rate of combustion in those portions of the fire covered by the clinker.

One of the chief factors influencing efficiency is the volume of coal in the fire. It is a known fact that a

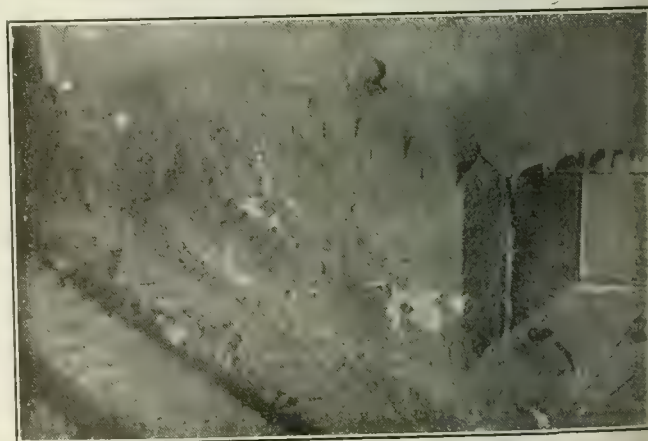


FIG. 2—ONE SIDE OF FURNACE, SHOWING BRICKWORK WHICH HAS BEEN FUSED

certain depth of fuel bed is essential in a producer to proper mixing of air, steam and volatile matter for final reduction to a uniform gas. This is also true to a considerable degree in the underfeed stoker. While grate surface has a well-fixed relation to rating, other things being equal, the stoker which has the most vol

ume of coal undergoing the process of distillation per square foot of projected surface will have the higher combustion rating. Therefore, for boilers which are to be forced to a very high degree it is desirable to provide as much retort capacity as possible so that the largest volume of coal possible will be under distillation all the

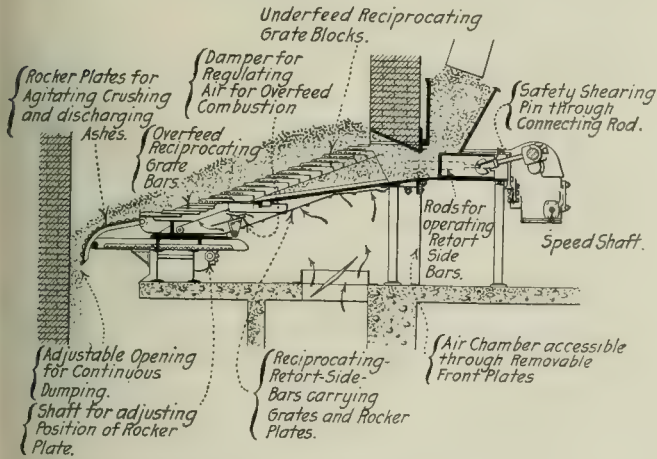


FIG. 3—FUEL BED KEPT IN MOTION BY MOVING GRATES

time. Certainly the time of distillation is a function of the depth of the retort; consequently the smokelessness of the fire will depend to a considerable degree upon this depth.

For successful burning of very low-grade fuels it is desirable to have a large combustion space. While the underfeed stoker is much better in the mixing of air and volatile matter than the old overfeed, it is still far from perfect. Consequently furnace volume is required for the completion of the mixing and burning of air and volatile matter. Best results are obtained with a furnace volume of about 9 cu. ft. per square foot (3.7 cu. m. per sq. m.) of projected area of the stoker. There are many installations which have not more than half this amount, but the restriction manifests itself in an increase of flue temperature. This is due to delaying the combustion of volatile matter and causing secondary combustion to take place at the top of the first pass. Operators who are employing underfeed stokers with low settings can consequently expect somewhat lower efficiencies with the low-grade coals than those who are more fortunate and have spacious furnaces. Certainly no new installation of Babcock & Wilcox boiler or any similar type of standard boiler should be made in which the bottom of the front header is less than 11 ft. or 12 ft. (3.4 m. to 3.7 m.) from the floor. With Badenhausen or Stirling boilers having very sharply inclined front tubes it is not a difficult matter to obtain generous combustion space.

Another make of underfeed stoker has stationary tuyères and retorts, but uses a moving overfeed section which pushes the clinker upon the adjustable dump grates with a view to continuous dumping. There is no motion of the grates as a whole relative to the furnace walls and bridge walls. A third type of stoker employs motion of the overfeed grates only. The motion of the fire bed is obtained from the plungers and rolling of the fuel by gravity, the inclination of the grates being about 25 deg.

There are two types of dump employed—the steam dump and a roller crusher. The steam dump is simply the application of a steam cylinder to the old hand

dump, giving a quick-return effect which is used to knock the clinkers off the bridge wall. The other device is usually applied to heavy-duty stokers, and consists of a deep pocket formed of ribbed cast-iron plates just beyond and below the extension grates. An adjustable swinging dump gate is used in conjunction with a roll crusher very similar to the old Murphy clinker crusher. Probably it is intended to allow the ash to cool and solidify before being brought down to the roll crusher. In the writer's opinion, however, the quicker the ash, hot or cool, is taken away from the cast-iron parts, the better. In accumulation lies the source of trouble.

The company with which the writer is connected has found that trouble from clinkers can be alleviated by keeping the surface of the grate in continuous motion, one way of doing this being to move the retort as a whole. The motion of the individual retorts at intervals which do not coincide causes a shearing action on the clinker between each retort. This may be increased with particularly bad coals by allowing only one-half of the retort to move, thus doubling the number of shearing lines. This continual motion tends to break up the clinker during the earliest stages of formation and acts as a preventive rather than a cure. This is especially noticeable at the side walls, where the adherence of clinker is very much reduced by this motion.

The next step was to carry the shearing action to the bridge wall where the most severe troubles with clinker are apt to occur. This was done through the medium of a rocker dump attached to the retort sides, from which it receives its motion. The result is that huge formations of clinker on the bridge wall do not occur with this device and the cleaning of the fire is not only very much simpler, owing to the fact that all clinker is kept small, but need not be done so frequently. In more than one plant the interval between cleanings has been increased from four or six hours with the old dump to from one to two days.

With a number of the French and English coals in

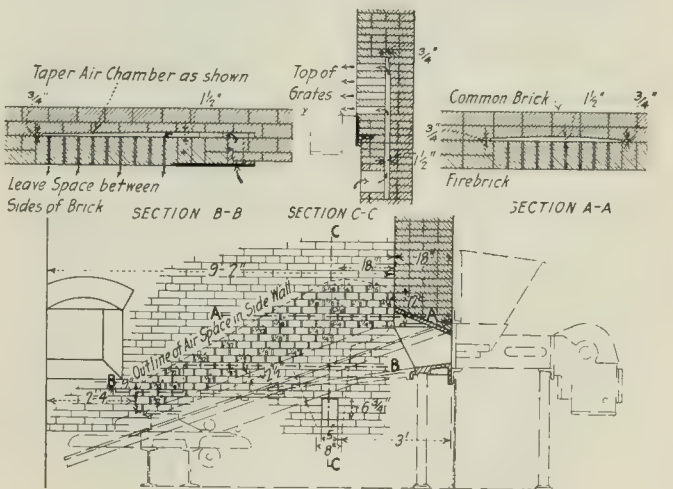


FIG. 4—VENTILATED SIDE-WALL CONSTRUCTION WHICH SOFTENS CLINKERS AND PREVENTS ADHERENCE

use on the European continent it was found that the use of stokers not having a continual motion to break up clinker had to be practically discontinued, as these coals are on an average very much poorer in quality than American coals. It is impossible to deal satisfactorily with the obstinate clinkers formed from high-

ash, high-sulphur coals unless there is continuous disturbance of the fire to prevent the clinkers welding together in large masses. In cases of very bad coals further disturbance of the fire can be obtained by means of ventilated coke breakers placed in the bottoms of the retorts. These coke breakers form a projection over which the fire must pass, producing a shearing line across the furnace which aids the action of the shearing lines produced from front to back of the furnace by the motion of the retort sides.

With the bad coals to be expected now, hand-fired furnaces will likely become such a burden and have such low ratings that they will be out of the question. Almost all of the low-grade coals are characterized by high ash in combination with high percentage of pyritic sulphur. The great objection to this combination of iron and sulphur is that it forms obstinate plastic clinkers which also have the undesirable quality of fluxing the iron of the tuyères or grates very much more readily than ordinary ash. In some cases a chemical action analogous to catalysis seems to take place in which a small portion of the tuyère will get hot enough to melt and the heat will be rapidly propagated to the neighboring parts of the stoker, resulting in a large burned area and complete breakdown. This condition, can occur, however, only if the coal lies practically undisturbed upon the iron.

COMBATING THE CLINKER NUISANCE

Trouble from this source has been successfully avoided by the continual motion of the grates, which keeps all these masses broken up and shifting. The contact of the clinker is therefore not intimate enough to start this melting action. There has been no case reported so far of the failure of stokers from this cause when grate motion is employed. There is no stoker built which will not give considerable trouble with bad coals if improperly handled, but there is certainly very much less risk where the grate is kept in continual motion and the clinkers thus kept down in size and free from intimate contact with the iron.

Generally speaking, the higher the temperature the greater the amount of clinker formed, since it is a function of the fusing point of the ash. Consequently more trouble is to be expected at high ratings than at low ratings. Since with very deep fire beds the temperature within the bed is higher at any rating, it is desirable to reduce the thickness of the fire as far as possible without, on the one hand, injuring the efficiency and, on the other hand, causing too much burning of the iron parts of the stoker because of bringing the intense zone of combustion down closer to the grates.

The maintenance of stokers must necessarily be higher with low-grade coals since in order to meet the conditions of burning the fire must be run thinner. This tends to injure the iron more and there is bound to be more formation of clinker, which in turn tends to fuse the brickwork. If the fire is allowed to remain stationary, the impurities in the fuel will fuse together in large masses which must be broken off by hand barring or by the power dump in those stokers so equipped. Where an attempt is made to dislodge large pieces of adhering clinker whole courses of the face brickwork may be torn out, especially that of the bridge wall. Motion of the grates minimizes the adherence of large masses of clinker, but even then the action of the

clinker is to form a fusible flux with the surface of the brickwork which melts and runs down in vitreous masses, gradually eating away the surface of the brick.

Of course, all of the effects mentioned are greatly aggravated if stokers are operated at very high ratings. The desirable condition should therefore be to keep the ratings on the stokers as low as possible. In fact, in many cases it will be found desirable to operate more boilers at somewhat lower rating with the low-grade fuels in order to reduce the average rating. Probably it would not be stating conditions too strongly to say that at least 50 per cent increase in maintenance is to be expected, even with all of the preventive measures noted above, if low-grade fuels are substituted for high-grade coal.

An additional advantage which may be realized by running more boilers with lighter loads is that the stokers can be kept in continual motion, which with slagging or heavy clinkering coal is very desirable. In short, the banking periods should be eliminated as far as possible with low-grade fuels. If banking is absolutely necessary, the stokers should be agitated at intervals of one or two hours in order to break up the large masses of clinker which tend to form during long periods of quiescence. The stoker parts are not likely to suffer seriously unless the operator is so careless as to run the fires very thin, in which case burning of the tuyères will certainly result to some extent.

Naturally, those troubles experienced with brickwork with good coals will be worse with poor coals, especially since the presence of sulphur and high ash tend to form fusible fluxes with the brickwork. It has been generally observed that coal and firebrick from the same district will usually be unsatisfactory when used together.

There has been a limited use of highly refractory and expensive makes of brick, such as bauxite or carborundum, for linings near the fire, with a view to cutting down maintenance. Ventilation of side and bridge walls with air and steam will give as satisfactory results at much less cost and has the additional advantage of assisting combustion and softening clinker formations. The writer's own work at the Dayton Power & Light Company, the Interborough Company and later installations along the same line by the Buffalo General Electric Company have proved that brickwork conditions can be greatly improved by wall ventilation. A mixture of exhaust steam with the blast air for ventilation permits controlling the mixture so as to avoid upsetting CO₂ conditions and has the additional advantage of softening clinker and preventing adherence to the brickwork. This scheme is particularly valuable with stokers having no motion of the grates.

The ventilated side-wall construction shown in Fig. 1 is an ingenious modification of this scheme. This consists chiefly of a chamber formed directly in the wall the outlets to the fire consisting of spaces between the edges of the firebrick, laid up dry on the vertical faces. The original idea of the writer was to use a wrought iron pipe header, supplying a number of 1-in. (2.54-cm.) pipe nipples, feeding through the wall. Curiously enough, very little trouble is experienced from the openings "sealing over." Even with great fluxing action, it was found that if an opening occasionally sealed over corrosion of the brickwork commenced, ate through the seal, and protection was re-established.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

CHIEF CONSIDERATIONS OF USE IN JOINING CABLES

Splicing Sleeve Should Have Ample Conductivity— Precautions to Be Used with Filling Compounds, and Practices of Chicago Company

A few of the requirements which should be considered in making underground cable joints are as follows: In order to prevent the insulation from being cracked when bending the individual conductors, the distance from the exposed conductors to the lead sheath should be 6 in. or 7 in. (15.2 cm. or 17.8 cm.), depending upon the thickness of the insulation around the conductors.

Since the resistance around the conductors at joints is usually made thicker than in the cable, heat radiation is reduced and the temperature of the joint will be increased thereby. If in addition the copper sleeves have a carrying capacity less than that of the conductor, the temperature of the joint will be still further increased. As all forms of insulation have a critical temperature above which the dielectric loss is so great that the temperature will continue to rise until a burn-out occurs, the splicing sleeve should have ample conductivity. The exterior surface edges of splicing sleeves should be carefully finished to prevent excessive dielectric stresses.

So that conductors shall retain fixed positions relative to each other and to the inclosing lead sleeve they should be separated from each other and the sleeve by some form of solid insulation, consisting of wrappings of insulating tape or formed or molded insulation, such as tubes of paper or other solid insulating material. Gages should be used for determining the proper amount of insulation to apply. When mechanically formed insulation is used, care should be taken to see that the parts are so shaped, placed and fastened that all air will be driven out by the filling compound.

Filling compounds should have a dielectric strength which is not considerably reduced at the maximum operating temperature, should be non-hygroscopic, and should not crack in cooling or during cold weather. When being poured they should be sufficiently liquid to flow into all air spaces before becoming chilled. At ordinary temperatures the compound should be of such consistency that it can be readily removed without injuring the original insulation around the conductors. It should have a low coefficient of expansion, shrinkage being allowed for by adding compound after the first "pour" has cooled slightly.

In applying wrappings of tape, the conductors, the splicing sleeve and the insulation around the conductors should be given alternately a generous coating of some thin insulating compound and the tape should be tightly wrapped until the required thickness is obtained as determined by the gage used. If some form of molded insulation is used, it should be held in position tem-

porarily by the form of the insulation or by tying with string or tape. In either case air should be excluded.

All moisture should be carefully excluded from the joint. It may be necessary to install some temporary shelter so as to prevent drippings from the roof or contact with the adjacent wall of the manhole. If necessary, rubber gloves should be worn by the cable splicer and care taken that no perspiration drops into the joint. If filling compound with a low melting point is used, care should be taken that it does not run back into the cable at the maximum operating temperature.

These points were brought out by D. W. Roper, superintendent of street department, Commonwealth Edison Company, at the last annual meeting of the A. I. E. E.

PERISCOPE FOR READING TRANSFORMER TEMPERATURES

Overcomes Inconvenience of Carrying Stepladder to Each Transformer—Details of Construction Given

In order to read the temperature of the oil as indicated by the thermometers on transformers, the Pacific Power & Light Company in its Walla Walla (Wash.) substation has attached periscopes to each transformer to enable the operator to observe the temperature from the floor. This makes it unnecessary to use step-ladders.



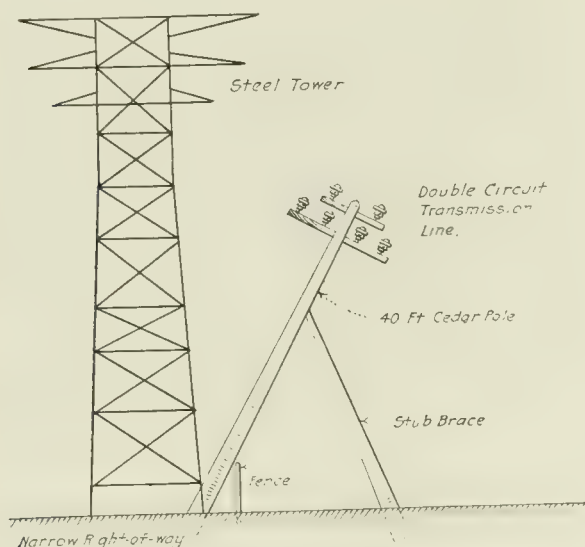
PERISCOPE AND IMAGE
OF SCALE

The periscope consists of a square metal tube 4 ft. 8 in. (1.4 m.) long and 2 in. (5 cm.) square. At the ends are placed two mirrors facing each other at an angle of 45 deg. with the sides of the tube. The lower mirror is $1\frac{7}{8}$ in. (4.8 cm.) wide and 3 in. (7.6 cm.) long, while the upper one is $1\frac{7}{8}$ in. (4.8 cm.) by $3\frac{3}{8}$ in. (8.6 cm.) long. The upper mirror is made longer to give a longer view of the thermometer scale. At the top of the periscope and directly in front of the upper mirror is a hole $1\frac{3}{4}$ in. by 2 in. (4.4 cm. by 5 cm.) while there is a hole 1 in. (2.54 cm.) square cut opposite the lower mirror. Observations of temperature are taken by looking into the small hole at the bottom of the periscope as shown in the illustration, which also shows the thermometer scale as seen through the periscope. The thermometer scale is illuminated by a lamp suspended near it.

ERECTING STEEL TOWERS ON POLE LINE RIGHT-OF-WAY

By Inclining the Wooden Poles so that the Wires Would Clear Towers, New Structures Were Set in Direct Alignment

In reconstructing about 0.5 miles (0.8 km.) of transmission line in which wooden poles were replaced by steel towers, a Middle Western company wished to set the towers in practically the same alignment as that



SOLUTION OF RECONSTRUCTION PROBLEM ON A NARROW RIGHT-OF-WAY

already occupied by the poles. It was at the same time important that service be maintained on the pole line while the new work was going on. Obviously this could not be accomplished if the towers were swung up into the overhead lines. Since the right-of-way at this point was narrow, permission was obtained to set stub poles temporarily on adjoining land. The upper part of the wooden pole line was then leaned over by digging out behind the butts of the poles and pulling them down until they touched the upper ends of supporting braces. The line was operated in this fashion until the work was finished.

LARGE AIR GAP CAUSE OF EXCESSIVE SPEED IN MOTOR

How the Fault Was Found and How It Was Remedied—Method Followed in Making the Various Tests Outlined

BY R. L. HEARVEY

A 35-hp., 500-volt interpole compound motor having a 4-ft. (1.2-m.) friction-saw blade mounted on the armature shaft was used to saw iron beams. During a lightning storm two field coils were burned out and the armature was grounded. To save time the grounded armature coil was cut out and the two field coils were rewound. When reassembled the armature ran 2300 r.p.m. at no load instead of 1900 r.p.m., the increased speed causing the saw blade to wobble badly when sawing. The first test made was to determine if the shunt coils had the proper voltage drop across each and if their polarity was correct. Both were found to be right. The next test was to check the polarity of the compound field coils. This was done by opening

the shunt circuit and starting the motor as a series machine. If the armature starts in the same direction as a series motor as it does as a shunt, the field coils are properly connected, as they proved to be in this case. This test requires considerable care as the field will be very weak and speed will reach dangerous proportions in a few seconds.

The above tests showed the voltage drop across the shunt coils to be uniform and the polarity correct for both the shunt and compound windings; hence there could be but one other cause for the high speed at no load—that is, a weak field. As there was about 3/32-in. (2.4-mm.) clearance between the armature and the poles, sheet-iron shims 0.04 in. (1.23 mm.) thick under each pole were tried, which brought the speed down to 2000 r.p.m. This was still too high, so the shims were increased to 0.055 in. (1.78 mm.), which gave a speed of 1900 r.p.m. At this speed the motor has been operating satisfactorily for over a year.

TESTING ARC CIRCUITS FOR GROUNDS AND OPENS

Magneto Method Abandoned in Favor of One Using Lamp in Series with Line and Source of Low-Potential Energy

BY W. R. DAVIS

In the plant of the Springfield Gas & Electric Company, Springfield, Ill., it is the custom to test the arc-lighting circuits for grounds or open circuit every day about an hour before lighting the lamps. These circuits supply the lamps at railroad crossings, and it is very important that they should always be ready for service. A magneto was used for testing until the writer received a severe shock one day when attaching

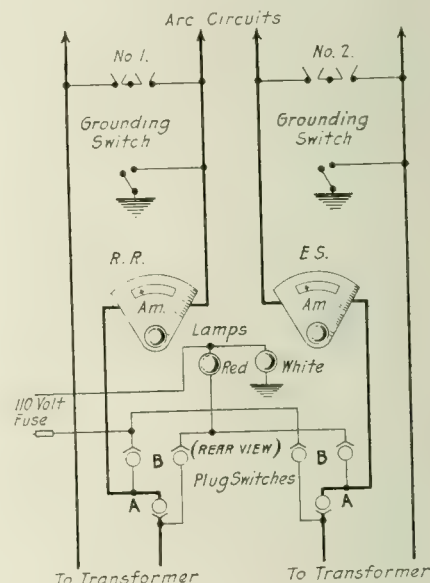


DIAGRAM OF CONNECTIONS FOR TESTING ARC CIRCUITS

the test wires to the circuit. The arc circuits are carried on poles that also carry 2300-volt wires, so there is a chance of their coming in contact with the high-voltage circuit and perhaps just at the time when the test wires are being attached. It was therefore considered advisable to use the method shown by the accompanying diagram.

A and B are standard plug switches. When the cir-

cuits are energized switches *B* are open and switches *A* closed. When testing, the transformer oil switch is opened, switches *A* removed and switches *B* closed. Under this condition the arc circuit is energized from a 110-volt circuit. By putting a 5-watt lamp in series with the entire arc circuit, including the secondary winding of the arc transformer, a positive indication that the circuit is closed is obtained if the lamp burns. In series with one side of the 110-volt test circuit and ground is another 5-watt lamp, which lights if the arc circuit is grounded. The 110-volt test circuit is energized by a 50-watt potential transformer. Plugs *B* must always be removed and plugs *A* inserted before closing transformer switch. Before sending a man out on the line to clear trouble the grounding switches are closed and a "hold" card placed on the transformer oil switch to guard against any interference.

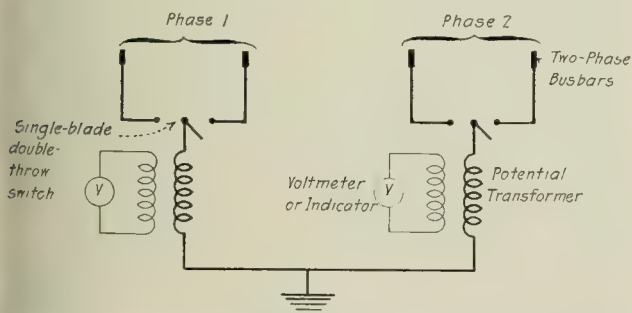
GROUND DETECTOR FOR USE WITH TWO-PHASE SYSTEM

Useful Device Developed by the Pacific Gas & Electric Company Consists of Two Potential Transformers

To detect grounds on its two-phase distribution system, the Pacific Gas & Electric Company, San Francisco, Cal., has developed a detector which consists of two potential transformers. One terminal of each transformer is joined with a single-pole, double-throw switch, while the remaining primary terminals are grounded. The secondaries are connected with the ground indicators. The jaws of one switch are joined with the legs of one phase, while the other switch is similarly connected with the other phase. Switch hooks are employed to operate the switches.

Formerly only one potential transformer was used, and the ungrounded terminal was connected to four busbars by fuse receptacles. However, this arrangement was dangerous as the fuses might "blow" and burn the operator's hands or face, and there was always a possibility of inserting two fuses at the same time in such a manner that a short circuit would occur. Finally there was the possibility of the plugs being unavailable in an emergency.

With the two-transformer arrangement none of these



METHOD OF CONNECTING POTENTIAL TRANSFORMERS TO SERVE AS GROUND DETECTORS

disadvantages exists. While the expense of the double potential transformer and the knife switch is possibly double that of the single potential transformer with fuse plugs, the additional cost is considered as more than offset by having this part of the system absolutely fool-proof.

DEVICE FOR GROUNDING

BROKEN LINE WIRES

Consists of Iron Pipe with Ground Connection and Is Attached to Pole at Right Angles to Line to Make Contact with Broken Wires

BY N. NESBITT TEAGUE

Augusta-Aiken Railway & Electric Corporation, Augusta, Ga.

A safety device for use at railroad and street crossings or where lines cross wires of other companies is shown herewith, its primary function being to ground broken or extra slack wires before they touch the ground or other wires beneath. It consists of iron pipes, one



METHOD OF INSTALLING PIPE TO GROUND FALLING WIRES

being attached to the double arm on each side of the crossing, so that a wire breaking anywhere in the span will touch the pipe immediately on becoming slack. The pipe is well grounded, and the cost of making and installing this device is very small. Persons or animals touching a broken wire will be safe as long as the wire touches the grounded pipe-work member. This scheme was developed by J. J. Borger, superintendent of the electrical department.

INDUSTRIAL TRUCKS USED TO TEST MOTOR ARMATURES

Energy from Battery of Industrial Electric Truck Used for the Purpose of Testing Armatures of Factory Motors

Efforts to better plant management often make it desirable to test factory motors to ascertain their efficiency in operation. Especially in motors of older types it is necessary to take actual readings to determine the resistance of the armature winding. To obtain this it is necessary to stop the motor and send current through it with the rotor blocked. Then, by knowing the current passing through the armature and the voltage drop across it, the resistance can be calculated.

Practically the only time that this can be done without interruption of service is at the noon hour. But the majority of plants shut off the power supplied to the shop at noon in order to reduce friction losses. Some other form of energy must, therefore, be used in testing. One way to get this energy is to drive an industrial electric truck to the motor, connect leads to its battery and send current through the factory motor's armature. The potential of a battery of this kind is usually about 32 volts. Therefore, the rotor of the factory motor does not have to be blocked and a rheostat is not needed to reduce the voltage as would be necessary when using a higher voltage supply. To insure good results with this low potential, care should be taken that contacts at the commutator are well made.

CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

ADJUSTING ELECTRIC SERVICE SALES TO WAR-TIME NEEDS

**How the Potomac Electric Power Company Has
Undertaken to Meet Requirements Without
Panicky Economies or Financial Contractions**

BY J. C. M'LAUGHLIN

Manager Commercial Department Potomac Electric Power
Company, Washington, D. C.

Every business man is by now familiar with the increasing costs in running his business. The government authorities are grappling with the problem. Meanwhile we are obliged to meet the changes from day to day as they confront us. In so far as the business of producing and selling electric energy and service is concerned, we are in a business whose initial financial outlay for installation and maintenance is one of the costliest imaginable. It is even hinted that many parts of our equipment may not be replaceable so long as the war continues.

Increasing costs and shortages of raw material have had a decided influence in reducing our normal surplus, and we believe that our experience is the experience of all other power companies throughout the country. Being part of the public utilities branch of municipalities, local laws prevent us from adjusting our selling prices in proportion to costs of production without sanction of the law.

Our problem, therefore, has been to find some way of increasing our business as much as possible at the least expense with a maximum of efficiency and immediate income.

Prolonged study by the personnel of the commercial department led us to discontinue aggressive seeking of new business by means of the usual campaigns and substitute a plan to intensify present business, thus eliminating the costs of initial extension. This is quite a factor in the amount of savings.

INTENSIFICATION BETTER THAN DUPLICATION

It has been figured out, in round numbers, that if a customer who has been in the habit of using 10 cents' worth of energy daily can be induced to double the quantity, the profit to the company will naturally be greater than if the original customer were allowed to use the normal amount daily and another customer was obtained to use another 10 cents' worth daily. The totals are the same, it is true, but in the first case one meter, one reading, one bill, one billing operation and one overhead cost percentage would suffice, whereas in the second case all equipment must be duplicated. Duplication means expense.

By this, of course, is not meant that new business must not be accepted or that it is not desirable. On the contrary, new business is always acceptable and is a means of extending our field of activity. But under present abnormal conditions, which affect every indi-

vidual and every business, efficiency dictates that until better days shall come it is well not to undertake too much.

The question of costs, to begin with, is of less concern to our business than the question of revenue. We know we have to contend with increasing costs. Thus we are put on guard to prepare to continue our business on a paying basis. Our purchasing department can figure out the general average cost of producing a kilowatt-hour. Sales to cover expenses and produce a reasonable income are put up to the commercial department. This department is obliged to make up the proportion of net income lost by increasing costs. If sales parallel the costs within a margin of safety, well and good; if not, we should face the emergency forcing us to ask permission of the Public Utilities Commission to increase our rates—something we should prefer not to do under any circumstances.

CUSTOMERS NOT THOROUGHLY INFORMED

We have about 33,000 meters in operation to-day in the District of Columbia and adjacent territory. Perhaps one-third of that number are placed in stores, the rest being found in homes. This shows that 22,000 meters are registering service in homes where, in ninety cases out of a hundred, the energy consumption is not so great as might be desired. In other words, the consumers are not thoroughly informed as to the extent to which electricity could be used by them to do household work and how its increased utilization would mean efficiency.

It is necessary, therefore, to get the householder not to use more light than is required—assuming that fixtures, location, lamp wattage and shades are used judiciously—but to use more energy in other ways, by the use of a fan, a sewing-machine motor, a toaster, an iron, a range, a vacuum cleaner, a washing machine or any other commodity.

The first step is the educative campaign which will cause families who now live in unwired homes to move, as soon as they are ready, not into unwired homes, but into the more modern properties which are rising every day. This would add a few hundred or a few thousand customers in the space of a few years. The project is not very difficult. Wired homes or apartments are the modern residences. Every builder has recognized this fact.

Introducing electricity in unwired homes is the very campaign we have suspended for the time being. We have done so not only because of the excessive cost of raw materials and labor, but also because the campaign can be made efficient and remunerative by diverting it to the channel of development rather than introduction. "Concentrate efforts to-day to develop that which we concentrated our efforts yesterday to introduce," is the slogan. Stress is placed on this point because to us the big problem to-day is not the securing of new cor-

sumers but the widest possible use by those who are already using energy.

It is a war-time problem the solving of which will not lose usefulness even after the war is over. Then, when peace is restored and we may hope to stabilize the market and figure out with reasonable certainty what production costs ought to be for a given period, we can go out for new business.

PROBLEM CONCERNS HOMES, NOT BUSINESS HOUSES

In the first place, business houses may be eliminated from our present problem, because all business properties are wired and are being run, it is presupposed, on an efficiency basis, war or no war, with the lamps placed where they will give their best result, with candle-power so measured as to avoid excessive light or waste, or, in the case of power, with motors of the best and most economical quality, their horsepower so regulated as to meet all required needs and no more. But in homes it is different. Even in the home of many a hard-working, efficient business man housekeeping is a drudgery.

The advantage of fostering the use of energy among the actual users makes it possible for us to sell more energy without any extra investment, and this means greater profit. To illustrate, take a family that reduced its bill from \$3 to \$1.50 by substituting tungsten lamps, but at the end of two or three years consumes \$4.50 worth of energy per month because of an iron and a cleaner. This can be increased to \$6 by further appliance sales. The number of traceable or untraceable sales which the same family brings about during that time is also worth considering.

RELATION BETWEEN CREDIT AND THE AMOUNT OF SALE

Middle Western Holding Company Fixes Amounts to Be Paid Down, According to Size of Order and Kind of Merchandise

The question of how much to ask as a payment down with any order is not always easy to determine, and many companies for that reason make it a policy to demand a flat percentage down and the remainder in a fixed time at monthly intervals, except in the case of special sales.

The Public Service Company of Northern Illinois, however, bases the amount to be paid down on both the type of merchandise and amount of the order. Its latest order provides that portable lamps, sewing-machine motors, vibrators, hair dryers and ironing machines, where the retail price is \$50 and under, shall be sold 10 per cent with the order and the balance divided in twelve equal monthly payments. Where the retail price is over \$50, 20 per cent must be paid with the order, the balance to be extended over twelve months. Irons, toasters, grills, curling irons, etc., when priced at retail \$10 and under, may be sold at \$1 with order and \$1 per month. If the price is more than \$10, 20 per cent must be paid down and the balance split in twelve monthly payments.

Power motors may be sold 25 per cent with the order, balance in twelve equal monthly payments; "Federal" washers, one-twelfth with the order, balance in twelve equal monthly payments; Federal vacuum cleaners, 10

per cent with the order, balance in twelve equal monthly payments; electric fans, cash, thirty days.

Five per cent discount for cash in full may be given within thirty days from the date of order on each appliance which retails for \$10 or over. Before goods are delivered credit must be approved by the credit department.

COLLECTING BY MAIL AND METHODS EMPLOYED

While Settlement of the Account Is Primarily Desired, Means Must Be Taken to Leave a Friendly Impression Upon the Debtor

When accounts are collected by mail the utility stands to lose or gain friends with almost every letter, according to the way it is expressed. It is with a realization of this fact in mind that so many lighting companies are paying more and more attention to the methods of letter writing which they employ in their collection department.

Form letters are almost universally used now to bring to the customer's attention the nature and amount of his delinquency. Where form letters, however, do not apply and personal letters therefore must be sent, a situation calling for the most diplomatic procedure presents itself.

Before a recent meeting of the employees of the enlarged Southern California Edison Company, Samuel Haver, Jr., credit manager of the company, delivered a paper on this topic, from which the following is quoted:

No matter how well a public service company may be organized nor how much care may be taken in selecting and training its employees, there is always room for improvement in each point of contact with the public whom it serves.

One of the most important points of contact is the written or printed communication, particularly those in regard to consumers' accounts. In sending out a collection form or letter the first consideration is, of course, to send one which will get the money; but another, which this company considers no less important, is to send one which will, if possible, leave a pleasant, friendly impression with the person we are writing to.

Successful collecting by mail is dependent on two things—care and skill in wording each individual communication to the debtor; promptness and regularity in sending and following up correspondence. Correspondence is usually sent out without sufficient thought or by some one inexperienced in the work. Too frequently such letters are in effect a reprimand to the debtor for not having paid, instead of a suggestion of the reasons why he should pay. Quite often letters are sent out at the convenience of the writer, instead of being sent at a time which has been carefully chosen in a well-thought-out collection scheme.

The experience of men who have given this subject much thought shows that a simply worded, courteous letter, putting the facts up to the debtor in a direct man-to-man fashion, will produce the best results. In wording a collection letter keep first in mind the old adage, "You can catch more flies with molasses than with vinegar." Try to figure out the kind of a man your debtor is and then place yourself in his position. Keep the pronoun "I" subservient to the pronoun "you." If a threat must necessarily be made, do not emphasize it too strongly, but try to bring out the reasons why the debtor should avoid the action threatened. Observe carefully the general rules of correspondence. In writing to a business man use as short and concise a letter as possible. In writing to a farmer, and especially to a woman, a longer letter, explaining the situation more fully, will be permissible. In writing to persons of

limited education use short words and explain your thoughts in a simple way. Use short sentences, not too involved. Use short paragraphs, with the most important arguments in the first and last paragraphs. Avoid hackneyed phrases, such as "we beg to acknowledge," "your kind favor," "thank-you in advance," "we beg to remain," etc.

The most difficult accounts a utility has to handle are closing bills against people who can no longer be reached by a personal call. Discussing a plan for handling such accounts, I want to emphasize the importance of collecting all closing bills, if possible, at the time the closing reading is taken. A little trouble spent in getting our money at this most opportune time will save much work and postage later on. Closing-bill collectors should be thoroughly instructed and schooled in this important duty.

If the bill cannot be collected with the closing reading, we must depend upon the results of future calls or resort to an effort to collect by mail. To assist in caring for the conditions arising from such accounts most companies have adopted standard form notices. These afford a basis on which to start correspondence with the debtor. They may in themselves be sufficient to bring in the money, but should only be considered as a means of getting in touch with him. It must be remembered that as soon as a reply is received in response to a form letter the efficacy of any subsequent correspondence until the account has been collected. When a consumer replies to one of our notices, his reply, no matter what he says, is the collector's golden opportunity. In the majority of cases collection can be made if the case is properly handled from that point on. Even if his reply is a well-worded tirade against corporations and a general denial of his debt, he has acknowledged something in answering the letter and afforded a basis for further correspondence, which, if properly handled, will result in payment of his account or afford us an opportunity of making a friend, if, as in rare cases, it is found that the account is not properly chargeable to him.

To accomplish this, it is highly important that one person be placed in charge of all collection correspondence and that he have sufficient time to take care of this duty regularly each day; that a complete record be kept of all correspondence sent out and the dates thereof and of the results of all personal calls by collectors; that any communication from the debtor be recorded immediately; that all the facts contained in such a record be in mind whenever a letter is dictated; that every possible argument be brought forth to make him pay. For instance, if a debtor has written in that the bill is too large or that some one else owes it, it is useless to write him again if you are going to ignore the claim which he has set up. His contentions must be answered and additional arguments put before him to show why he personally owes the account.

I have said before that our correspondence is never considered closed until we have got the money and, if possible, left the consumer in a friendly frame of mind. We are not satisfied with getting the money and leaving the debtor with a grudge against the company, feeling that he has been obliged to pay a bill which he does not owe or that he has been overcharged. In many instances we have spent as much time and postage in straightening out our relations with the debtor, after the account has been paid, as we did in getting him to send in his remittance. To illustrate this, I will read the correspondence we had with one of our consumers who had moved away leaving an unsettled bill:

"VENICE, CAL., Oct. 9, 1916.

"S. C. Haver, Jr., Credit Agent,
"Southern California Edison Company,

"Dear Sir—In re yours of the 7th inst. Beg to state that the bill would have been paid many months ago if the man I spoke to at the time I moved (at your office) hadn't been quite so officious. At the time that I moved I really couldn't spare the amount of the bill. I will take care of same within a few days. Yours truly,
JOHN DOE."

"LOS ANGELES, Oct. 14, 1916.

"Mr. John Doe, 2214 Walnut Avenue, Venice, Cal.

"Dear Sir—Referring to your letter of Oct. 9 in regard to bill of \$1.21 for service at 2226 Fifth Avenue, Los An-

geles. I am very sorry you feel that you were not properly treated in our office at the time you moved from Fifth Avenue, as our employees are all instructed to observe the greatest possible courtesy in caring for the wants of our customers. Will you please accept our sincerest apology, and I may safely say that you will not have another such experience in any of our offices. In regard to the amount which you owe, I hope you will find it convenient to send me a remittance on or before the 20th of this month. Yours truly,
CREDIT AGENT."

"VENICE, CAL., Oct. 16, 1916.

"Mr. S. C. Haver, Jr., Credit Agent,
"Southern California Edison Company.

"Dear Sir—Your letter of the 14th very much appreciated. I am very sorry for my own actions in this matter; it was too small a thing to warrant my going as far as I did. Inclosed please find check for \$1.21. Yours in appreciation,
JOHN DOE."

"LOS ANGELES, Oct. 23, 1916.

"Mr. John Doe, 2214 Walnut Avenue, Venice, Cal.

"Dear Sir—We acknowledge with thanks receipt of your check in the amount of \$1.21 to cover closing bill for service at 2226 Fifth Avenue, Los Angeles, and inclose herewith receipt to cover. We regret any inconvenience which this matter may have caused you, but such instances have at least one advantage—namely, that of putting a large corporation such as ours in closer touch with at least one more of our consumers. We are in business in many cities in southern California, and it is always our desire to maintain friendly and frank business relations with every one. I sincerely hope that you will continue to favor us with your patronage, wherever you may be in need of electricity for lighting or power service, and assure you of our desire to render you the best possible service at all times.
Yours truly,
CREDIT AGENT."

SOME NEW USES FOR HOUSEHOLD DEVICES

Fans and Vacuum Cleaners Have Been Put to Novel Service in Farming Communities of the Northwest

There are new uses being found for electrical devices almost every day, some good and some bad. The following ingenious use of fans and vacuum cleaners on farms in the territory of the Pacific Power & Light Company may be of value to other companies.

Electric fans have been put to a somewhat novel but entirely practical use at the Congdon Orchards, near North Yakima, Wash. The Congdon Orchards Company has a very fine herd of Aberdeen-Angus prize cattle, which were very much worried during the hot weather by flies and gnats. Four 16-in. (40.6-cm.) fans were installed in their quarters with very satisfactory results.

In the Prosser district there has been found a new use for the vacuum cleaner, which it is expected will open up a new field of work and give the company a chance to place several of these machines on the market. The new idea is to use the vacuum cleaner with the blower attachment to drive the bees out of the super during the honey flow instead of using the old method of smoking them out. The smoke often discolors the honey and in some cases even flavors it. There are a few bee growers in this locality whom the company is going to have try out this method, and if successful the company will advertise the fact. The idea, it is believed, can be used in several localities where the bee industry is followed, and its success would soon lead to a general adoption of the practice.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

PRODUCTION OF SYNTHETIC NITRATES BY ELECTRICITY

Importance of Contact of Air with Electric Arc, Advisability of Preheating the Air, and Other Considerations of Weight

AN INTERESTING paper was presented recently before the Society of Chemical Industry by E. Kilburn Scott (abstracted in July 27, 1917, issue of the *London Electrician*), in which the author discussed the value of certain furnace details in the production of synthetic nitrates, the advantages of the magnetic and air-blow systems, considerations in starting furnaces, the advantages of preheating the air and cooling the nitric oxide as soon as it leaves the furnaces, and other considerations.

When fixing atmospheric nitrogen in an electric furnace, the reaction depends chiefly on the contact of air with the electric arc; therefore the furnace design which permits the largest amount of air to come under the action of the arc is obviously the best. In some types of furnaces the arc alternately fills the top and bottom half, but never both simultaneously, and as air flows into the reaction chamber through all entrances it follows that only one-half of it can be on the side where the arc is at any moment.

With three-phase furnaces, however, the three electrodes are arranged with intervening firebricks so that together they entirely inclose a six-sided conical space. Air entering the bottom expands and fills the cone before passing out by the only exit, at the top. The currents passing between the electrodes interact in much the same manner as they do in a three-phase motor, producing an arc flame which rotates rapidly in accordance with the periodicity of the supply, which, for example, may be fifty times a second. Since the air takes longer than one-fiftieth of a second to pass up through the reaction chamber, every particle must come in contact with the rapidly revolving sheet of flame.

For the proper working of nitrogen fixation furnaces it is essential to blow the arcs into the flames, and this can be done by magnetic field, as in the Birkeland-Eyde furnace, which has a stable magnetic field, or in the Mosciski furnace, which has a rotating magnetic field. On the other hand, it can be done merely by the air flowing through the furnace, as in the Schonherr, Pauling or Kilburn Scott types. One objection to the magnetic blow is that direct current is required to excite the magnets in addition to the alternating current required for the arc.

For a given power or output the trouble of operating electric furnaces may be said to vary with the number of electrodes, as does also the energy lost in the furnace. The material of which the electrodes are made has an important bearing on the yield. For example, the electrodes of the Birkeland-Eyde furnace consist of

a special alloy, which has been found by experience to be beneficial. The modified Pauling furnaces have electrodes made of aluminum alloy which are said to have a catalytic action favorable to the yield.

The author has found that it is advisable to maintain the pilot sparks at all times, because their presence improves the yield and tends toward continuity of operation. Interruptions cause surges and other electrical phenomena which are liable to cause trouble. The three-phase furnace has a special advantage in this respect because the arcs assist in maintaining each other.

Preheating the air not only economizes heat and raises the temperature of the furnace, but it also enables the air to enter the furnace dry and assists ionization. A temperature of 250 deg. C. has been found advantageous for furnaces producing synthetic nitrate. The preheat may be obtained from gases leaving the furnace, one large efficient preheater being recommended for several furnaces.

The chemical reaction involved in producing synthetic nitrates being reversible, it is important to chill nitric-oxide gas quickly. With single-phase furnaces this can only be effected by blowing excess air through the furnace, whereas in some other types of furnaces it can be done by having a boiler mounted directly over the furnace to form a roof, the boiler being connected to earth and serving as the neutral plate for the arc flame. No trouble from corrosion need be expected as nitric oxide does not attack metal. Tests have shown that about 10 per cent of the total energy put into the furnace can be regained in the form of low-pressure steam when a boiler is mounted over the furnace.

The yield which can be expected from single-phase furnaces, the author points out, is 50 to 60 grams of pure nitric acid per kilowatt-hour, or half a ton (0.453 t.) of pure acid per kilowatt-year. From investigations conducted with one type of three-phase furnace it appears that a yield 50 per cent greater than the value given for single-phase furnaces can be obtained.

Generators, Motors and Transformers

Design of Electromagnetic Machines.—STANLEY PARKER SMITH.—Second section of a series, this installment dealing with alternating-current generators. The subject is being handled under the heads "theory," "design of low-speed alternator" and "design of turbo-generators." In the section on theory the following subjects are discussed: Operation of synchronous machines, armature windings for three-phase machines, emf., mmf. and inductance of three-phase windings, conversion of energy, and effect of number of phases on the output.—*London Electrician*, July 27, 1917.

Synchronous Motor Operation.—RALPH KELLY.—By means of simple fundamental principles the following questions are explained: What limits the pull-out torque of a synchronous motor, and what can be done to in-

crease that torque? Why does a synchronous motor carrying normal load pull out of step when the line voltage drops appreciably? Why does overexciting a synchronous motor make it possible for that motor to carry a larger overload, and why is the reverse true when the motor is underexcited? Why is it that a synchronous condenser built only for leading power-factor operation can carry but a small part of its rating when operated at zero per cent lagging power factor, and why does a condenser designed for normal rating, both zero per cent leading and lagging power factor, cost so much more than a standard condenser? What is the explanation of "rotor shift"?—*Electric Journal*, August, 1917.

Essentials of Transformer Practice.—E. G. REED.—Methods of calculating the copper losses in transformers are given and typical examples are solved. Among the subjects discussed are the relation between current density and the copper loss per pound and the eddy-current loss in conductors of rectangular cross-section.—*Electric Journal*, August, 1917.

Lamps and Lighting

Floodlighting for Protection.—J. L. STAIR, K. W. MACKALL and SAMUEL G. HIBBEN.—To secure the best results, the same fundamental principles that make installations successful for other purposes must be applied to protective illumination. First, the light must be directed onto the object to be seen and away from the observer; in other words, onto the hypothetical vandal and the factory surroundings, not the factory building nor the guards. Second, glare should both be avoided and be made useful. It is almost impossible to see beyond a bright light, as every automobilist can testify. The guard should not be subjected to any such handicap, but the marauder should. The fact that glare is extremely objectionable in ordinary lighting installations can be made use of as one of the valuable features of a protective installation. Third, the lighting must be adequate for the purpose, but for commercial reasons must not greatly exceed the minimum permissible value. It should be as uniform as possible. The lights must be inexpensive to install and operate. The field of floodlighting is, primarily, in that class of installations where other units are impracticable, usually because of the difficulty or undesirability of running wires and installing lighting units at the locations where the illumination is wanted. These requirements are amplified in the articles by the above-mentioned authors. Methods of determining the type and rating of lamps to use, the total wattage to employ, the method of installing the lamps, etc., are given.—*Electric Journal*, August, 1917.

Generation, Transmission and Distribution

Condenser Tube Corrosion.—WILLIAM RAMSAY.—Account of some observations and experiments. The author refers to dezincification of condenser tubes, saying that it is a normal process which so long as it remains superficial, as with 70:30 brass, may even be protective. One of the commonest and perhaps most serious forms of corrosion is that which leaves the tube scored with more or less continuous and parallel lines, which eventually cause the tube to split. Tubes drawn from castings having sand cores are much more liable to have laminations that will eventually open up and corrode than those drawn from castings in which the

bore is drilled or pierced. Foreign particles which can form galvanic couples with the brass may start corrosion, too, especially along the bottoms of the tubes. Gases adhering to the tubes around the water inlet end and crushing or bruising the tubes with ferrules are also frequent causes of corrosion. Annealing tubes to reduce all hard brass to the soft variety will prevent corrosion due to the contact of these different potential materials. The higher the percentage of zinc in brass the sooner it will corrode. Air, CO₂, ammonia and sewage in condensing water will also hasten the action. Use of cupro-nickel, or even iron or steel tubes, will eliminate corrosion troubles considerably.—*London Engineering*, July 13, 1917.

The Primary Volatile Products of the Carbonization of Coal.—GUY B. TAYLOR and HORACE C. PORTER.—This report is a continuation of the work described in Bureau of Mines Bulletin No. 1 on the character of the volatile matter of coal. The experimental methods have been refined and more precise results obtained. The results presented are more or less of a fundamental character, a study of basic phenomena in carbonization, rather than of the ultimate results of these phenomena as a whole.—*Technical Paper 140, Bureau of Mines*, Washington, D. C.

Transmission Line Design.—F. K. KIRSTEN.—This paper contains a complete mathematical analysis of the forces which determine the location in space of a cable suspended from points of equal elevation, and gives the designer and constructing engineer of a transmission line some useful working formulas based on this analysis. Section A of the paper covers the derivation of the catenary formulas and contains a chart from which any catenary problem may be quickly and accurately solved. Section B contains an analysis of the influences of changes in temperature and cable load, resulting in formulas by the aid of which the magnitude of these influences in regard to changes in position of the cable and changes in stresses at any point of the cable may be accurately computed. The formulas derived make it possible to plot a temperature-tension stringing chart to be used by the constructing engineer when stringing the cable at various temperatures. Section C is an investigation of the economic features involved in the proper design of the cable supports. A working formula is derived enabling the designer to determine the most economical span and corresponding height of tower. Solutions of typical design problems are given in each section of the paper demonstrating the use and manipulation of all formulas derived.—*Proceedings A. I. E. E.*, August, 1917.

The Tasmanian Great Lake Hydroelectric Power Scheme.—This article briefly describes the history of this development and the general layout of the system. A new generating unit, consisting of an 8000-hp. Boving-Pelton wheel turbine provided with two jets operating on a single wheel and coupled to a 7000-kva., three-phase generator, is to be installed. A new substation is to be erected to supply energy for the manufacture of calcium carbide as well as for the treatment of zinc ores.—*London Engineering*, July 27, 1917.

Electrophysics and Magnetism

Oscillatory Spark Discharges Between Unlike Metals.—D. L. RICH.—Results of an investigation to determine whether or not the material of the electrodes has

any influence on the initiation of a discharge. The conclusions are based on photographs of oscillatory spark discharges between electrodes of copper, iron, zinc and bismuth with alternating and intermittent direct currents. An interpretation of the relative number of spark trains per half-cycle, the relative number of individual oscillation sparks per train and the relative number of trains containing odd numbers and even numbers of individual sparks is given, with reasons for such interpretation. When the electrodes were alike symmetrical discharges were always found. When the electrodes were of two unlike metals decided rectification effects were always produced, being very pronounced when copper was one of the electrodes and most prominent when iron was the other electrode. In other words, the material of the electrodes is not a negligible factor in the initiation of a spark discharge. If the discharge is electronic, the electrons are emitted from iron more easily than from bismuth or zinc, and much more easily than from copper; they are emitted from bismuth more easily than from zinc or copper, and from zinc more easily than from copper. Arranged in a rectification series, these metals stand Fe, Bi, Zn, Cu. The rectification effects seemed marked and consistent throughout.—*Phys. Review*, August, 1917.

Comparative Studies of Magnetic Phenomena.—S. R. WILLIAMS.—This paper confirms the viewpoint that primarily the Wiedemann effect is a special case of the Joule, but that one condition prevails in the former which does not in the latter, viz., there is a constantly changing direction of the resultant field imposed. This condition gives rise to several variants already noted. There has been offered in this paper an explanation why the maximum twist in steel for the Wiedemann effect comes at lower field strengths than does the maximum elongation in the Joule effect. The importance of considering the effects of auxiliary fields upon the magnetostrictive effects has been brought out. In the case of iron, the earth's field as an auxiliary field has very little influence on the magnetostrictive effects as compared with those in nickel. A possible explanation of why the magnetostrictive effects vary in different substances has been presented.—*Phys. Review*, August, 1917.

Units, Measurements and Instruments

Standard Samples for Thermometric Fixed Points.—In a circular on this topic the Bureau of Standards announces that it is prepared to distribute samples of pure tin, zinc, aluminum and copper for use in testing pyrometers used in measuring high temperatures. These metals melt at definite temperatures, and by using the pyrometer to observe the temperature at which the metal melts it is possible to decide whether the pyrometer reads correctly.—*Bureau of Standards Circular No. 66*.

A Study of the Current Transformers with Particular Reference to Iron Loss.—P. G. AGNEW.—The following summary was made by the author from the work carried out: 1. While the ratio of transformation of current transformers usually decreases with increasing current, it may increase in individual cases, or even pass through a maximum. 2. The ratio and the phase-angle performance may be accurately computed from the magnetic data of the core. 3. In general the slope of the ratio curve may be qualitatively predicted from the

value of the Steinmetz exponent if the latter be assumed to be constant. But the iron losses, particularly at the low flux densities used, depart too widely from such a simple law for accurate work. 4. The slope of the ratio curve may be accurately computed from the slope of the curve obtained by plotting the core loss against the flux on logarithmic co-ordinate paper. 5. It is proposed that this logarithmic slope or logarithmic derivative shall be called the ratio of variation. It is much more useful than the actual exponent. 6. The methods now in use for determining the "exponent" fail to give a true exponent that will satisfy the equation $W = KB^z$, unless z is a constant. The quantity actually determined by these methods is the ratio of variation. 7. The wave form of the secondary of a current transformer may be considered to be the same as that of the primary current for even the most precise measurements, as the distortion within the transformer is entirely negligible. 8. While the effect of variations in wave form on ratio and phase angle may be detected by accurate measurements, it is too small to be of practical importance, being of the same order of magnitude as the effect of small changes in frequency. 9. The null methods used for accurate determinations of ratio and phase angle all give the theoretically correct results, well within the experimental error, so that the accuracy attainable is decidedly greater than is required in practice.—*Bulletin of Bureau of Standards*, Washington, D. C.

Telegraphy, Telephony and Signals

Laying Largest Duplex Submarine Telephone Cable in World.—H. M. BENHAM.—The methods used in laying 28,248 ft. (8610.6 m.) of double-armored cable containing seventy-four pairs of No. 16 wire and twelve pairs of No. 22 wires from Keansburg, N. J., to Annadale, Staten Island, were described in this paper. Loading pots were inserted at five points, the splices being tested for water tightness by dry air pumped into the sleeves before filling with paraffine. The locations of the pots are indicated by spar buoys.—*Telephone Review*, August, 1917.

Miscellaneous

Electric Discharge and Crop Production.—Includes a résumé of history and growth of this application with descriptions of early and late types of apparatus designed for use in connection with it.—*London Engineering*, July 27, 1917.

The Metrical System in China.—Apparently authentic news represents China as about to adopt the metrical system of weights and measures. On Feb. 15, according to the report, the stores of Peking adopted new measurements based on the metrical system. These measurements have been popularized by the Chinese Chamber of Commerce, acting under the instructions of the Minister of Agriculture and Commerce. Just how closely they correspond to the European system has not yet been clearly established.—*L'Industrie Elec.*, July 25, 1917.

Permissible Explosives Tested Prior to Jan. 1, 1917.—SPENCER P. HOWELL.—This bulletin gives the brand names of all explosives now considered as permissible explosives that were tested by the Bureau of Mines prior to Jan. 1, 1917. A definition of permissible explosives is also given.—*Technical Paper 169, Bureau of Mines*, Washington, D. C.

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

MUNITIONS CONTRACTS FOR WAGNER ELECTRIC COMPANY

Subsidiary Corporation Formed in Connection with
Other Interests as a Part of the
New Activities

Following a report published in the daily newspapers that large munitions contracts, aggregating a total of \$9,000,000, had been awarded to the Wagner Electric Manufacturing Company, St. Louis, the ELECTRICAL WORLD telegraphed to W. A. Layman, president of that company, asking for a statement of the facts.

Mr. Layman telegraphed in reply that the facts as reported were substantially correct. The guns will be made in association with the Root & Van Dervoort Engineering Company, East Moline, Ill., in a special plant being erected there by a new subsidiary corporation called the R. & V. Wagner Ordnance Company. The gun contract is for machining 4-in. (10.16-cm.) naval gun forgings supplied by the government and includes deck mounts.

NEW YORK SUBWAY OPERATION STOPPED BY COAL SHORTAGE

Public Service Commission Orders Interborough
Company to Maintain Reserve of 5000
Tons at One Plant

New York City had a shock on the afternoon of Aug. 25, when the Interborough Rapid Transit Company subway suspended operation for several hours on account of lack of coal for its boilers. As it was Saturday, great numbers of people were inconvenienced, and an investigation was begun by the Public Service Commission, First District, on Aug. 27.

The investigation showed that the Interborough company had contracts with the Consolidation Coal Company and with the Berwind-White Coal Company, the president of which, E. J. Berwind, is a director of the Transit company. It was testified that a miscalculation of the amount of coal on hand on the evening of Aug. 24 had been made by the force at the West Fifty-ninth Street power house.

The contract price for coal paid to the Berwind-White company by the Interborough company, \$3.23 per ton, has been increased 40 cents on account of increase in labor cost, making a total of \$3.63. It was testified that the New York Edison Company is paying the same company \$5.25.

During the hearing a number of references were made to the subject of interconnection with the New York Edison Company generating plants and the possibility of such action on a large scale as a further precaution against more difficulty.

The commission announced that it would issue an order requiring the Interborough company to keep on

hand at all times at its Fifty-ninth Street plant a reserve supply of at least 5000 tons (4500 t.). When cut into for daily consumption or in an emergency it shall not be lower for more than forty-eight hours. Notice shall be given to the commission whenever the reserve is lowered.

William L. Ransom, chief counsel of the commission, in a public statement, placed the blame upon Mr. Berwind, and declared that there would not have been a shortage if the company of which he is president had furnished the coal called for instead of selling it elsewhere at a higher price than the Interborough contract named.

ELECTRICITY TO MARK AERIAL TRIAL ROUTES

Companies in the Central West Responding to Call
for Energy to Guide Student Aviators
in Their Flights

Electrical companies in the Middle West and city and town councils are offering enthusiastically to provide the "lighthouses" necessary to mark the aerial routes between Dayton, Ohio, and Indianapolis, Ind., and other cities to be used by the aviation corps of the United States Army in training students for this service.

Carl G. Fisher, chairman of the airplane mapping committee of the national advisory committee on aeronautics, has announced that already word has been received from many towns along the proposed airplane-training route that the authorities and patriotic electric companies would be glad to provide the lighting facilities needed. Searchlights will be turned upward each night to guide flyers on their way during the training period in making night flights.

Large searchlights will be placed in Indianapolis, either on the Soldiers and Sailors' Monument or the Statehouse.

Thomas A. Wynne, Indianapolis Light & Heat Company, has informed Mr. Fisher that his company will provide energy to operate the lamps in Indianapolis free of charge to the government. It is not yet determined whether an appropriation will be asked from the Indianapolis City Council to provide the lamps. The Indianapolis Motor Speedway, which has been turned over by Mr. Fisher to the government for use as a landing place for aviators, also will be equipped with lights.

Mr. Fisher announced that "Dayton will be equipped with the most powerful set of searchlights that can be procured in the United States."

Fort Wayne and Ladoga commercial clubs are ready to supply lights for the committee. T. E. Meyers and Wallace Lee, Indianapolis, are members of a committee which will travel over the route in Indiana to boost the plan of providing the lights as soon as possible.

COAL PRICE-FIXING ORDER AFFECTS INDIANA RATE CASES

Hearings Before Public Service Commission on
Surcharge Petition Suspended by the
President's Action

The coal price-fixing order of President Wilson has resulted in temporary disarrangement of the plans of Indiana electric companies to press claims for authority to make surcharges on account of extraordinary war costs. However, the developments of the next few weeks in the coal situation will be watched closely by utility managers, and at first sign that prices of last winter and spring are to be in effect during the approaching season petitions for relief will be pressed again before the Indiana Public Service Commission. That appears to be the consensus of opinion in Indianapolis, although the hearing before the commission last week came to a sudden close when the President's order was made public.

Many companies dropped from the list of those participating in the first petition for surcharge filed by the Indiana Electric Light Association. Subsequently companies filed individual petitions. Gradually a number of these companies decided not to press their cases, so that, when the President's order was promulgated, only those cases which the commission had heard, as reported in last week's issue of the *ELECTRICAL WORLD*, or which are mentioned in the present article, were before the commission.

It seems to be the consensus of opinion in Indianapolis that if the national administration succeeds in lowering coal prices to a normal level again, about the only relief granted by the commission will be in the cases of the Indianapolis Light & Heat Company and the Merchants' Heat & Light Company. Whether the commission has in mind to give these companies relief is, of course, not known. Competitive conditions in Indianapolis have done much to raise operating cost to a high point with these companies, and the former low rates fixed by the old commission, it is complained, have not yielded what is considered an adequate return. Heavily increased taxes also have been added to these companies.

At the last hearing by the commission last week the Wabash Valley Electric Company announced the withdrawal of its petition for a surcharge. Mark E. Weberkerer, Clinton, attorney for the company, said that the withdrawal was due to President Wilson's announced coal prices. He said that the government scale would result in a reduction of 80 cents per ton for coal used by his company.

E. J. Condon, Angola, president Indiana Utilities Company, asked for the postponement of the hearing on the petition of that company for a surcharge. The government's action influenced him to take this action.

The Martinsville Gas & Electric Company, which was to have had a hearing, had no representative present, and its case was postponed. Homer L. McGinnis, city attorney, moved for the dismissal of the petition, but the commission decided not to act until the company is heard. The petitions of the following companies have been heard: Browne-Mills Electric Company, North Manchester; Madison Light & Railway Company, Oakland City Light & Power Company, Batesville Electric Light & Power Company, Rockport Waterworks Com-

pany, Owensville Light Company and Boonville Electric Light & Power Company.

E. I. Lewis, chairman of the commission, and Edwin Corr conducted the hearings.

Kenneth Weyerbacher, Boonville Electric Light & Power Company, said that he anticipated a 50 per cent increase in the price of coal and 25 per cent increase in labor cost during the next year, and that his company wished authority to add a surcharge of 30 per cent. As Boonville is in the midst of the Indiana bituminous coal fields, Mr. Lewis questioned Mr. Weyerbacher at some length. It was shown that the Boonville company had been buying mine-run coal for \$1 a ton delivered, but that the price had been raised to \$1.50 a ton. Mr. Weyerbacher said that he bought coal from a small mine which was not as well equipped as larger mines that loaded coal directly on railway cars. Coal that was loaded on cars from larger mines brought \$2 to \$2.50 at the mine, he testified.

Mr. Weyerbacher said that, although his plant was close to the mines, he figured that for the coming year there would be an increase of \$10,000 in expense on account of coal and at least \$900 on account of higher labor cost.

It was shown that the Owensville Light Company formerly was able to buy coal at \$1.37 per ton delivered, but is now paying \$3.25 delivered, and cannot obtain a contract for future delivery. Increased cost of coal and other materials would amount to \$1,714 in a year.

J. A. Hillenbrand, Batesville Electric Light & Power Company, testified that his company had bought coal at Cincinnati last year for \$1.65 a ton and was paying \$3 plus 60 cents freight charges this year. He feared that he would have to pay \$4 in the open market.

All of this testimony was based, of course, on conditions prevailing prior to the promulgation of prices by President Wilson.

When these dispatches were written prices of coal in Indiana were still at the exorbitant point to which they ascended last winter and spring.

WAR TAX ON ELECTRICITY STILL OPPOSED IN SENATE

Senator Simmons Expresses Confidence That Senate
Will Be Opposed to Any Plan for Taxation
of Electrical Energy

It seems clear from reports of the Washington correspondent of the *ELECTRICAL WORLD* that no tax on electricity will be fastened to the war revenue bill.

Senator Simmons, chairman of the Senate finance committee, who has the war revenue tax bill in charge, made this statement on Aug. 28:

I have not yet been able to ascertain what the House committee, when we go into conference, intends to do. But I believe that the fact that we have important Senators ready to serve on the conference committee when the bill finally goes through would indicate that no matter what the House does the Senate finally will frame its own bill so far as the electricity tax is concerned.

The Senators who will conduct this conference for the Upper House are Stone, Pomerene, Lodge, Williams of Mississippi and myself.

So far as I have been able to ascertain by discussion among the Senators the Senate will be opposed to adoption of any conference report which brings with it a tax upon electricity.

PATRIOTIC ECONOMY TO HELP THE NATION

Everett Morss Says that We Cannot Increase Supply, but Can So Reduce Demands that Available Supply Shall Meet Needs

Everett Morss, president Simplex Wire & Cable Company, Boston, Mass., has sent to a large number of friends in the electrical industry a folder on "Patriotic Economy." It is a direct appeal to practical economy in the national emergency. The discussion of Mr. Morss in full follows:

The necessity for patriotic economy will be evident if we think of finance in terms of labor instead of in dollars. We have natural resources and we have capital invested in the tools of production, but even with these facilities our productive capacity is limited by the supply of labor. By labor we mean the personal service, whether of brain or of brawn, of the 40,000,000 of us who are engaged in gainful occupation.

To carry on the war we shall spend at least \$12,000,000,000 per year, or \$33,000,000 per day. This is as much as Great Britain is spending and 50 per cent more than Germany is spending, and the figures are so huge that few of us appreciate what they really mean.

Europe is already so deeply in debt that she may never be able to pay, and we are on the road to the same condition. Balance of trade statistics indicate that we have made an extra profit from foreign business since 1914 of \$5,000,000,000, or about \$2,000,000,000 per year. The effect of this in enriching the country is suggestive of the result of three years of impoverishment at the rate of \$8,000,000,000.

Our normal annual savings are about \$4,000,000,000, and not only will our war expenditure absorb all of these savings, but we must find \$8,000,000,000 in addition. During the last three years our present allies have obtained much assistance from us, but as there is no country to whom we can turn we must carry our burden alone.

Our savings go into public and private improvements, including the extension of business enterprises. These savings will not be available for war until we stop federal, state, municipal and private improvements; until we forbid all issue of securities except under federal license, following the example whereby England reduced the issue of industrial securities from \$468,000,000 in the first half of 1914 to \$11,000,000 in the same period of 1917.

The danger of a famine has been brought home to us, and we are making a real effort to reduce consumption, though our efforts to increase production are being seriously handicapped by the high price of labor.

Immediately after war was declared the President warned the country that every one should produce more and consume less. The idea that business was to be suddenly reduced by a wave of economy was a shock to business men and the cry "business as usual" was spread over the country and caused the President's appeal to be forgotten. Not only are people spending as usual, but many conscientiously believe it their duty so to do.

Every dollar spent means the consumption of labor. We shall not be far wrong if we say that every \$4 spent consumes a day's labor, and that every \$1,200 spent consumes a year's labor. A war expenditure of \$12,000,000,000 will consume the labor of 10,000,000 people, 25 per cent of our total labor supply. This added demand comes during the greatest labor famine in our history, which has increased commodity prices 85 per cent since 1914.

We have reached a point where the increasing demand reduces the efficiency of labor and thereby reduces the supply, and we are facing a further rise in commodity prices, perhaps to exceed present conditions in England, where prices are up 120 per cent.

The most effective remedy is to decrease consumption, and it is imperative that every one should make a drastic reduction in personal expenditures. The example must be set by the rich, but every man, woman and child must be drawn into the movement until patriotic economy becomes

the greatest fad the American people have ever known.

Our young men who try to avoid military service are "slackers." Every one of us who will not economize to help the war is a "slacker." Who will fail to spend less when he realizes that every \$4 saved is a day's labor contributed to the war? It is not a question whether your income justifies an expenditure, but whether the country can afford to let you spend.

Even to prevent hardship we have no right to spend to keep people in their usual employment, for only by a process of readjustment can we obtain the labor necessary for the war. Already the government is resorting to price fixing and other dangerous experiments, because we can no longer submit to the law of supply and demand. We cannot increase supply, but we can so reduce demand that the available supply shall meet our needs and so keep prices within bounds.

With 2,000,000 men in cantonments or in tents there are houses enough for the rest of us. We can reduce the famine in wool and cotton by wearing our old clothes. We can stop the purchase of automobiles, so that the factories and their operatives may produce motor trucks, aircraft and munitions. We can use the automobiles we now have less freely and save gasoline. We can reduce the number of our servants and let our wives and daughters do more of the work. We can do away with the wastefulness of charity entertainments if we go less to the theater and give the money saved to charity.

The real horrors in Europe are not on the firing line, but among the civil population, who are pinched for the necessities of life and in many cases dying of starvation. If each one of us is not willing to make sacrifices for the war, Germany was right when she characterized us a "nation of slackers."

PRICE-FIXING SITUATION AT THE NATIONAL CAPITAL

President Receiving Reports from Federal Trade Commission as to Basic Costs of Raw Materials and Production

Within a few days, perhaps before this issue is in the hands of readers, the price of copper will have been fixed. Also within the same period a copper administration may have been established charged with the same duties which have been laid upon the food and the coal administrations. The best information obtainable is that the price of copper will be fixed at between 20 and 25 cents per pound.

This information comes from the Washington correspondent of the ELECTRICAL WORLD, who also reports that within a few days the price of steel also will have been fixed. No positive indication of the price of steel is obtainable at present, although the situation is changing so much from day to day that developments would not be surprising.

President Wilson is apparently doing all the work of price fixing alone. He is receiving from day to day, in his study at the White House, far removed from the White House executive offices, the reports of the Federal Trade Commission as to basic costs of raw material and production on coal, steel, copper, etc.

The curious fact has developed that some of the production figures in regard to cost of labor do not take into account the fact that the labor situation is constantly shifting, and will shift more and more as time goes on and men are sent to Europe from American industries. It is pointed out in Washington that some of the labor now being sent to Europe or which will be sent there later will remain abroad after the war. Some of the expert men in the various engineering

regiments will find life and labor more attractive in Europe after the war, so that it may be stated upon authority of some of the most important Cabinet officers that the whole price-fixing situation resolves itself into a question of conserving labor not only during the war but after it.

President Wilson has fixed the price of coal, and he has created a coal administration, appointing Dr. Garfield, president of Williams College, as its head. This coal administration will take charge of the many details created by coal-price fixing. Washington official life thoroughly expects that in the end it will take charge of all questions of priority of shipments on railroads. Operators have been meeting in Washington during the past week for the ostensible purpose of protesting against the fixing of these prices, but it is well known that underneath the surface the soft-coal operators do not object to the price President Wilson has fixed. When they met in Washington some weeks ago, the Washington correspondent of the *ELECTRICAL WORLD* reports, they did so with the intention of getting a better price if possible than has been named by the President. They intend to leave Washington satisfied, it is stated in Washington, and their appearance in Washington, it is reported, has been for the purpose of effect.

The fate of the coal production committee of the Council of National Defense, some of whose members have characterized themselves heretofore as members of a coal distributing committee, remains in abeyance. Some of the members may possibly be taken into the coal administration, but there is a general belief in Washington, according to the correspondent of the *ELECTRICAL WORLD*, that they will not care to enter the coal administration under Dr. Garfield, although it may be stated upon authority that Dr. Garfield will welcome the help of all coal men, no matter what their shades of opinion may be or their past affiliations may have been.

SIGNAL CORPS PURCHASING DIVISIONS TO BE CHANGED

Internal Changes in Buying Arrangements—Expectation of Additional Appropriation of \$1,000,000,000 by Congressional Action

A reorganization is in progress in connection with the purchase and supply divisions of the Signal Corps of the United States Army. These divisions, which have been known heretofore as the finance and supply divisions of the Signal Corps, will have added to them within a few days what is to be called the equipment division.

Col. C. F. Wallace, who has been in charge heretofore of the finance and supply division, will become the chief signal officer of the Department of the East, with headquarters at Governor's Island, New York. Robert L. Montgomery, expert accountant at New York, it is understood will be in charge of delivery of materials for the new equipment division, and E. A. Deeds, formerly connected with the automobile industry and also formerly general manager National Cash Register Company, will be in charge of the supply of materials. There seems to be no question that Congress will appropriate in the near future \$1,000,000,000 more for the Signal Corps of the Army in addition to the \$640,000,000 already appropriated.

TECHNICAL EDUCATION URGED UPON HIGH SCHOOL GRADUATES

**Engineers Advise Young Men to Begin at Once
Because of World-Wide Scarcity of
Engineers Due to War**

Leading engineers are unanimous in urging young men, especially high-school graduates, to begin at once on a technical education because of the world-wide scarcity of engineers brought about by war conditions. The South Dakota State College has received many letters from such men.

C. R. Dooley, educational manager Westinghouse Electric & Manufacturing Company, asserts that "the high-school graduate of mechanical talents can serve his country most valiantly by securing a thorough training in engineering or general science, and even though called to the trenches will find his training of inestimable value for leadership. The matter is indeed serious, for if the war continues several years, the Allies may fail for lack of scientific men to plan and construct and direct the efforts of our fighters."

C. E. Skinner, research engineer with the Westinghouse company, spent some time in England in 1915 when the technical schools of that country were practically without students, owing to enlistments for war. He learned from a French scientific commission which visited America that technical schools of that country were almost at a standstill. Therefore, declares Mr. Skinner, the crying need to-day is for engineers, and yet more engineers, both during the war and after its close, and every effort should be made to get increased numbers of men securing an intensive training.

Carl Hering, consulting engineer, Philadelphia, says: "There is no question that technical training is of even greater importance in modern warfare than in times of peace. It is stated that for every man actually engaged on the fighting lines five are necessary elsewhere to supply his needs, and that a very large part of the work of these five is of an engineering character."

A. L. Rohrer, electrical superintendent General Electric Company, Schenectady, writes: "No matter how long or how short the war is to be, we must expect the demands for technically trained men to continue or increase, because buildings, bridges, railways and highways that have been destroyed must be rebuilt and all industrial plants rehabilitated."

Gano Dunn, president J. G. White Engineering Corporation, New York, gives his opinion that "our country will be faced after the war with the most serious industrial competition it has ever had, when we shall need all the technically trained men we can possibly muster. I also believe that technical training will then be at a premium and men possessing it will have more than the usual advantage over men who do not, and unless the high-school graduates start immediately, they as well as the country will not be equipped for success."

South Dakota young men should heed this appeal, in the belief of Dr. E. C. Perisho, president State College. In presenting the advantages of engineering education at State College he says: "If America is to do her full part in this great struggle, we must have a large number of young men who are willing this fall to take engineering work in technical schools. France is now asking the United States to send 10,000 engineers; Russia wants 15,000; China soon will need as many."

SCOPE AND AIMS OF ENGINEERING COUNCIL

Outgrowth of a Real Need for Proper Consideration of General Questions—Work in the War

The American engineering service committee of the Engineering Council has made a public announcement regarding the scope and aims of the council. George J. Foran is chairman and A. S. McAllister secretary of the committee. The announcement is in substance as follows:

The formation of an Engineering Council is the outgrowth of a real need for proper consideration of questions of general interest to engineers and to the public and to provide the means for united action upon questions of common concern. This war has brought out very impressively the actual need for united action. At present the council is concerned with only four societies because that seemed the most practical way of getting a group of men together to answer the immediate needs, but these societies do not assume to speak for all engineering societies in the country. Criticism that they are exclusive in any way is utterly mistaken. There is the hope that such a council by proving itself effective may lead to much wider co-operation in a strictly representative body for all engineers, and thus pave the way for a very much larger union in the future.

How can the council be enlarged? By a union of all societies either as the outgrowth of the present council or by a congress of engineers leading to united action by all societies. The first method will be the most natural one because many local societies and national societies also have a large membership in the four societies at present concerned. We have three classes of engineers to reach—first, those who are members of local societies and not members of national societies; second, those who are members of national societies and not members of local societies, and, third, those who are members of no society. The last-named class constitutes a very large number in our profession. We are almost as mixed as American citizenship, and we suffer therefrom just as much as America, with a population representing every race and every people in Europe. There can be no question of the enormous advantage of union. That union should be completed by strengthening the existing agencies and not by the formation of new societies. The national societies are thoroughly national, notwithstanding an occasional complaint that they are run by New York. If they have not been able to express the democratic spirit of our country as fully as might be desired, it is the fault of the members in all the states and not of the city in which the principal offices are located.

The four societies concerned at present are the American Society of Civil Engineers, American Institute of Mining Engineers, American Society of Mechanical Engineers and American Institute of Electrical Engineers. They have come together in pairs from time to time in the past for special purposes, and there have been general conferences on subjects requiring immediate settlement, but until the council was organized in June there was no permanent body to advise all the societies. We have had many fruitful discussions in the past leading to useful action. The standardization committee, representing five societies, has passed upon commercial standards of all kinds.

Many problems have already been presented before the council. The first duty was necessarily the organization and appointment of standing committees which have already been reported in the press. They might with advantage be mentioned here:

1. Committee on public affairs—C. W. Baker, G. F. Swain, S. J. Jennings and E. W. Rice.
2. Committee on rules—J. P. Channing, Clemens Herschel, N. A. Carle and D. S. Jacobus.
3. Committee on finance—B. B. Thayer, I. E. Moulthrop, Calvert Townley and Alex. C. Humphreys.

Certain questions relate, however, to the war and the assistance that engineers can render. A committee, to be called the American engineering service committee, was

appointed with instructions to invite the co-operation of all engineering societies. This committee in the first instance consists of A. D. Flinn of the Civil Engineers, A. S. McAllister of the Electrical Engineers, George J. Foran of the Mechanical Engineers, G. C. Stone of the Mining Engineers and E. B. Sturgis of the Mining and Metallurgical Engineers. Its present duty is the tabulation and listing of the members of the five societies represented, in order that we as a profession may be in a position to take a larger part in the industries after peace is declared. This tabulation has already been done in part, but in a rather unsystematic and unequal way.

It is hoped that the new committee, by having additions from other societies, may make a final and lasting tabulation of all the engineers in the United States. The list is to be kept in the Engineering Building for general use in government problems and in the industries. At present the committee is devoting its attention to the immediate need of the hour, namely, the procurement of men for special service in the government. Already a list of specialists in the societies has been completed. There are three methods by which engineers may enter United States service—first, through some organization; second, through individual application to a department of the government, and, third, through selection by the conscription law. But this is war service wholly and not civil service, which is the same now as it has always been. As a matter of fact, a great many engineers have already entered through the engineering societies, through colleges and through various special boards in Washington. The importance, however, of a complete list of engineers and their professional specialties cannot be overrated. Such a complete list can be made only with the help of the local as well as of the national societies. The committee mentioned above is organized with George J. Foran as chairman and A. S. McAllister as secretary.

Another committee, of which Harold W. Buck is chairman, is called the war committee of technical societies. The members are H. W. Buck, A. M. Greene, R. N. Inglis, C. R. Corning, G. C. Stone, D. W. Brunton, J. M. Boyle, J. V. Davies, Joseph Bijur, A. S. McAllister, W. D. Richardson and Charles Baskerville. It was appointed to assist any organization in Washington—such as, for instance, the Council of National Defense, the National Research Council and the Naval Consulting Board.

A council organized by the enlargement of the present Engineering Council can be very effective in many ways, without interfering with the autonomy of any individual society. Every society has some definite purpose of its own and also some which it holds in common with all other societies. One of the latter purposes relates to public service and to co-operation. To the end that all societies may understand fully their opportunity, the committee of which Mr. Foran is chairman has made a complete list of all the societies and their officers, and communications will be sent out inviting co-operation, and it is hoped that the council may be successful in arousing sufficient interest to bring about a larger and better council for all engineers.

In organizing the council provision was made for the election to membership of other national engineering and technical societies.

The office of the council will be in the Engineering Building, 29 West Thirty-ninth Street, New York.
CALVERT TOWNLEY, secretary, IRA N. HOLLIS, chairman,
115 Broadway, N. Y. Worcester Polytechnic Institute.

MEMBERS OF THE ENGINEERING COUNCIL

United Engineering Society—Clemens Herschel, B. B. Thayer, I. E. Moulthrop; Calvert Townley, secretary.

American Society of Civil Engineers—John F. Stevens, George F. Swain, vice-chairman; Fred H. Newell, Alex. C. Humphreys, John D. Galloway.

American Institute of Mining Engineers—P. N. Moore, S. J. Jennings, B. B. Lawrence, J. Parke Channing, Edwin Ludlow.

American Society of Mechanical Engineers—Dr. Ira N. Hollis, chairman; John H. Barr, Charles Whiting Baker, Arthur M. Greene, Jr., Dr. D. S. Jacobus.

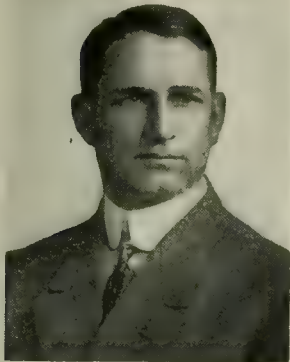
American Institute of Electrical Engineers—H. W. Buck, vice-chairman; E. W. Rice, N. A. Carle, P. Junkersfeld, C. E. Skinner.

George E. Willard, Quakertown, Pa., has resigned as superintendent of the local municipal electric plant.

Andrew W. Rogers has been elected president of the Beverly (Mass.) Gas and Electric Light Company, succeeding the late Sidney Winslow.

G. W. Johns has been appointed manager of the Newton Gas & Electric Company, Newton, N. J., tendering his resignation as manager of the Boonton Gas Light & Improvement Company, Boonton.

M. S. Sloan has been appointed vice-president and general manager of the New Orleans (La.) Railway & Light Company. Mr. Sloan, who is a graduate of the Alabama Polytechnic Institute, first entered the employ of the General Electric Company. During the summer of 1906 he was made chief engineer of the Birmingham (Ala.) Railway, Light & Power Company. He was soon promoted to assistant superintendent of the lighting and power departments of the



M. S. SLOAN

company and in 1907 to superintendent of power. In the following year he became superintendent of the electric department and in 1910, upon his appointment as assistant to the president, he assumed supervision over all departments. Toward the end of 1913 he became connected with the New Orleans property, an affiliated company, as assistant to the vice-president. A few months later he became manager of the railway and electrical departments of the New Orleans Railway & Light company.

George W. Bunnell, president of the Lower Construction Company, Worcester, Mass., has been elected colonel of the First Regiment of Engineers, Massachusetts, formerly the First Corps of Cadets, Boston. Colonel Bunnell is a graduate of West Point, class of 1899, and after several years of military duty was for some time associated with J. G. White & Company, New York, in engineering and construction service. He is in charge of the construction of the hydroelectric power plants of the New England Power Company in the Merrimack River Valley in Massachusetts and Vermont.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

H. C. Holt has resigned as chief engineer at the Prosser plant of the Pacific Power & Light Company.

Stacey C. Richmond, formerly a director of the Niagara Falls (N. Y.) Power Company, has been elected president of the company. He succeeds E. A. Wickes, who has retired.

Frank G. Tappan, formerly instructor in electrical engineering at Cornell University, has been appointed associate professor of electrical engineering at the University of Oklahoma, Norman, Okla., succeeding Lester W. W. Morrow.

Lester W. W. Morrow, who has been associate professor of electrical engineering at the University of Oklahoma and acting head of the department the past year, has been made professor of electrical engineering and head of the department, succeeding Professor Bozell.

F. H. Lane, manager of the department of examinations and reports of H. M. Byllesby & Company, will have temporary charge of the engineering and construction department, succeeding W. R. Thompson, now a captain in the United States Army, stationed at Battle Creek, Mich., and A. H. Sayce, who has joined the Second Officers' Reserve Camp at Fort Sheridan.

Prof. A. M. Buck, who for the last six years has been in charge of the electric railway courses at the University of Illinois, has resigned to join Mr. John A. Beeler, of 52 Vanderbilt Avenue, New York City, in the consulting field. Professor Buck was born in Washington, D. C., in 1881, and received his early education in the public schools of that city. He received his technical education at Sibley College, Cornell University, graduating with the degree of mechanical engineer in 1904. He was instructor in electrical engineering at Cornell for one year, assistant professor of electrical engineering at New Hampshire College for two years, and professor of electrical engineering at the Clarkson School of Technology for one year, previous to assuming his duties at the University of Illinois. He was also connected with the D., L. & W. for a short period, and has held positions in the engineering departments of the Westinghouse Electric & Manufacturing Company and the Mechanical Appliance Company. He is the author of "The Electric Railway," a standard text-book, and a number of articles which have appeared in the technical press from time to time. Professor Buck is a member of the American Electric Railway Association, the American Institute of Electrical Engi-

neers and the Society for the Promotion of Engineering Education, and is a fellow of the American Association for the Advancement of Science. He also received the degree of electrical engineer from the University of Illinois in 1917. His new work will consist largely of investigations dealing with the construction, operation and management of electric railway properties.

Obituary

Ernest Harlan Haughton, general manager of the Bryan-Marsh division, National Lamp Works of General Electric Company, Chicago, who together with his wife lost his life on Aug. 22 when on an automobile tour through the Adirondacks, was a graduate of the University of Nebraska in the class of 1895. He started his career as an inspector with the Underwriters' Electrical Testing Laboratories. He remained but a short time, when he decided to enter the field of salesmanship,



E. H. HAUGHTON

in which he was active until his death. On Sept. 1, 1901, he entered the incandescent lamp business, selling lamps at first in Southern territory. On Jan. 1, 1902, Mr. Haughton resigned from the Morgan Lamp Company and joined the Bryan-Marsh Company, which he served in the capacity of a salesman from that date until the following October, when he became manager of the company's Cincinnati branch. He continued in this position until Jan. 1, 1904, and on Aug. 1, 1904, he became manager of the company's main office at Chicago. The funeral was held at Henderson, Ky.

Arthur Kneisel, national treasurer for the American Association of Engineers, died in Chicago on Aug. 17. He was one of the original promoters of the association and was secretary up to this year. Mr. Kneisel was born in Lexington, Ky., in 1880, and received his early education in the Lexington schools, later graduating from the University of Kentucky. He went to Chicago more than fifteen years ago and was engaged as a telephone engineer and patent attorney. At the time of his death he was president of the Utilities Development & Sales Company.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Report of Merchants' Heat & Light Company, Indianapolis.—The Merchants' Heat & Light Company, Indianapolis, has filed its annual report for the year ended June 30 with the Indiana Public Service Commission. The total operating revenue was \$1,199,668, of which \$313,418 was from steam and hot-water heating. The report shows a total of 52,171,800 kw.-hr. generated during the year, of which 39,099,539 kw.-hr. was sold.

Increasing Use of Electricity in Hawaii.—During the last year 500 electric light connections have been added to the system of the Hilo (Hawaii) Electric Light Company, and forty electric ranges, eighty-five water heaters and about 1000 socket appliances have been sold. The motor load has been increased by 600 hp. This company, which is the only electric company on the island, has a rating of about 2000 kw. The company has ordered a 1000-hp. generator to be operated by water power, which is to be added to its present plant. Still another water-power development is contemplated. New equipment has been ordered for reconstruction of the street-lighting system at a cost of about \$5,000.

Limitation of Imports of Electrical Equipment.—United States Consul General George H. Murphy, Cape Town, South Africa, reports that the Cape Town Chamber of Commerce has received the following letter from the Secretary for Mines and Industries: "In view of the position in which the electrical industry of the United Kingdom is placed in regard to its export trade, owing to restrictions of manufacture and exportation involved by the war, it is desired to call the attention of your chamber to the desirability of deferring as far as possible the calling for tenders for electrical machinery and equipment for public contracts until the conclusion of hostilities."

Power for Oil Pumping in California.—A. G. Balch, vice-president San Joaquin Light & Power Company, Fresno, Cal., is quoted as follows: "The strong financial position of the company and the rapid extension of its system might be attributed in a measure to the power demanded by the various oil companies for pumping purposes. To give an idea of the magnitude of this business, we have expended in the neighborhood of \$1,000,000 so far this year for extensions to take care of new business, necessitating the use of 700,000 lb. of copper, which in itself is a considerable item at present prices. The San Joaquin company is now serving 1500 wells, or 10 per cent of the wells in the field. Owing to the lack of

transformers over 200 wells contracted with cannot be supplied with power. We are serving all of the larger companies, which find that it is profitable to pump with electric power when oil is selling above 35 cents a barrel in the field. Electric installation costs about \$500 per well, gas engine equipment about \$900 and steam equipment about \$1,200. Aside from the original cost and the saving in power, one man can take care of from sixteen to twenty electrically equipped wells and only of eight gas or four steam rigs. The last item in itself is a considerable saving."

Consolidation in Indiana.—R. E. Breed, president Indiana General Service Company, Elwood, has filed with the Indiana Public Service Commission a petition for authority to merge several properties. The Indiana General Service Company, it is proposed, will purchase the Marion Light & Heat Company and the Muncie Electric Light Company. The petition asks authority for the issue by the Indiana General Service Company of \$3,000,000 common stock and \$207,700 preferred stock, with \$3,359,500 bonds. These are to be used to retire bonded indebtedness and stock of the companies. Mr. Breed said that no increase in capitalization of the companies was involved.

New Zealand Water Power Development.—The chief electrical engineer of the public works department of New Zealand has recommended that three sources of water power should be developed in the North Island—Lake Waikaremoana for the Hawks Bay district; Arapuni Gorge (about 8 miles from Horahora), or some other place to be selected, for the Auckland district; and the Mangahao River for the Wellington district. The Wellington plan for 25,000 hp. will cost about \$5,000,000 and the Auckland plan for 30,000 hp. about \$6,000,000. It is recommended that the development of Lake Waikaremoana should be deferred for the present, and that the Auckland and Wellington schemes should proceed simultaneously.

Hydroelectric Development in Spain.—United States Consul General Carl Bailey Hurst writes from Barcelona: "The growing need of coal in Spain has emphasized the importance of utilizing more generally the hydraulic power available in this country. Although the conversion of hydraulic power into electric energy has greatly developed in the Peninsula during recent years, it is estimated that at present not more than 8 per cent of obtainable hydroelectric force is employed. Could more capital be invested in the exploitation of resources, the electrification of the railroads and manufacturing plants of Spain would be easy. The Unión Eléctrica Española publishes statistics showing that 170 hydroelectric plants operated in Spain have 881,174 hp. available, with only 384,297 hp. exploited. As the figures given do not include quite all such plants, it is estimated that the force exploited yields 400,000 hp. at present and will reach 500,000 hp. when work already under way has been completed.

The capital invested in hydroelectric enterprises amounts to \$500,000,000. Most companies work on comparatively small capital, only six of them being capitalized at over \$4,000,000. The most important is domiciled in Barcelona and already disposes of about 100,000 hp. Next in importance is a French company, which utilizes twenty-four natural lakes."

Electric Announcer at Dutch Auctions.—Paul L. Edwards, clerk to the United States commercial attaché at The Hague, writes that at the regular trade auctions in the Netherlands, instead of having an auctioneer call for bids, a large dial is provided with an index hand. The face of the dial is marked with prices, increasing in clockwise fashion. The hand is set at a price above that which the goods offered will probably bring, then is slowly moved to lower and lower figures until some trader indicates willingness to buy. Electric push buttons are connected with the dial, which traders press when a price satisfactory to them is shown. As the trader presses his button his number appears on the face of the dial and the lot of goods is sold to him at the price indicated.

Oregon Commission Asked to Prevent Competition.—Complaint has been filed with the Oregon Public Service Commission under the public convenience and necessity clause of the law by the North Coast Power Company against the Portland Gas & Coke Company, asking that the Portland company be required to cease invading the Tualatin Valley in competition with the plaintiff without having first obtained a certificate of public necessity. The North Coast company has operated in the Tualatin Valley since Sept. 29, 1915, furnishing electricity for heating and lighting in Garden Home, Beaverton, Orenco, Hillsboro, Cornelius, Gaston and Dilley, and it declares that the Portland company is extending its plant into the territory where it had not served previous to May 21, 1917, and that such extension will cause a duplication of electrical service equipment.

Electric Central Station in India.—United States Consul Lucien Memminger, Madras, writes that the English concern of Best & Company, Ltd., First Line Beach, Madras, has applied recently to the government for a license to establish an electric lighting and power plant in Madura, 344 miles from Madras. Madura has 134,130 inhabitants and next to Madras is probably the most important city in South India. At present it has no electric power establishment or modern lighting system. If the license is secured, the scheme will be the most important of its kind in all this part of India with the exception of the lighting systems at Madras and at Bangalore Mysore. All public lighting in Madras and Bangalore is by electricity, there being no gas-lighting companies in this district. Petroleum and lamps with vegetable oils are used to a considerable extent.

American Telephone Service.—An American officer landed from one of our ships at a certain port in France. He hurried to a post office to telephone to Paris. "Your number," said the employee, "is twenty-three." "What do you mean by that?" the officer inquired. "There are twenty-two ahead of you." "How long will it take?" "They average about ten minutes apiece." The officer departed. Five days later there were nine new telephone lines to Paris from that port. This incident is reported by Norman Hapgood in the *New York Evening Post*.

Increased Rates Asked by Rome (Ga.) Utility.—The Rome (Ga.) Railway & Light Company has sought the permission of the Georgia Railway Commission to increase its rates. The company seeks to raise the minimum bill from 50 cents to \$1 a month, to add 1 cent per kilowatt-hour to the respective quantities used per month, to have a base rate of 10 cents per kilowatt-hour for the first 100 kw.-hr. and a minimum rate of 6 cents for all above 1000 kw.-hr., to increase the rate for sign-advertising lighting from 5 cents to 6 cents, to increase the minimum bill for motor service from 75 cents to \$1.50 per month, and to add 0.5 cent per kilowatt-hour to each class of motor customers.

Restricted Supply of Electrical Energy at Hongkong.—United States Consul General George E. Anderson, Hongkong, British China, writes: "A public service corporation rarely is able, as the result of a year's business, to declare a dividend of 30 per cent on its stock, place one-sixth of the amount of its paid-up capital to increase its reserves, write off its plant account more than one-third of the amount of its stock, and be compelled to call upon its patrons, the public, not to use its product so freely. Nevertheless, this is the record of the Hongkong Electric Company, Ltd., which supplies electric light and power for the principal portions of the colony as distinct from another concern which serves Kowloon and the mainland of the colony. The unusual business condition arises from the great increase in the use of electric light by Chinese residents of Hongkong and from the inability of the company to obtain the equipment needed to complete a new plant it has had under construction. Apparently no effort has been made by the concern to get the equipment in the United States."

Extension of Electrical Systems in England.—United States Vice-Consul Hamilton C. Claiborne, Bradford, England, writes: "Much attention is being given to the investigations and recommendations of the committee appointed by the board of trade to report upon the possibilities of extending and interconnecting various sources of supply and providing economical and convenient electric power for British industries. The full report of the committee is not yet available, but a great deal of discussion upon the subject has recently appeared in the English press. It is suggested that a national power

distribution system is as important as national railway, road, telegraph and telephone systems, and stress is laid upon the advisability of insuring that there shall be an adequate and economical supply of power for all classes of consumers in the United Kingdom, particularly industries that depend upon a cheap supply of power for their development. The intercommunication of existing municipal electrical plants and the establishment of central generating stations are among the questions now being given practical attention."

Southern California Edison Stock Offering.—The Southern California Edison Company has applied to the California Railroad Commission for authority to enter into subscription contracts with employees so that they may become shareholders on a special payment plan. The company still has unsold 21,174 shares, par \$100, which it offered to stockholders at 88. The stockholders bought 3826 of the 25,000 shares offered, and the company wants to sell 7000 shares to department heads and officers and 5000 shares to other employees, and the remainder of the 25,000 shares to the general public, if the employees do not care for more. To officers and department heads it wants to offer the shares on a payment of 7½ per cent of the purchaser's salary each month, with 6 per cent interest on unpaid shares, dividends to be retained and credited. The entire balance of the purchase price must be paid by Oct 1, 1922. To general employees the company offers the same terms, but without limitation as to time of final payment. Employees are to pay 88 a share and the general public 89 per share cash or 90 in installments.

Hydroelectric Development in Sweden.—United States Consul B. M. Ras-musen writes from Gothenburg, Sweden, that owing to the scarcity of coal and coke hydroelectric power plants are being extended and new plants constructed with all possible speed. The government hydroelectric power plant at Trollhättan is being enlarged by eight new machine units. The flow from Lake Vänern will be regulated at an expense of \$3,484,000, and a new power plant near Trollhättan is to be built. The government Water Power Board has drawn up a preliminary contract for the delivery of 12,000 kw. from the power station at Trollhättan to the Aktiebolaget Elektro-Salpeter, at Stallbacka, which plans to manufacture nitrogen products by the Norwegian Birkeland-Eyde electric methods. The minimum capital stock, \$857,600, has been subscribed; the maximum will be \$2,572,800. Production is estimated at 7000 tons per annum. A high-tension electric transmission line is to be built from the government transforming station at Alingsas to a new transforming station at Sjömarken to provide electric power for several factories. Another company was organized at Hesselholm for building a hydroelectric power plant to distribute current. Committees were appointed to investigate the utilization of electric power for agricultural purposes.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 461 of this number.

Denver Section, A. I. E. E.—At a recent meeting of the Denver Section of the A. I. E. E. the following officers were elected: Chairman, Norman Read; vice-chairman, Fred J. Rankin; secretary-treasurer, Robert B. Bonney. R. G. Griswold delivered an address on "The Development of Gas versus Electricity for Domestic Uses."

Long Island Contractors Meet.—Forty Long Island electrical contractors met at Babylon, L. I., recently and formed the Association of Electrical Contractors of Long Island, with a view of affiliating with state and national associations at some future time. The officers chosen were R. M. Mansfield, Babylon, president, and S. Howard Titus, Patchogue, secretary.

Activities of Panama Engineers.—The Panama Section of the A. I. E. E. elected the following officers for the coming year: Chairman, C. J. Embree; vice-chairman, E. D. Stillwell; secretary-treasurer, W. F. Kleene; executive committee, E. S. Guild, H. W. Jacobsen and R. D. Prescott. Captain T. H. Dillon gave an outline of the conditions under which an engineer regiment might be formed on the Canal Zone. At a later meeting of this section the following papers were presented: "Inspection, Tests and Specifications for Lock Equipment," by C. J. Embree, and "Galvanic Action Between Metals, and Life Tests of Paints," by F. B. Coyle.

Oregon Contractors to Meet.—The second annual convention of the Oregon Association of Electrical Contractors and Dealers will be held on Sept. 17-18 at Eugene, Ore. The important addresses of the meeting follow: Address of welcome, by J. E. Shelton, editor *Eugene Guard* and chairman of publicity and convention bureau of the Eugene Chamber of Commerce; response, F. C. Green of Portland, Ore., president Oregon Association of Electrical Contractors and Dealers; paper, "Business Methods and Outlook," by C. D. Rorer of Eugene, president Bank of Commerce of that place; address, "Oregon's Electrical Industry," by Franklin T. Griffith of Portland, Ore., president Portland Railway, Light & Power Company; paper, "The Need of Proper Electrical Inspection and How to Organize an Electrical Inspection Department," by F. Dunlap of Portland, Ore., chief electrical inspector of the bureau of buildings of that city; paper, "The Electrical Jobber," by J. I. Colwell, Northwest manager Western Electric Company of Seattle, Wash. A good attendance is expected.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

SELLING BY MAIL IN WHOLESALE QUANTITIES

**Several Electrical Manufacturers Are Now Trying
This Method with a Gratifying
Amount of Success**

At the present time, owing to enlistments, the draft and other causes, there is a very noticeable shortage in salesmen. Help wanted columns in the daily papers show an ever-increasing call for salesmen in every line. The electrical line, of course, feels this condition as well as the others. As a result some manufacturers and large distributors have been trying out the mail method of selling. No attempt is made to hide the facts. The customer is told that he can save both himself and the company time by doing his business by mail. The results obtained, it is understood, have warranted a further use of the mails for sales purposes under the abnormal conditions that have now to be met.

A report from one company that tried this plan with its smaller customers shows that out of 100 cards mailed out fifty-six replies were received within two weeks, resulting in eight orders. In this case the goods for sale were different kinds of switching equipment. In this particular case the manufacturer offered immediate deliveries as an additional inducement to customers to take advantage of the new method of selling electrical goods.

PRICE-FIXING PROGRAM CAUSES UNCERTAINTIES

**Business Falls Off and Prices Remain Stationary—
Possibility of Establishing Premiums
for Delivery**

There have been fewer changes in prices on electrical goods during the past two or three weeks probably than in any other period of similar length in the past two years. In addition, for the first time in that period there has come a lull in buying, and demand outside of government orders has fallen below normal.

In no small amount can these conditions be traced directly to the uncertainty that exists regarding the ultimate goal of the government in its price-fixing scheme. The action taken in connection with coal has been interpreted as an indication of the procedure that may be expected in other directions.

Should the government fix maximum prices on raw materials much lower than prevailing prices, there is no small belief that it would act to prevent higher prices of manufactured products and in some instances even force a reduction. Consequently manufacturers hesitate to make any move, and buyers are loath to lay in stocks that may at any moment depreciate in value owing to a falling market. That this latter action is taken in the face of winter approaching, with the railroad situation not all that is to be desired, and realizing that the railways will undoubtedly be under a more severe strain with the national army in training, is significant.

However, there is another phase of the situation that is being taken into consideration. The fundamental economic law of supply and demand, it is felt in many quarters, will continue to obtain, the government notwithstanding.

The prices to be fixed by the government, if present indications can be relied on, will, if lived up to, prevent certain

producers from operating. It is well known that certain copper mines that have a very considerable production cannot produce copper for less than 20 cents. On a 22.5-cent basis they would probably cease to operate, for the 2.5 cent and less margin that this would mean would hardly be worth the risk of operating.

Therefore it is argued that production will be cut down. On the other hand, the government has promised to stimulate production, and consequently a way out is being sought by the trade and there is a strong belief that the way out will be through premiums.

In other words, the quoted price will conform to the government's maximum, but in order to obtain delivery in any acceptable time it probably will be necessary to pay a premium sufficient in amount to provide a return more commensurate with the risk and demand. The delivery situation, therefore, will be the controlling factor.

Should this situation occur, it is doubtful if any decrease in price can be expected, and in fact when such a scheme is resorted to there are reasons to believe that even higher prices may obtain.

CASH DISCOUNT SITUATION UNDER INSPECTION

**Practice Has Been Found Open to Many Abuses
Which Manufacturers Are Now in a Favor-
able Position to Correct**

Wholesale distributors of electrical goods are turning their attention to the so-called cash discount in an effort, if not to abolish it, at least to have the terms of it exactly understood by those who would take advantage thereof. The cash discount really is not a discount, but is rather a premium for prompt payment. It costs considerable to have bills outstanding, and the distributor has been willing to recognize this, not by selling to the prompt payer at a smaller amount, but by returning to him a certain amount of the purchase price when the account is paid within a certain definite time.

This system, however, is open to many abuses which in the almost non-competitive market of to-day the distributor is in an admirable situation to correct. Buyers, many of them, believe that, although the cash discount terms are say, 2 per cent ten days, it does not really matter if eleven or twelve days are taken. They send in their check with the discount subtracted. Of course, in a number of cases, perhaps most cases, the distributors have been to blame, for they have accepted the amount and receipted the bill.

It is safe to say, however, that more and more distributors are becoming firmer and refusing to allow any credit unless the full terms are complied with. It is manifestly unfair for some to be lax while others are firm, but the number of lax ones is diminishing rapidly.

In fact, the entire practice is meeting with less and less favor among the manufacturers. Already many have dropped this practice, and a number of others are contemplating doing so. It is doubtful, however, if the industry is yet ready as a whole to abolish the practice of cash discounts.

The Electrical Supply Jobbers' Association at its recent meeting held at Hot Springs, Va., adopted the following resolution:

"Resolved, That it is the sense of this meeting that the discontinuance or reduction by manufacturers of cash discounts to distributors would be detrimental to the best interests of the jobbing industry."

RAPID GROWTH IN EXPORTS
OF ELECTRICAL APPARATUS

Compilation Shows Increasing Demand from All
Parts of the Globe for Merchandise of
American Manufacture

American electrical apparatus is gaining rapidly in popularity the world over. A compilation by the National City Bank of New York shows that the value of electrical machinery, appliances and instruments exported from the United States in the fiscal year 1917 aggregated more than \$50,000,000 against \$30,000,000 in 1916, \$20,000,000 in 1914, \$10,000,000 in 1911 and \$6,000,000 in 1900.

Of the nearly \$2,000,000 worth of telephones exported in the fiscal year 1917, more than \$100,000 worth went to Asia, about an equal value to South America, nearly \$100,000 worth to Oceania, \$300,000 worth to our North American neighbors, and practically \$1,000,000 worth to Europe, the total of telephones exported in 1917 being twice as great in value as in 1912. Of the nearly \$500,000 worth of electric fans exported in 1917 the largest market was in India, while Hongkong, the Straits Settlements, China, Japan, and even Siam, were also large buyers.

Electrical apparatus of all sorts sent to Asia increased from \$1,000,000 in 1910 to approximately \$2,500,000 in 1917; to Africa, from \$298,000 in 1910 to more than \$500,000 in 1917; to Oceania, from \$650,000 in 1910 to approximately \$2,500,000 in 1917, and to South America from about \$3,000,000 in 1910 to approximately \$4,000,000 in 1917, while the total of 1917 is nearly ten times as much as in 1900 and thirty times as much as in 1890.

METAL MARKETS CONDITIONS

Prices Still Softening in Anticipation of Government
Price Fixing

There was a general softening in the quotations for different metals in the New York market last week. Probably the most conspicuous factor was the government price-fixing program. Based on the prices fixed for soft coal and later for hard coal, dealers in metals foresaw much lower prices for metals than had formerly been expected. In some quarters a price as low as 20 cents would not be surprising, although the consensus of opinion within the trade is that a price in the neighborhood of 22.5 cents may well be expected. There seems to be no doubt now that the price to the Allies will be the same as the price to the United States government. All of this has had the effect of forcing the market down, so that 25-cent spot copper seems now only a matter of a few days.

Copper prices of course are nominal, and actual purchases can be made only on a bargain between buyer and seller, which in most cases represents higher prices than prevail in the daily market quotations. Quotations on electrolytic were quoted nominally on Monday as follows: September, 26 cents; October, 25.5 cents; fourth quarter, 24.75 cents.

NEW YORK METAL MARKET PRICES

	Aug. 20			Aug. 27		
	£	s	d	£	s	d
Copper:						
London, standard spot	120	0	0	120	0	0
Prime Lake				27.00	to	28.00*
Electrolytic				26.00	to	26.50*
Casting				25.50	to	26.00*
Wire base				32.00	to	32.00*
Lead, trust price	34.00	to	37.00			
Nickel, ingot	11.00			11.00		
Sheet zinc, f.o.b. smelter	19.00			50.00		
Spelter, spot	8.40			19.00		
Tin, Straits	62.75			7.92½	to	8.30
Aluminum, 98 to 99 per cent.				61.50		
				44.00	to	46.00

OLD METALS

Heavy copper and wire	25.00	24.00	to	25.50
Brass, heavy	16.00 to 16.50	15.00	to	15.50
Brass, light	12.50 to 13.00	12.50	to	13.00
Lead, heavy	8.50 to 9.00	9.00	to	9.25
Zinc, old scrap	6.25 to 6.75	5.50	to	6.00

*Nominal.

THE WEEK IN TRADE

THERE was practically no change in the volume of business in electrical materials during the past week from that experienced during the two or three previous weeks. It is very evident, however, that regular business is falling off, the gap being closed by government orders. Fall business is opening up a couple of weeks earlier than usual, probably on account of the delivery situation. Prices remained stationary during the week. It is doubtful if any considerable amount of price change will be evident until the government makes known its decision regarding maximum prices for raw materials, particularly copper and iron and steel.

NEW YORK

Business from regular directions has fallen off considerably of late. Total demand probably will be found to be maintained, but only on account of the tremendous buying for government work. Some factories are doing nothing but government work. It is probably true that some of the let-up in incoming orders is due to a realization of the congested condition of the factories working on war contracts and a consequent deferment of purchases until it is possible to talk deliveries.

Ordinarily there is a lull at this time of the year, but now in comparison with the flood of incoming business that was experienced in previous months of the year the falling off appears much larger.

While the government's program on price fixation took on a broader aspect during the week, and while the intentions of the government seemed more apparent, there was still a large amount of uncertainty and very few changes in price occurred. There seems to be considerable doubt expressed that the government can maintain its announced program and still stimulate production.

The growing scarcity of salesmen is particularly noticeable. A number of salesmen have enlisted; others have been drafted. For these and other reasons there are a large number of sales positions open.

INCANDESCENT LAMPS.—Fall business opened a week or two earlier this year than ordinarily and there is now a good demand. Deliveries are good. Some factories are having a hard time filling orders in certain types, but this deficiency is made up by an exceedingly strong position in other types.

FLASHLAMPS.—Total demand is very large, but this includes some government contracts. With the dealers, however, business is pretty quiet.

BELLS AND GONGS.—Except for government work business is soft. The scarcity of new building is particularly discouraging to this line.

MOTORS.—There has been a decided slump in incoming orders for small motors locally. One manufacturer estimates the falling off to be in the neighborhood of 25 to 35 per cent. Prices, however, are still increasing, another advance in the neighborhood of 15 per cent having taken effect within the last few weeks. Export demand is picking up, and it is felt that present inquiries should develop into an excellent foreign trade during the fall months.

OUTDOOR LIGHTING FIXTURES.—Business at present is unusually good, with a very considerable demand for units for lighting government cantonments and camps. The call for ornamental lighting equipment is also good, some very large jobs being reported. Export inquiries are better and a good trade is under way. Prices continue to advance. In fact, almost every month advances of some kind are announced.

LIGHTING GLASSWARE.—Another increase was announced early in August. The fall season is now opening up and a good demand is noticed. Automobile headlamps are moving very fast.

PROJECTORS.—Business has fallen off perceptibly, although the outlook appears promising. Some of the manu-

facturers have recently advanced prices and other advances are looked for.

WIRE.—There is little change in the copper wire situation. Most manufacturers are quoting on either 36-cent or 37-cent base, with one on 35 cents and another on 38 cents.

HEATING APPLIANCES.—The Hotpoint Electric Heating Company has sent notices to the trade announcing an advance in prices of chafing dishes, grills, heaters, percolators, tea kettles, toasters and immersion heaters, effective Sept. 5.

WATERWHEELS.—One large manufacturer of waterwheels reports that its plant is running to its full capacity, a large part working day and night. Collections are exceptionally good. No new business is being solicited, by reason of which very few orders are being booked; the company, however, has business enough to keep it going for the next year; the number of employees is greater than it was a year ago, and the operating conditions are favorable.

CHICAGO

Jobbers report business somewhat better during the last week, with increased requests for quotations. The opinion is frequently expressed, however, that manufacturers' prices are being raised unduly and that general construction will remain at a standstill until the markets become more settled. There is also a feeling that all energies should be concentrated on filling government demands before making extensions not essential to the war.

Possible legislation on steel and copper prices is adding to the uncertainty of the market. If prices are fixed, orders now held in abeyance will be released whether the price level is high or low.

CABLE FITTINGS.—Manufacturers of devices for overhead and underground distribution report unusually heavy business. The July, 1917, business of one manufacturer was over six times that of July, 1916. Part of the demand is probably due to central-station extensions to industrial plants having war orders.

ELECTRIC RANGES.—Business is steady and government orders are mostly completed.

WASHING MACHINES.—All manufacturers report a very heavy demand.

SECOND-HAND MACHINERY.—Dealers are having good sales, but are experiencing considerable difficulty in obtaining equipment.

METERS.—The demand is steady and deliveries are good except in larger sizes.

TRANSFORMERS.—Deliveries are very poor. Manufacturers are unable to promise shipment on some sizes in less than twelve months.

LIGHTING FIXTURES.—The general trend is toward steel-stamped fixtures. Business in this type will undoubtedly increase as manufacturers are able to install the necessary machinery and develop manufacturing methods. The general tendency is to push sets in standard packages.

MINE LOCOMOTIVES.—The Calumet & Hecla Mining Company has placed an order for thirty-one Goodman locomotives, each equipped with forty-eight cells of "Ironclad-Exide" batteries.

BOSTON

The volume of trade has continued to slow up somewhat in New England electrical circles during the past week, and not much increase is anticipated until after Labor Day. The tide of vacation travel is beginning to turn toward the cities, and some increase in inquiries is noted by dealers in fixtures and other domestic supplies. Prices remain steady and collections are reported a trifle slower. Industrial demands are very active. Central stations report a good summer in respect to appliance sales. A number of active campaigns are planned for early fall. Government work is increasing in volume, and in some quarters the view prevails that federal price regulation under the food control bill may lead to some reduction in the cost of raw materials used in

the electrical industry. At least, there is some reason to think that higher prices will be deferred for some time unless the actual draft of men for overseas service proves more serious than at first appears likely. There is already a marked shortage of labor in electrical manufacturing.

LAMPS.—Prices remain firm, with a heavy volume of business. It is said that better service has been given to the trade this year by lamp manufacturers than by any other producers of electrical apparatus. Deliveries are good at present. It is expected that there will be a shortage in lamps this fall, although strenuous efforts are being made to increase production facilities. This fall one factory in Boston will have increased its production rate from 48,000 to 100,000 lamps per day in response to increasing demands. Stocks are at present somewhat larger than earlier in the summer.

APPLIANCES.—Business remains good in various staple lines, and recent price increases appear to have had little effect in discouraging popular interest in domestic equipment. Trade has been adversely influenced, however, by the marked dullness experienced in the residential building field this summer, due largely to high cost of labor and materials. Flatirons continue in steady demand and fans are nearly sold out of many stocks.

FIXTURES.—Some improvement is noted in the fixture demand, and dealers are expecting an increased sale in September. Although factory prices have stiffened somewhat, retail prices have not as yet been increased. Stocks are in excellent shape for the fall movement, and prompt deliveries can be made in most cases covered by recent inquiry. Commercial fixtures are in fairly good demand.

ELECTRICAL SUNDRIES.—Small motors, bell transformers and other sundries are in considerable demand. A shortage in skilled labor is reported and the increase in government orders has in some cases greatly curtailed development work outside war requirements. Telephone apparatus is in great demand for war and industrial service at present. Inquiry of independent manufacturing interests regarding the possibility of supplying the present commercial shortage in Bell apparatus from outside sources leads to the opinion that little aid could be expected at present, even were the Bell interests disposed to seek it, on account of the need of extended engineering development and present activity of all manufacturing plants.

STORAGE BATTERIES.—Batteries for signaling, fire alarm, military and naval service are in great demand. No recent price advances are reported. It is rumored that a break is imminent in the price of lead, and that this may affect the market for batteries of that type.

WIRE AND CABLE.—The volume of business holds up well. Manufacturers report gaining somewhat in factory stocks. Government orders are active and installation work at the Ayer (Mass.) cantonment is proceeding very rapidly. An 8-mile transmission line to this cantonment was completed last week in six weeks' total time.

ELECTRICAL REFRIGERATING MACHINERY.—An excellent trade in this class of equipment is reported for this summer. Deliveries are growing longer and high prices still rule. Government orders bulk large in this field. Residential demands are very quiet at present, and little attempt to encourage this branch of the business is expected this fall.

IRON CONDUIT.—The situation remains unsatisfactory. Jobbers' stocks appear to be getting lower. No recent price movements are reported, and no immediate changes are forecast.

WATER-SPRAYING EQUIPMENT.—The Spray Engineering Company of Boston, Mass., reports that the month of June was the best in the history of the organization. Inquiries are being received from foreign countries, and recent sales include cooling ponds or equipment for China, Ecuador and Cuba. Domestic orders include the following: Consolidated Coal Company, Fairmount, Pa., cooling equipment, 20,000 gal. per minute; United Illuminating Company, Bridgeport, Conn., three air washers; Minneapolis (Minn.) General Electric Company, air washer, capacity 60,000 cu. ft.

per minute; Lackawanna Steel Company, New York, two air washers, capacity 74,000 cu. ft. per minute; United Gas & Electric Company, New Orleans, La., one air washer, capacity 50,000 cu. ft. per minute; Pittsburgh Steel Company, Pittsburgh, Pa., air washer, 45,000 cu. ft. per minute, and for the Consolidated Gas & Electric Company, Baltimore, Md., the largest washer the company has so far built, having a capacity of 125,000 cu. ft. of air per minute. At the Waterbury (Conn.) station of the Housatonic Power Company a fifty-thousand-dollar spray cooling installation is to be completed within six weeks, and a novel feature of this installation will be the supporting of the spray nozzles by Archbold-Brady structural steel frames 50 ft. over the river edge without supporting piers in the water. This construction was determined upon to avoid difficulties from ice in the neighborhood of foundations.

ATLANTA

The general building situation in the Southeast is slowing up, but activity in Atlanta seems to be increasing. The number of permits for buildings in the Atlanta fire district shows a slight increase due to lessening of pressure on government work in this vicinity.

The electrical contractors report a good business and a slight improvement over last week. Collections also continue good. Up to date the miscellaneous supply business for the Southeast shows an increase of approximately 80 per cent over 1916. This increase is accounted for by the fact that a number of concerns are rehabilitating and utilizing old apparatus for their own use or for sale at a good profit, as indicated by the great activity in second-hand machinery. On the whole, the position of the electrical business is excellent at this time.

OIL-BREAK CIRCUIT BREAKERS.—There is a very strong demand in the face of long deliveries.

APPARATUS.—The market in general is good for nearly all types of heavy equipment. Street-railway extensions to the cantonment have stimulated the demand for rotary converters.

PANELBOARDS.—Activity seems to be increasing in this line, owing probably to the finishing up of a number of business structures.

CONDUIT.—Increasing length of deliveries is apparently slowing up demand. Prices remain about the same. Deliveries of five to six weeks are being promised. Local stocks are 25 per cent below normal.

OUTLET BOXES.—There seems to be very little demand at the present time, as jobbers purchased heavily previous to the last price advance and stocks are, on the whole, in fair shape.

ELECTRIC HOISTS.—Manufacturers of this class of equipment are enjoying an excellent business, and the present manufacturing facilities are not sufficient to handle all the immediate requirements. Shipbuilding plants of all descriptions are being erected at Southeast coast cities as rapidly as material and labor will permit. This class of construction has also stimulated the lumber industry, and in most cases both of these industries have been able to secure preferential shipment on hoisting machinery as the lumber is being used for government construction in cantonments and shipyards.

THEATRICAL DEVICES.—As the many men at cantonments will require entertainment and amusement, a number of new theaters are under construction, which in turn has created a very strong demand for theatrical devices. Deliveries on theatrical devices are reported to be quite satisfactory, with the exception of dimmers, on which there is said to be a considerable delay.

TRANSFORMERS.—Sales for the Southeast covering 150 kva. and below for the first thirty weeks of 1917 show an increase of approximately 65 per cent as compared with 1916.

SWITCHBOARDS.—A number of good orders have been placed recently and there has been no break in the normal demand. Delivery promises vary from six months to one year, depending on type of equipment.

SEATTLE

Electrical interests in the Northwest report business about the same as last week, with trade active in exceptional cases. Prices rule at virtually the same level that they were on last week.

Organized lumber manufacturers in Washington recently announced a continued and practically unanimous shutdown of all Northwest lumber mills and logging camps until after Jan. 1, with the exception of those plants working on spruce for government aeroplanes. Oregon mills plan to continue operation. With the market falling and no new business in sight, Washington lumbermen state that the present strike in mills and camps has resulted in curtailing production. Mill operators are taking advantage of shut-down to make needed repairs and in some cases extensions and betterments, which means the purchase of considerable electrical equipment, including motors, transformers and switchboards. Development work in mining that would be active is being held up by labor scarcity, unsettled labor conditions and exorbitant prices for all mining supplies. Considerable equipment, however, was sold during the summer for mining work, but demand is very slight at present. A strike at the shipyards involving a majority of the Seattle plants is again probable. Credit and collections continue satisfactory. Labor in the electrical field is very difficult to obtain, and the situation is growing more serious. Reasons given are high wages in shipbuilding, plenty of other remunerative work, and the draft.

FARM LIGHTING OUTFIT.—One big Seattle firm recently inaugurated a selling campaign, and satisfactory results are confidently expected. These outfits are comparatively new in the Northwest and fill a popular demand that promises to grow.

HOUSEHOLD APPLIANCES.—Heating devices and novelties are moving satisfactorily.

MACHINERY.—Demand for electrical machinery is good. Shipments are fairly easy, but do not meet requirements.

CANTONMENTS.—Work on the American Lake cantonment is practically completed. Local electrical dealers recently filled practically the last requirements, including motors, wires, lamps and sockets.

WIRING SUPPLIES.—Copper and conduit are still in active demand, with prices about the same and shipment hard to obtain. Buying for the future is very light. Stocks are low and practically no attempt is made to replenish them. The present demand for wire and cost of same indicate that there may be scarcity in the immediate future. There is an increasing tendency to refrain from any new commitment in store, apartment-house or dwelling-house activities, although the projects for new manufacturing plants show no interruption. Because of building inactivities the sale of fixtures and sockets is very light.

LAMPS.—Lamps show satisfactory sales, although they are hard to obtain in large quantities.

SAN FRANCISCO

The greatest demand at present is for heating devices, owing probably to so many people earning good wages. There is also a noticeable activity in stocks used in shipbuilding and industrial plants, demand for the more staple lines being better than at any time during the year. Insulated wire is in fairly good shape, while bare copper is rather short. In spite of a shortage of conduit at the mills, stocks here are in good shape. Deliveries on all wires and cables and supplies are coming along nicely, except knife switches and lamp cord, on which deliveries are very slow, anywhere from six to eight months. Lamp stocks are normal, and all orders are being filled promptly from local stocks. Demand for washing machines in both city and country is increasing, with a good stock on hand. The electric range demand is increasing and stocks are generally good.

Prices remain about the same. Retail business is better than this time last year. Collections are running quite well up to average; in fact, a little better than they did last week.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor	
B. & S. Size	List, per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor	
No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE PER 1000 FT.—NEW YORK

Single-Conductor	
No. 14 solid:	
Less than coil.....	\$54.90 to \$61.00
Coil to 1000 ft.....	48.80 to 59.17
No. 12 solid:	
Less than coil.....	63.90 to 71.00
Coil to 1000 ft.....	56.80 to 68.87

Twin-Conductor	
No. 14 solid:	
Less than coil.....	\$78.00 to \$104.00
Coil to 1000 ft.....	75.00 to 80.00
No. 12 solid:	
Less than coil.....	121.50 to 135.00
Coil to 1000 ft.....	108.00 to 130.95

DISCOUNT—CHICAGO

Single-Conductor	
Less than coil.....	List plus 10%
Coil to 1000 ft.....	List less 10%

Twin-Conductor

Less than coil.....	List plus 10%
Coil to 1000 ft.....	List less 10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	—10% to 12%
1/5 to std. pkg.....	10% to 20%
Std. pkg.....	34% to 44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	12% to +20%
1/5 to std. pkg.....	Net to 20%
Std. pkg.....	30% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28	.29

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 30.....	.35	.35
30 to 50.....	.31 to .318	.32 to .328
Barrel lots.....	.28 to .288	.29 to .298

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less than Coil	Coil to 1000 Ft.
3/8-in. single strip.....	\$67.50 to \$75.00
3/8-in. double strip.....	71.75 to 75.00
1/2-in. single strip.....	90.00 to 100.00
1/2-in. double strip.....	95.00 to 100.00

NET PER 1000 FT.—CHICAGO

Less than Coil	Coil to 100 Ft.
3/8-in. single strip.....	\$75.00
3/8-in. double strip.....	78.75
1/2-in. single strip.....	100.00
1/2-in. double strip.....	105.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
5/8.....	.15	2.....	.55
3/4.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$55.00	\$24.50-\$25.50
1/4-in.—	\$40.00-\$60.00	\$27.00-\$30.00
		\$23.50-\$27.00

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$36.67-\$55.00	\$27.50
1/4-in.—	\$40.00-\$60.00	\$30.00
		\$25.20-\$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List Elbows, List

Size, In.	Couplings, List	Elbows, List
1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.60
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

Less than 2500 lb.	2500 to 5000 lb.	5000 to 10000 lb.	10000 to 25000 lb.
6% to 8%	6% to 8%	8% to 10%	8% to 10%
9% to 11%	9% to 11%	11% to 13%	11% to 13%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

Less than 2500 lb.	2500 to 5000 lb.	5000 to 10000 lb.	10000 to 25000 lb.
3.8% to 8%	3.8% to 8%	5.8% to 10%	5.8% to 10%
6.8% to 11%	6.8% to 11%	8.8% to 13%	8.8% to 13%

(For galvanized deduct six points from above discounts.)

FLATIRONS NEW YORK

Net.....	\$3.50
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CHICAGO

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	.28%
1/5 to std. pkg.....	.38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	.28%
1/5 to std. pkg.....	.38%

FUSE PLUGS		
3-Amp. to 30-Amp.		
NEW YORK		
	Per 100 Net	
Less than 1/5 std. pkg.	\$5.75 to \$6.30	
1/5 to std. pkg.	4.50 to 5.25	
Standard package, 500.	List, each, \$0.07.	
CHICAGO		
	Per 100 Net	
Less than 1/5 std. pkg.	\$6.25	
1/5 to std. pkg.	5.25	
Standard package, 500.	List, each, \$0.07.	

LAMPS, MAZDA		
105 to 125 Volts		
	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B	100	\$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulbs, 3 3/4 in., frosted:		
15-watt—G 25	50	.50
25-watt—G 25	50	.50
40-watt—G 25	50	.50
Round bulbs, 3 3/4 in., frosted:		
60-watt—G 30	24	.72
Round bulbs, 4 1/4 in., frosted:		
100-watt—G 35	24	1.05

DISCOUNT—NEW YORK	
Less than std. pkg.	Net
Std. pkg.	10%
DISCOUNT—CHICAGO	
Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD	
Cotton-Covered, Type C, No. 18	
NEW YORK	
	Per 1000 Ft. Net
Less than coil (250 ft.)	\$30.00 to \$34.88
Coil to 1000 ft.	21.00 to 26.52

CHICAGO	
	Per 1000 Ft. Net
Less than coil (250 ft.)	\$37.20 to \$37.84
Coil to 1000 ft.	27.90 to 28.38

LAMP GUARDS, WIRE	
Standard packages from 50 to 150.	
NEW YORK	
Net per 100	\$18.00 to \$29.00
CHICAGO	
Net per 100	\$22.50 to \$38.25

OUTLET BOXES	
Nos.	List, per 100
101—A, A1 1/2, 4 S.C., 6200, 320	\$30.00
102—B.A., 6200 S.E., 300, A.X. 1 1/2,	
4 S.	30.00
103—C.A., 9, 4R, B 1 1/2	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK		
	Black	Galvanized
Less than \$10.00 list	List to 33%	List to 27%
\$10.00 to \$50.00 list	List to 42%	37%

DISCOUNT—CHICAGO		
	Black	Galvanized
Less than \$10.00 list	40%	35%
\$10.00 to \$50.00 list	50%	45%

PIPE FITTINGS	
DISCOUNT—NEW YORK	
Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%
DISCOUNT—CHICAGO	
Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED		
2 and 3 Wire		
NEW YORK		
	Per 1000 Net	
Less than 1/5 std. pkg.	\$14.00 to \$20.00	
1/5 to std. pkg.	13.00 to 15.00	
Standard package, 2200.	List per 1000, \$20.	
CHICAGO		
	Per 1000 Net	
Less than 1/5 std. pkg.	\$15.80 to \$20.54	
1/5 to std. pkg.	13.00 to 19.24	
Standard package, 2200.	List per 1000, \$20.	

PORCELAIN KNOBS		
NEW YORK		
	5 1/2 N.C.—Solid Nail-it—N.C.	
Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
Less than 1/5 std. pkg.	\$10.50 to \$24.30	\$28.00
1/5 to std. pkg.	9.75 to 12.15	21.50
CHICAGO		
	5 1/2 N.C.—Solid Nail-it—N.C.	
Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
Less than 1/5 std. pkg.	\$11.85 to \$26.00	\$20.75 to \$30.75
1/5 to std. pkg.	9.00 to 20.00	16.30 to 24.20

SOCKETS AND RECEPTACLES		
	Std. Pk.	List
1/4-in. cap key and push sockets	500	\$0.33
1/4-in. cap keyless socket	500	.30
1/4-in. cap pull socket	250	.60

DISCOUNT—NEW YORK	
Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15% to 20%
DISCOUNT—CHICAGO	
Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%

SWITCHES, KNIFE	
250-Volt, Front Connections, No. Fuse	
High Grade:	List
30-amp. S. P. S. T.	\$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK	
High Grade:	
Less than \$10 list	List to —5%
\$10 to \$25 list	11% to 16%
\$25 to \$50 list	14% to 24%
Low Grade:	
Less than \$10.00 list	5% to —5%
\$10.00 to \$25.00 list	11% to 16%
\$25.00 to \$50.00 list	14% to 24%

DISCOUNT—CHICAGO	
Less than \$10 list	5% to +5%
\$10 to \$25 list	11% to 16%
\$25 to \$50 list	14% to 24%

SWITCHES, SNAP AND FLUSH		
5-Amp. and 10-Amp., 125-Volt Snap Switches		
	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.43
10-amp. single-pole, ind.	100	.54
5-amp., three-point	100	.54
10-amp., three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd		
10-Amp. 250-Volt Push-Button Switches		
	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	.50	.70
10-amp. double-pole	.50	.70

DISCOUNT—NEW YORK	
Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO	
Less than 1/5 std. pkg.	Net to +20%
1/5 to std. pkg.	15% to Net
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT	
Union and Similar	List, Each
No. 155	\$0.34
No. 160	.60

DISCOUNT—NEW YORK		
	Black	Galvanized
Less than \$2.00 list	List to 23%	18%
\$2.00 to \$10.00 list	20% to 23%	18%
\$10.00 to \$50.00 list	23% to 30%	18%

DISCOUNT—CHICAGO		
	Black	Galvanized
Less than \$2.00 list	25% to 50%	15% to 40%
\$2.00 to \$10.00 list	25% to 50%	20% to 40%
\$10.00 to \$50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT	
NEW YORK	
Net price	\$3.10 to \$3.50

CHICAGO	
List price	\$4.50 to \$5.00
Discount	25% to 30%

WIRE, ANNUNCIATOR	
NET PRICE—NEW YORK	
No. 18, less than full spools	\$0.52
No. 18, full spools	0.48

CHICAGO	
	Per Lb. Net
No. 18, less than full spools	\$0.565 to \$0.6885
No. 18, full spools	0.495 to 0.56

WIRE-RUBBER-COVERED, N. C.			
Solid-Conductor, Single-Braid			
NEW YORK			
	Price per 1000 Ft. Net		
	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No.	500 Ft.	1000 Ft.	5000 Ft.
14	\$15.00-18.00	\$12.00-14.50	\$11.50-12.50
12	21.06-28.35	18.96-24.30	18.01-20.25
10	29.60-39.83	26.64-34.14	25.31-28.45
8	42.40-56.49	38.16-48.42	36.25-40.36
6	72.19-89.39	64.98-76.62	61.73-63.85

CHICAGO			
	Price per 1000 Ft. Net		
	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No.	500 Ft.	1000 Ft.	5000 Ft.
14	\$18.00	\$16.00	\$14.00
12	25.99-29.89	21.96-25.62	20.13-22.50
10	36.49-41.51	30.84-35.58	28.27-31.57
8	47.97-60.13	43.80-51.50	40.15-44.77
6	70.24-90.16	69.24-77.28	56.54-70.84

WIRE, WEATHERPROOF	
Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.	

NEW YORK	
	Per 100 Lb. Net
Less than 25 lb.	\$40.25 to \$45.00
25 to 50 lb.	39.25 to 42.00
50 to 100 lb.	38.00 to 38.25

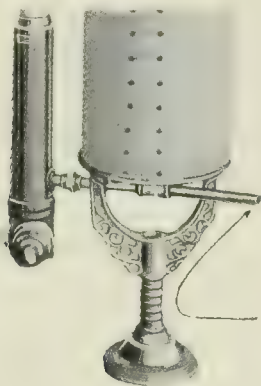
CHICAGO	
	Per 100 Lb. Net
Less than 25 lb.	\$42.00 to \$45.50
25 to 50 lb.	41.35 to 46.00
50 to 100 lb.	39.00 to 43.50

NEW APPARATUS AND APPLIANCES

*A Record of Latest Developments and Improvements in Manufacturers' Products
Used in the Electrical Field*

Continuous-Service Electric Water Heaters

Electric water heaters of the circulation type that employ the thermal storage system—that is, they store the hot water in the regular kitchen boiler—are made by the Hughes Electric Heating Company, 5660 West Taylor



CIRCULATION-TYPE WATER HEATER

Street, Chicago. This type of water heater is made in two sizes for 750-watt and 2000-watt consumption. It consists primarily of a waterproof bayonet-type heating element inserted in a metal casing which is adequately insulated by a tightly packed insulating material $\frac{3}{4}$ in. (1.9 cm.) thick. This heating element is placed squarely in the center of the water flow, and all heat generated is absorbed into the water, making the heater 100 per cent efficient, it is claimed. This heater can be attached to any kitchen boiler in the same manner as the gas circulation heaters or the coal and wood water-back heaters are installed. The heater is easily cleaned by unscrewing the bolts at the bottom and removing the heating element without disconnecting the body of the heater.

Sixty-Day Portable Signal Battery

Portable signal batteries which, it is claimed, will operate a busy signal circuit for sixty days on one charge, even in summer weather, have recently been put on the market by the Electric Storage Battery Company, Philadelphia. Attention is called to the fact that the grids and separators have been made more rugged, the rubber jars more substantial, and additional sediment space provided. A double-flanged cover is used, which protects the upper edges of the jar from mechanical injury, while the automatic vent and filling

plug prevent careless overfilling of the cells and the consequent slopping of electrolyte over the covers and carrying case. This cover also acts as a spray trap, preventing the escape of acid spray while charging. The increase from thirty-day to sixty-day service is largely obtained by a design of cell which eliminates internal losses, rather than by increasing the amount of active material, since the sixty-day battery weighs only 25 per cent more than the thirty-day battery.

Electric Broiler for Hotel Kitchens

The General Electric Company of Schenectady, N. Y., has developed a hotel broiler which has a sheathed-fire heating unit, with two heats, consuming 2500 and 5000 watts respectively, in the top of the broiling chamber. The top of the chamber is provided with 2 in. (5.08 cm.) of heat-insulating material to prevent radiation of heat upward. The heating unit is operated by



GRIDIRON IS SUPPORTED ON A MOVABLE FRAME

a double-pole knife switch on the top of the broiler. The broiler is furnished complete with a substantial drip pan and a gridiron on which the meat is placed. The gridiron is supported below the unit on a movable frame which may be raised or lowered by means of a lever on the side of the broiler near the front.

Coffee Filter

The latest addition to the line of coffee filters manufactured by the Silex Company, 45 High Street, Boston, Mass., is an outfit equipped with a "water control." By means of this feature water is retained in the lower of the two compartments composing the coffee maker until it reaches the

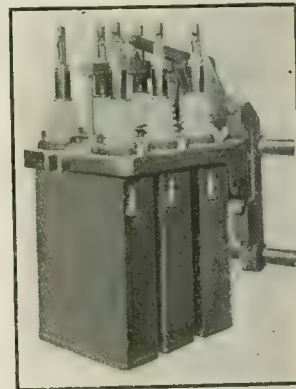
boiling point, when it is released from the lower compartment and rises into the upper section, containing finely pulverized coffee. When the current is disconnected the filtered coffee returns to the lower container. "Pyrex" glass is used in the construction of the filter, which, it is claimed, eliminates metallic flavor.

Oil Switches for Voltages Up to 23,000

To its line of type B oil circuit breakers the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has added the two types of breakers designated as type B-2 and B-3, for use on alternating-current circuits up to 23,000 volts. Type B-2 breakers have a carrying capacity of from 300 amp. to 2000 amp.; type B-3 of from 300 amp. to 1200 amp.

Distinctive features pointed out are rigidly clamped porcelain pillar bushings, self-cleaning butt-brush contacts, auxiliary arcing contacts and spring-accelerated opening.

Type B-2 breakers are furnished for panel mounting, hand operation, or for wall or pipe-frame mounting, electrical operation. Type B-3 breakers are furnished for wall or pipe mounting only, for hand operation through bell cranks or for electrical operation. For both types tripping may be either automatic or by hand. Hand-operated breakers are actuated by a handle projecting through a cover plate on which is mounted the automatic trip coil (if any). When the breaker is electrically operated the trip coil is mounted on the

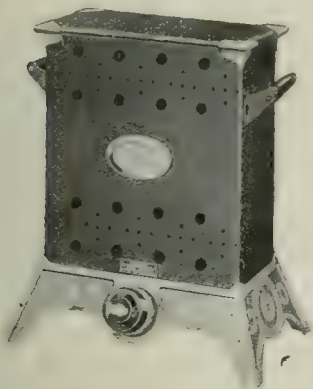


CIRCUIT BREAKER WITH SELF-CLEANING BUTT-BRUSH CONTACTS

face of the panel. Remote-control breakers operated by bell cranks and rods are provided with a spring to assist the force of gravity in opening. A dashpot brings the moving parts to rest without shock.

Portable Electric Air Heaters

Portable electric air heaters that are especially desirable for sickrooms, bathrooms and bedrooms, nurseries, studios, box offices and similar places are made by the Hughes Electric Heat-



THIS AIR HEATER DOES NOT DIFFUSE NOXIOUS ODORS

ing Company, 5660 West Taylor Street, Chicago. These heaters are instantly regulated, may be moved to any part of the room, do not diffuse noxious fumes and do not burn the oxygen of the air, it is claimed. These air heaters are made in six sizes, each with and without switches—ranging from 1000 watts to 4000 watts rating. The heaters have black-enameled steel bodies and bases of cast iron finished in nickel.

Floodlight Projectors

An enlarged line of floodlighting projectors for various purposes that embody the use of a 14-in. (35.6 cm.) glass mirror, either of "Golden Glow" or "Crystal" glass, the particular type suited for any purpose depending largely upon the functioning of the eye under the given condition, are announced by the Electric Service Supplies Company of Philadelphia. The mirrors used are true paraboloids.

The only difference between "Crystal" and "Golden Glow" mirrors is in the quality of the glass employed, the former being of clear crystal glass, while the latter is greenish-yellow in color. The projected light from a "Crystal" mirror projector is white. The "Golden Glow" projectors project a flood of soft golden-yellow light, owing to the fact that the "Golden Glow" mirror alters the spectral quality of the light received from the incandescent bulb before projecting it into the beam.

Since the light from the "Crystal" mirror projector is white and spectacular, it should be used on all floodlighting jobs where spectacular results are desired. The "Golden Glow" light should be used in floodlighting all utilitarian objects; it should be used for all objects in which the eye must be able to disclose fine detail, or where it is to be called into continuous use.

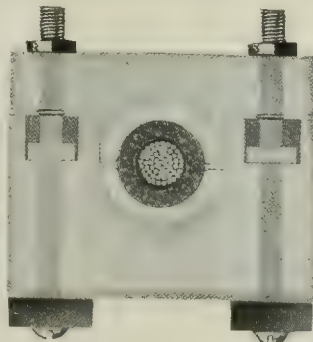
Both the 14-in. (35.6 cm.) "Golden Glow" and the "Crystal" mirror projectors are adapted to take a 400-watt Mazda C concentrated-filament flood-

lighting lamp, and by the use of an adapter any medium screw-base lamp may be employed, such as the 200-watt Mazda C floodlighting lamp, or any other standard concentrated-filament lamps designed for headlight or stereopticon service. With this wide range of lamps to select from, it is readily seen to what a wide variety of uses these projectors may be put.

Equipped with a 400-watt floodlighting bulb, these projectors give a maximum beam candlepower of more than 250,000, with a beam dispersion of 12 deg. By drawing the filament of the bulb slightly behind the focal point of the reflector the dispersion may be increased to 16 deg., the candlepower decreasing to approximately 140,000. Controlling the dispersion in this manner enables the beam to be most effectively controlled for any particular purpose.

Cleat-Type Switchboard Insulator

Cleat-type insulators, designed particularly for high-voltage switchboard construction, that lend themselves to low-voltage work as well, are made by the Electrical Development & Machine



EDGES ARE ROUNDED TO AVOID INJURING OF CABLE

Company of Philadelphia. The clamping members composing the insulator grip the cable uniformly between two circular tube-like surfaces approximately 2 in. (5.08 cm.) in length. All edges are rounded to avoid any possibility of injuring the cable covering because of forcing sharp corners or grooved inner surfaces into the insulation. It is pointed out that this type of insulator practically doubles the length of surface leakage path to ground. Attention is called to the fact that the lower half of the insulator may be bolted to its support and properly aligned before the wire or insulated bus is fastened in position. The Philadelphia Electric Company, Supply Department, 132 South Eleventh Street, Philadelphia, is the selling agent for this cleat insulator.

Face Shield for Electric Welders

Face shields that are light in weight, being constructed of aluminum and vulcanized fiber, are made by the Ideal Face Shield Company, 468 North Gar-

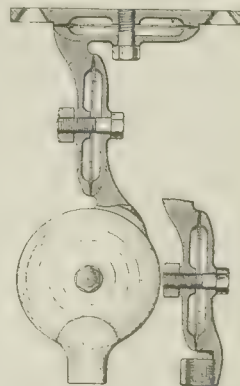
field Avenue, Columbus, Ohio. The shield is supported entirely upon the head of the operator. Another feature which the makers call attention to is the ease with which the operator can open and close the door containing the colored glasses, thus making it convenient for him to examine his work without removing the shield. When the door is thus opened there is still a clear glass which protects the eyes from any flying particles. The shield also prevents the possibility of a glare or reflection from the side or rear, and an apron of fireproof material protects the chest of the operator from his own arc.

Porcelain Pull Sockets and Receptacles

For outdoor installations, cellars, in factories, etc., where a metal pull socket would be seriously damaged by the weather or other corroding influences, the General Electric Company of Schenectady, N. Y., recommends its porcelain pull socket, G.E. 639. This socket takes the "Standard" G.E. pull-socket interior and is therefore interchangeable in metal and porcelain shells. Sockets are furnished with $\frac{1}{8}$ -in. (3.2-mm.), $\frac{3}{8}$ -in. (4.8-mm.) and pendent caps, 250 watts and 660 watts rating. Receptacles are furnished with bases for cleat and concealed work, as well as bases for $3\frac{1}{4}$ -in. (8.2-mm.) and 4-in. (20-mm.) outlet boxes. The caps, bodies and bases are interchangeable.

Adjustable Light Holder

The Franklin Specialty Manufacturing Company of Providence, R. I., has developed a permanent tension universal friction joint for use with light holders. In the accompanying illustration is shown the ceiling type, the principle of this type applying to the scores of combination joints and sizes already in use. The maximum frictional resistance is obtained by having the point of contact at the extreme outer edge of the disks. The hollowed-out centers



PERMANENT TENSION FRICTION JOINT

produce a resilient tension which, it is claimed, remains constant for years without readjusting. The clamping screws pass through one disk and screw through the opposing disk. The nut locks the adjustment permanently.

Trade Publications

GENERATING SETS.—The Universal Motor Company of Oshkosh, Wis., is distributing bulletin No. 26, descriptive of its 4-kw. generating set.

INSULATORS.—The Electro Manufacturing Company of Brooklyn, N. Y., is distributing a bulletin descriptive of its Electro-trope insulators for voltages of from 1000 to 1,000,000.

ELECTRIC RECORDERS.—The Wight Electric Recorder Company of Brookside Park, Cleveland, Ohio, is distributing a bulletin descriptive of its electrical boiler water level recorder and high and low alarm.

SHADES AND REFLECTORS.—Shade bulletin No. 25, descriptive of the shades and reflectors made by the Faries Manufacturing Company of Decatur, Ill., is now being distributed. This bulletin includes a revised list of prices of this line of fixtures.

REFLECTORS.—The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, Ill., is distributing an industrial lighting number of Eye Comfort, published to aid advocates of good lighting. This number includes information on the Beehive line of industrial lighting reflectors, two pages of reasons why X-ray industrial lighting is best, a full page about the special demonstration package and a page of sales helps.

PROTECTIVE DEVICES.—The Condit Electrical Manufacturing Company, South Boston, Mass., is distributing several bulletins descriptive of its electrical protective devices. This set includes bulletin No. 413, descriptive of oil switches and circuit breakers; bulletin No. 415, descriptive of current and potential transformers, and bulletin No. 416, descriptive of induction and synchronous motor panels and type C-3 overload relays for use with alternating-current motor starting devices.

INDUSTRIAL TRUCKS.—The General Vehicle Company, Inc., at Long Island City, New York, is distributing a bulletin descriptive of its industrial trucks. This bulletin gives a brief résumé of the possibilities of the electrical industrial trucks. A brief description is also given of the standard 2000-lb. type truck, including satisfactory performance data under various conditions, interesting time studies, and increased practicability and efficiency. Many photographs of actual uses are given in this book.

FLOODLIGHTING PROJECTORS.—In its general floodlighting catalog the Electric Service Supplies Company of Philadelphia publishes a list of some 125 subjects suitable for floodlighting. This list is further subdivided for purposes of convenience into four distinct groups—(a) esthetic subjects, (b) advertising subjects, (c) pleasure subjects, (d) utilitarian subjects. This catalog, besides listing the projectors proper, takes up such subjects as general characteristics of floodlighting, floodlighting projectors, characteristics of parabolic reflectors, quality of light for floodlighting, floodlighting subjects, intensities of illumination required, photometric characteristics of projectors, covering power of projectors, circular projection, elliptical projection, searchlights and general floodlighting rules.

ELECTRICAL APPARATUS.—The General Electric Company of Schenectady, N. Y., is distributing the following bulletins: Bulletin No. 44417A, descriptive of GE-258 ventilated commutating-pole railway motors; bulletin No. 47380A, descriptive of safety-first inclosed lever switches, types LM-1, LM-2 and LM-3; bulletin No. 45600-A, descriptive of vacuum tube lighting arresters; bulletin No. 48319A, descriptive of CR-1340 and CR-1342 pressure-controlled, speed-regulating panels with automatic pressure regulator; bulletin No. 49301, descriptive of varnished cambric and paper-insulated cables; bulletin No. 49302, descriptive of wires and cables; general bulletin No. 49303, descriptive of splicing materials and junction boxes for underground cable systems, and bulletin No. 49304, descriptive of conductors insulated with vulcanized rubber compound.

CIRCUIT BREAKERS.—"Oil Circuit-Breaker Accessories" is the title of a bulletin (DS272) recently issued by the Westinghouse Electric & Manufacturing Company. Trip-magnet frames and coils are listed for obtaining underload, undervoltage, overload, overvoltage, series and shunt trip. Several, and in some cases all, of these can be applied on the same breaker to act with

the standard automatic overload trip mechanism. For controlling the operating circuit of electrically operated breakers, control switches are listed. There are described and listed signal switches, inverse-time element attachments, bell-alarm signal-contact attachments, ball-crank accelerating devices, universal mounting brackets for mounting breakers, instrument transformers and other accessories on the rear of the panel or on a separate pipe or angle-iron frame.

New Incorporations

THE J. L. HADLEY ELECTRIC COMPANY, Covington, Ky., has been incorporated by John A. Glindmeyer, J. L. Hadley and Emma Glindmeyer.

THE FLINT (MICH.) STORAGE BATTERY COMPANY has been incorporated, with a capital stock of \$5,000, by R. A. Welch, H. F. Hanning and James A. Watson.

THE BUCKLE ELECTRIC COMPANY of Salt Lake City, Utah, has been incorporated by J. V. Buckle, M. M. Allison, J. G. Larison and others to do a general contracting business.

THE DOUBLE LIFE STORAGE BATTERY & SERVICE COMPANY of Chicago, Ill., has been incorporated, with a capital stock of \$5,000, by Ward S. Perry, J. F. Henning and E. J. Frietag.

N. J. GORKE, INC., Syracuse, N. Y., has been incorporated by H. J. Gorke, K. S. Gorke and D. Gorke, Syracuse, to make electrical goods, supplies and equipment. The company is capitalized at \$50,000.

THE AUTOMATIC ELECTRIC CONTROLLER COMPANY of Seattle, Wash., has been chartered, with a capital stock of \$250,000, by J. C. Arnold, E. C. Kilbourne, H. McMullen and R. W. A. Simmons.

THE SPRINGDALE (ARK.) LIGHT & POWER COMPANY has been incorporated with a capital stock of \$50,000. The officers are George D. Locke, president; F. L. O'Neal, vice-president, and H. L. Hughes, secretary-treasurer.

THE NORTHPORT POWER & LIGHT COMPANY, Northport, B. C., has been organized to supply light and power to the Nelson district. One of the directors is Lorne A. Campbell, of the West Kootenay Power & Light Company.

THE ELECTRIC SPECIALTY MANUFACTURING COMPANY of St. Louis, Mo., has been chartered, with a capital stock of \$5,000, by H. T. V. Perry, H. Perry and M. T. Lewis. The company proposes to deal in electrical specialties.

THE ANDERSON ELECTRIC SALES COMPANY of New York, N. Y., has been chartered, with a capital stock of \$500, to deal in electrical machinery. The incorporators are: Frank C. Rose, Joseph E. Ward and Bailey C. Elliott.

THE BRYANT (IND.) ELECTRIC COMPANY has been incorporated by Orville, D. Arnold, James Rupel, Henry Huckreid and J. C. L. Whiteman. The company is capitalized at \$10,000, and proposes to generate and distribute electricity.

THE OHIO GAS & ELECTRIC CORPORATION OF DELAWARE of Wilmington, Del., has been chartered, with a capital stock of \$500,000. The incorporators are Clement M. Enger, Winfield S. Randall, and Herbert H. Ward, Jr., of Wilmington, Del.

THE STRYKER DEFLECTOR COMPANY of Buffalo, N. Y., has been incorporated, with a capital stock of \$5,000, to manufacture the Stryker patent light deflector. The incorporators are: J. H. Prescott, D. Porter and C. L. Stryker of Buffalo, N. Y.

THE BAY RIDGE ELECTRICAL COMPANY of Brooklyn, N. Y., has been chartered, with a capital stock of \$5,000, to deal in electrical goods, motor vehicles, etc. The incorporators are: Daniel F. MacDonald, Alexander M. Stagg and John F. Warner.

THE GENERAL LIGHT, HEAT & POWER COMPANY, INC., New York, has been incorporated by S. B. Howard, George V. Reilly and Louis H. Gunther, all of New York, to carry on the business of mechanical and electrical engineers. The company is capitalized at \$3,000,000.

THE FOGELSVILLE & TREXLER-TOWN ELECTRIC COMPANY of Topton,

Pa., has been chartered, with a capital stock of \$5,000, by W. J. Martin of Topton; D. S. Martin and S. R. Rothermel of Reading. The company proposes to supply electricity for lamps, heaters and motors in Upper Macungie Township.

THE ENGEL-KELLY ELECTRICAL NEUTRALIZER MANUFACTURING COMPANY of St. Louis, Mo., has been incorporated by Jacob A. Engel and others. The company is capitalized at \$20,000, and proposes to manufacture a device for neutralizing the static electricity which develops on paper stock when it is being printed.

THE MARBLE-CARD ELECTRIC COMPANY of Gladstone, Mich., has been organized, with a capital stock of \$60,000, to manufacture direct-current, commutating-pole motors and dynamos for all classes of service. The incorporators are: F. H. Van Cleve, J. T. Jones, W. L. Marble and J. F. Card. Ground is being broken for the erection of a factory building 60 ft. by 140 ft., one story high.

Trade Notes

THE ROSS HEATER & MANUFACTURING COMPANY, INC., announces the removal of its offices from 753 Bird Avenue to 504 Mutual Life Building, Buffalo, N. Y.

V. L. CRAWFORD, formerly of Hubbard & Company, is now in charge of sales of the B & K Manufacturing Company, manufacturer of pole line and bracket hardware, New Britain, Conn.

THE OSTERHOUT ELECTRIC COMPANY, Philadelphia, Pa., has leased property at 1013 Race Street for a new electrical supply establishment. Frederick C. Osterhout is head of the company.

THE ADAMS-MORGAN COMPANY, Montclair, N. J., has been organized to operate an electrical specialty plant on Aborn Place, Alfred P. Morgan, 69 Brookfield Road, Montclair, heads the company.

C. A. MUDGE, formerly with the United States Light & Heat Corporation, Niagara Falls, N. Y., has severed his connection with that company to become general manager of the Electro Dynamic Company, Bayonne, N. J.

THE CALERAUGH SELF-LUBRICATING CARBON COMPANY, Columbia Avenue, Philadelphia, Pa., manufacturer of carbon brushes for generator and motor use, has removed its plant to 1508-1518 Columbia Avenue for increased operations. Offices will be maintained at 1503 Columbia Avenue.

EDWARD L. FRANTZ has just disposed of his entire stock interest in the Frantz Premier Company of Cleveland, Ohio, and resigned his office of vice-president and general manager, thereby entirely severing his connection. Mr. Frantz is the founder of the company and one of the pioneers in the vacuum cleaner industry.

WESTINGHOUSE SALES FORCES.—John Shoolbred has recently been added to the Boston staff of the Westinghouse Electric & Manufacturing Company as a commercial engineer on industrial motor problems. R. M. Keck has been appointed a supply department salesman at Dallas, succeeding D. S. Pryde, who has resigned. Joseph A. Summers is a new salesman at Charleston, W. Va. He will handle supplies, replacing R. T. Robinson, who has resigned. W. E. Smith and J. T. Watson have recently been attached to the Bluefield (W. Va.) staff. Mr. Watson will handle industrial motors and Mr. Smith will handle supplies. W. C. Walke is a recent addition to the industrial motor sales staff at Pittsburgh.

WESTINGHOUSE ESTABLISHES A PRACTICAL COURSE FOR FOUNDRYMEN.—Owing to conditions with which industrial managers are only too familiar, there is a great demand for trained foundrymen in responsible positions. To insure itself a supply of such men the Westinghouse Electric & Manufacturing Company has recently established a course in foundry work for those of its employees between the ages of seventeen and twenty-one years who have completed at least the eighth grade of public school or its equivalent. The shop courses will include the following: Bench and floor molding, machine molding, core making, tempering of sand, cupola operation, mixing of alloys, cost calculating. Classroom instructions will be given during the course on blueprint reading, mechanical drawing, shop problems and metallurgy, particular attention being given to the alloys of iron and copper. The company plans to give those desiring it a thorough all-round knowledge of this phase of its work.

New England States

CLAREMONT, N. H.—The installation of a new 44,000-volt transmission line, extending from Claremont to Charleston, has just been completed by the Claremont Power Company.

PORTSMOUTH, N. H.—The Morley Botton Company will build a one-story addition to its power plant for factory operation.

RUTLAND, VT.—The Rutland Railway, Light & Power Company is planning for the early operation of its new substation at Castleton, which will be used for local service. The company has also completed the construction of a new high-tension line from Rutland to Castleton.

CLINTON, MASS.—Paul E. Meissner, president of the Roubaix mill, is planning the construction of a one-story brick power house to be added to the present mill.

DORCHESTER, MASS.—It is planned to erect a white-way system in Dorchester from Eaton Square to Geneva Avenue.

FALL RIVER, MASS.—The Union Street Railway Company is planning to build a new power station to meet increasing demands upon its generating capacity. The building will be erected upon the company's wharf, at the foot of Middle Street. It will be of brick, 80 ft. by 115 ft. and 70 ft. high. It will be equipped with a 30-ton crane. Contracts have already been placed for the Babcock & Wilcox boilers; also for the electrical equipment. The plans for the new power plant were prepared by the Harry M. Hope Engineering Company, Boston. Work will be started immediately.

FLORENCE, MASS.—Work has been commenced on the new two-story addition to the power plant of the Nonotuck Silk Company. The structure will be about 25 ft. by 30 ft.

NEW BEDFORD, MASS.—Work has been started on the large addition to the power plant at the foot of Cannon Street of the New Bedford Gas & Edison Light Company. The addition will be built of brick, concrete and steel, 60 ft. by 90 ft. and 75 ft. high. It will be a thoroughly fireproof building throughout and will house a 15,000-kw. turbine-driven generator and auxiliary electrical equipment. Stone & Webster, Boston, are the engineers and contractors.

READSBORO, MASS.—The New England Power Company's petition for authority to issue securities of the par value of \$7,000,000 has been granted by the State gas and electric lighting commission. A dam will be built at Readsboro just over the line in Vermont, and will be about 200 ft. high. The power plant will have an installed capacity in waterwheels of about 36,000 hp.

WORCESTER, MASS.—D. Shapiro filed a petition with City Clerk W. Henry Towne asking the City Council to consider the installation of a lighting system on Arthur Street, north of Dorchester Street.

PROVIDENCE, R. I.—Plans are being completed for a power plant and distributing system for the United States government. F. R. Harris, chief of bureau of yards and docks, Navy Department, Washington. The cost will be about \$450,000.

MERIDEN, CONN.—The H. Wales Lines Company of Meriden, Conn., has been given the contract to build an addition to the power plant at the factory of A. & E. Henkels on Connecticut Avenue. The addition will be of brick with a gravel roof. Work will be started immediately.

PLAINVILLE, CONN.—The Trumbull Electric Manufacturing Company has awarded the contract for a new factory building to be erected adjacent to its present plant.

SOUTHINGTON, CONN.—A special meeting of the Board of Selectmen will be called for the purpose of making an appropriation to pay for the lighting of the streets during the coming year.

WATERBURY, CONN.—The Housatonic Power Company, West Main Street, has had plans prepared for the construction of a new two-story addition to its power plant on Freight Street. The structure is estimated to cost about \$25,000.

Middle Atlantic States

BROOKLYN, N. Y.—W. B. Armstrong, Albany, has been awarded a contract for the installation of new power plant equipment at the Brooklyn State Hospital, Brooklyn, at \$19,948.

BUFFALO, N. Y.—Plans have been filed by the Buffalo General Electric Company for the erection of a new transformer station on Gladstone Street.

CARTHAGE, N. Y.—The new additions to the plant of the Newton Falls Power

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

Company at Newton Falls are nearing completion. The new power plant will develop 1000 hp. and is expected to be in operation on Nov. 1.

DUNKIRK, N. Y.—It is planned to adopt a new post-lighting system for the business streets of Dunkirk.

DUNKIRK, N. Y.—The electric light department has about completed the work of stringing a high-tension wire, it is reported, to the new Catholic college being erected at Hemlock Grove, to supply that institution with electricity.

FULTON, N. Y.—The Dilts Machine Company has had plans prepared for the construction of a new hydroelectric power plant to be used for the operation of its gate-hoisting machinery works on North First Street. Frank Dilts is president.

LOCKPORT, N. Y.—The last machinery for the new hydroelectric power station at Lockport, N. Y., has been installed, enabling the Hydraulic Race Company of that city to develop an additional 1600 hp. from the surplus waters of the Erie Canal at the Lockport locks.

NEW YORK, N. Y.—The Electric Bond & Share Company, 71 Broadway, has increased its capital from \$1,600,000 to \$2,000,000.

POUGHKEEPSIE, N. Y.—The Wallace Company, Main Street, has awarded a contract to Kingston & Campbell, 1 Washington Street, for a one-story brick and concrete heating plant at its factory, to cost about \$25,000.

ROCHESTER, N. Y.—The Rochester Railway & Light Company has started work on two new underground conduit systems. One extends through Ridge Road from Lake Avenue to the city line and the other extends from Driving Park Avenue bridge through that street to St. Paul.

BLOOMFIELD, N. J.—An appropriation of \$21,750 is planned by the Town Council for street lighting for 1918.

CAMDEN, N. J.—The asylum and almshouse committee of the Board of Freeholders is planning for the construction of new pumping plants and joint heating system at the county institutions.

DOVER, N. J.—Construction of the extensions to the new station of the New Jersey Power & Light Company outside the city limits has been completed and the company is planning to discontinue the use of the old city steam plant on North Sussex Street, the entire load to be carried by the new plant.

ENGLEWOOD, N. J.—The Board of Education will receive bids until Sept. 5 for electrical equipment in the new Lincoln School on Englewood Avenue. A. S. Coe, secretary.

GARFIELD, N. J.—The Garfield Worsted Mills has had plans prepared for the erection of a new boiler house addition for plant operation. Lee & Hewitt, 1123 Broadway, New York, are the architects.

GLOUCESTER CITY, N. J.—An appropriation of \$12,000 for street lighting has been approved by the Common Council for 1918.

HADDONFIELD, N. J.—The installation of a new street-lighting system is being considered by the borough officials. It is planned to install incandescent units to replace the arc lamps now in service.

LAKEWOOD, N. J.—The Board of Public Utility Commissioners has granted the Lakewood & Coast Electric Company permission to issue stock and certificates of indebtedness to the amount of \$20,500 for improvements.

NEWARK, N. J.—The building committee of the Common Council will receive bids Sept. 4 for lighting fixtures and a refrigerating plant to be installed at the City Hospital. Thomas J. Lee, Jr., chairman.

NEWTON, N. J.—The Sussex Print Works has had plans prepared for the construction of a new boiler house, 50 ft. by 150 ft., to cost about \$10,000.

PERTH AMBOY, N. J.—Plans have been completed for the installation of a new commercial street-lighting system in the business section of the city, which will include a new underground conduit system and will be operated by the municipal electric light plant. Bids will be received until Sept. 17 by the committee on streets of the Board of Aldermen. Runyon & Carey, 843 Broad Street, Newark, are the engineers.

PRINCETON, N. J.—The Public Service Electric Company is planning for the installation of underground lines on Nassau Street to replace its overhead system.

TRENTON, N. J.—The City Commission has completed the installation of an ornamental lighting system in Mahlon Stacy Park.

TRENTON, N. J.—Bids will be received until Sept. 11 for improvements and new equipment at the boiler plant of the State Home for Boys, Jamesburg. The work will include the installation of pumping machinery, piping, and a new radial brick stack. Francis H. Bent, State architect, State House, is the architect.

TRENTON, N. J.—The Board of Trenton City Commissioners has handed down an order instructing the Trenton & Mercer County Traction Company to remove its overhead lines and poles on Monmouth, Kent, Prospect, Globe, Division, Hudson and a number of other streets. The commission holds that the company did not have the authority to construct these lines, and that other arrangements for installation must be made.

UNION HILL, N. J.—The Borough Council has approved an appropriation of \$14,700 for street-lighting during the coming season.

WEST ORANGE, N. J.—The Town Council has approved an appropriation of \$25,000 for street lighting. George W. Foster, town clerk.

CARROLLTOWN, PA.—The Penn Central Electric Company, Johnstown, is planning for the construction of a new transmission line to Carrolltown, and will furnish service for street lighting.

CHELTENHAM, PA.—The Hoffman, DeWitt & McDonough Company will build a new one-story boiler plant at its braid factory.

DAUPHIN, PA.—The boiler plant of the William P. Zortman Lumber Company was recently destroyed by fire with a loss of about \$10,000. The structure will be rebuilt.

ELIZABETHVILLE, PA.—The Wisconsin Telephone Company has commenced the construction of a new line at Millersburg, Pa.

HARRISBURG, PA.—The Workmen's Non-partisan League has adopted resolutions favoring the establishment of a municipal light, heat and power plant.

HARRISBURG, PA.—The Public Service Commission has granted permission to the following companies to issue bonds to the amount voted for improvements and extensions: Penn Central Light & Power Company, Altoona, \$78,000; the Edison Electric Company, Lancaster, \$230,000; the Philadelphia Suburban Gas & Electric Company, Philadelphia, \$168,000, and the Mahoning & Shenango Railway & Light Company, Pittsburgh, \$500,000.

JARRETTOWN, PA.—Residents of Jarrettown are signing petitions for the installation of an electric lighting system. A meeting with representatives of the electric light company will be held early in September.

JOHNSTOWN, PA.—The Johnstown Traction Company is planning for the extension of its lines in the Seventh and Seventeenth Wards and in Coopersdale.

LANCASTER, PA.—The General Hospital has awarded a contract to Herman Wohlsen, Lancaster, for the construction of a new one-story boiler plant about 60 ft. by 65 ft.

LOCK HAVEN, PA.—An ordinance has been passed for the execution of a contract with the Lock Haven Electric Light, Heat & Power Company for the lighting of the streets of the city for a period of five years.

MILLERSBURG, PA.—The Public Service Commission has granted permission to the Millersburg Electric Company to build a new transmission line from Halifax to New Buffalo, by way of Clemson's Island.

PHILADELPHIA, PA.—The Philadelphia General Hospital will build a new one-story power plant, 50 ft. by 150 ft., on Thirty-fourth Street, for service for the institution.

PHILADELPHIA, PA.—H. H. Collins, 226 Columbia Avenue, has filed plans for the construction of a new engine house addition to his plant at 1436-1444 North Sixth Street.

PHILADELPHIA, PA.—O'Neill Brothers have awarded a contract for the construction of a new one-story brick boiler house to their plant to William Marriott, 3020 North Second Street.

PHILADELPHIA, PA.—The Atlantic Refining Company has filed plans for the construction of a one-story brick power plant, about 41 ft. by 42 ft., at its works at Thirty-sixth and Jackson Streets, to cost about \$21,000.

PHILADELPHIA, PA.—The Pennsylvania Railroad has awarded a contract for the construction of a new one-story power house at its Girard Point works for plant operation, to John N. Gill & Company, 1215 Filbert Street, Philadelphia.

PHILADELPHIA, PA.—The Department of Public Health and Charities, City Hall, is receiving bids up to Sept. 12 for the construction of a new one-story power house at the institution on Thirty-fourth Street. P. H. Johnson, 110 South Broad Street, is architect.

PITTSBURGH, PA.—The Pennsylvania Railroad, Union Station, will build a power plant for works operation at its new round-house, machine and repair shops near Indianapolis, Ind.

PITTSBURGH, PA.—The Rex Hide & Rubber Company, East Brady, will build a power plant in connection with a new factory building. The W. E. Moore Company, Union Bank Building, is engineer.

POTTSTOWN, PA.—The Eastern Steel Company will install a new converter and auxiliary equipment at its works.

POTTSTOWN, PA.—The installation of new electrical equipment at the Glasgow works of the Nagle Steel Company has been commenced.

READING, PA.—The Public Service Commission has approved the proposed merger of the Reading Transit & Light Company, the Metropolitan Electric Company, the United Traction Company, the Birdsboro Street Railway, the Beyerstown & Pottstown Railway Company, the Front & Fifth Street Railway Company and the Reading & Womelsdorf Electric Railway Company. The new organization will be known as the Reading Transit & Light Company. The merger is said to involve about \$10,000,000.

SAYRE, PA.—The Sayre Electric Company has just completed improvements and betterments in its power plant. Automatic stokers have been installed.

BALTIMORE, MD.—An appropriation of \$3,000,000 is being considered by the United Railways Company for extensions and betterments in its system during the coming four years.

BALTIMORE, MD.—A new one-story power house to cost about \$20,000 will be constructed by the Baltimore Dry Docks & Shipbuilding Company at its works on East Fort Avenue. Contract for erection has been awarded.

GARY, W. VA.—The United States Coal & Coke Company owns properties in Letcher and Harlan Counties, Ky., of which 20,000 acres will be developed. The company plans to install electric machinery to provide for a capacity of 10,000 tons daily. Howard N. Eavenson is chief engineer.

MORGANTOWN, W. VA.—The West Virginia Traction & Electric Company is making rapid progress in the construction of a new transmission line in this district.

NORFOLK, VA.—The Bureau of Yards and Docks, Navy Department, will build a new central power station and distributing system at its local navy yard, to cost about \$800,000.

WASHINGTON, D. C.—The Potomac Electric Power Company is reported to have completed plans for the construction of its proposed new power house on Benning Road, N. E. The structure will cost about \$40,000.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, has given a contract to the Blumenthal-Kahn Electric Company, 505 Eutaw Street, Baltimore, Md., for the installation of a new lighting system in the foundry to be constructed at the Portsmouth Navy Yard, at \$10,000. The bureau has also awarded a contract to the Carroll Electric Company, 714 Twelfth Street, for installing a similar system in the new machine shop at the same location, at \$12,000.

North Central States

MUSKEGON, MICH.—Work has been started on an addition to the substation of the Consumers' Power Company at Muskegon Heights.

CLEVELAND, OHIO.—Sealed proposals will be received at the office of the commissioner of purchases and supplies, room 219 City Hall, until 12 o'clock on Sept. 13, 1917, for furnishing and installing complete an 84-in. Venturi meter.

CLEVELAND, OHIO.—The Turner Construction Company, 244 Madison Avenue, New York, has received a contract from the Cleveland Electric Illuminating Company for the reinforced-concrete work at its new power plant, which will be about 125 ft. by 300 ft.

CLEVELAND, OHIO.—Light Commissioner W. E. Davis has assured business men on Lorain Avenue that work on the new "white way" lighting system on that street, between West Twenty-fifth and West Fifty-eighth Streets, will be started very soon. The Lorain Business Men's Association has raised \$6,000 to be applied on the cost.

KENTON, OHIO.—Plans are being made for the building of a "white way" system to extend two blocks from the Court House Square.

LEIPSI, OHIO.—The Village Council has notified the Northwestern Ohio Light Company that unless better service can be given within thirty days the franchise will be revoked.

MANSFIELD, OHIO.—The Ohio Electric Light & Power Company, which has a big plant at Mount Vernon, has strung wires to Belleville, and according to reports the line will be extended to Johnsville and Lexington.

MANSFIELD, OHIO.—The Melco power plant of the Mansfield Electric Light & Power Company was recently destroyed by fire. The loss included electrical equipment which was to have been installed in the main building and is estimated at \$10,000.

SANDUSKY, OHIO.—Arrangements are being made by the Sandusky Gas & Electric Company for the construction of a new transmission line to be connected with the system of the Lake Shore Electric Company.

WHITESBURG, KY.—The Kentucky Solvay Company of Grennough has begun the erection of a power plant, the cost of which will be \$100,000.

ELWOOD, IND.—R. E. Breed, president of the Indiana General Service Company of Elwood, filed a petition with the Public Service Commission of Indiana for permission for his company to buy the Marion Light & Heat Company and the Muncie Electric Light Company and consolidate them with the Elwood company.

REMSEN, IOWA.—Construction of the first unit of the power plant that is to be built at the Dalton sandpit for the Iowa Light, Heat & Power Company has been commenced by Zack Eyers, who received the contract for the structure.

KANSAS CITY, MO.—Walter Root of the Jackson County Anti-Tuberculosis Society and H. R. Ennis, president of the Board of Public Welfare, placed a proposition before the hospital and health board to furnish the Tuberculosis Hospital at Leeds with electric light and power.

FREMONT, NEB.—The Fremont Gas, Electric Light & Power Company is installing a turbine-driven generator of 500-kw. capacity at its plant at H Street and the Northwestern tracks.

ORD, NEB.—An election to vote \$30,000 in bonds to build a new electric light plant will be held on Sept. 11. O. P. Cramwell, clerk.

Southern States

ATLANTA, GA.—T. H. McKinney, Inc., contracting electrical engineer of Atlanta, has been awarded the entire contract for installing electricity at Camp McClelland, Anniston.

MACON, GA.—The Home Electric Light & Power Company has filed notice of increase in its capital from \$50,000 to \$100,000.

JOHNSON CITY, TENN.—The Beaver Creek Coal Company is planning to electrify its properties near Alpharetta, Ky., by the installation of electric operating machinery, electric locomotive and kindred apparatus. S. R. Jennings is president.

MOUNT PLEASANT, TENN.—The Republic Light & Power Company of Chattanooga, Tenn., has purchased the Mount Pleasant Electric Light Company and will enlarge and improve the local plant.

OAKDALE, TENN.—It is planned to install new electric equipment at the proposed new plant of the Oakdale Hosiery Mills. S. N. Oakley, head.

BIRMINGHAM, ALA.—The first unit of the new steam-power plant erected by the Alabama Power Company as an auxiliary to its hydroelectric plant will be in operation soon. The cost of the initial installation is \$1,850,000.

FORT SMITH, ARK.—The Fort Smith Light & Traction Company is planning for the construction of a new transmission line to Alma and vicinity for the furnishing of service to the Citizens' Electric Company for local distribution. The construction of a new electric generating station to be erected on the Arkansas River is also planned by the company. The new station will have a capacity of 5000 hp.

Pacific and Mountain States

SEATTLE, WASH.—A special election has been called for Sept. 11 to vote on an ordinance covering a plan to acquire or construct a municipal light and power plant for Seattle. It is estimated that the cost of constructing a plant would be \$7,000. It is proposed to obtain a site on Maloney Creek. Paul Fournier, clerk.

TACOMA, WASH.—The City Council has authorized the purchase of a 500-kw. motor-generator set, comprising a 4000-volt alternating-current motor and a 600-volt direct-current generator, together with a concrete substation building, at a total cost of \$22,000.

JOHN DAY, ORE.—The Consolidated Electric Light Company has been leased by Horace Johnson and J. N. Pocock of Canyon City, for a period of five years. Negotiations will be entered into for lighting Canyon City.

PORTLAND, ORE.—Engineers working on the Interstate Bridge have recommended that motor-generator sets be installed, so as to make use of 11,000-volt lines to operate the bridge in case the voltage on the Portland Railway & Power Company's line is lowered.

FRESNO, CAL.—Work has been started on the erection of a new substation to be built by the San Joaquin Light & Power Company.

LOS ANGELES, CAL.—Charles E. Stokes filed a petition with the city clerk urging the City Council to provide for the ornamental lighting of the new concrete bridge across the Arroyo Seco between Southern Pasadena and Garvanza.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company plans to extend its electric power lines all through the county, it was reported, following the company's application to the supervisors for a fifty-year franchise throughout the county.

SAN DIEGO, CAL.—Plans for the development of two big water systems in San Diego County and the building of a huge power plant to furnish power for San Diego County and the Imperial Valley have been announced by the Edward Fletcher Company. Incorporation papers were filed in the County Clerk's office for the Warner Mutual Water Company, incorporated for \$6,000,000, and the Pamo Mutual Water Company, for \$4,750,000. The Warner company will build a dam at the Warner dam site and a power plant from which power will be furnished to a number of companies. The Pamo company will build three dams, one at the San Clemente site, at Linda Vista, one at the Sutherland site, at Ramona, and one at the Pamo site, at the head of the San Pasqual Valley.

SAN FRANCISCO, CAL.—The Railroad Commission has authorized the San Jose Railroads and the Peninsular Railway Company to transfer to the Pacific Gas & Electric Company for \$6,400 a transmission line, including poles, wires, etc., along the right-of-way of the two railroads from San José to Saratoga; also the stationary motor system of the railroads in Santa Clara County, for \$62,500.

SANTA ANA, CAL.—The Southern California Edison Company is building two important lines, one down the west side of the Santa Ana River and along the coast and the other on the Santa Ana side of the river, across the Irvine ranch and through to San Juan Capistrano by the inland route.

ANACONDA, MONT.—It is planned to erect an ornamental street-lighting system on South Montana Street similar to that in the downtown business district.

Canada

PORTAGE LA PRAIRIE, MAN.—The electric light committee contemplates the installation of one 100-hp. boiler with mechanic stoker, costing about \$5,000. D. McGowan, clerk.

ST. JOHN, N. B.—The city has voted to spend \$2,000 for rewiring the old post office. R. C. Desbrochers, secretary Public Works Department, Ottawa.

BLOOMFIELD, ONT.—A by-law has been passed to provide \$8,000 for development of electric energy. Charles H. Sayle, clerk.

TORONTO, ONT.—The Toronto Hydro Electric System has been granted permission to construct a wrought-iron conduit from the corner of Front and John Streets to the main pumping station.

WELLINGTON, ONT.—A by-law was voted on to provide \$10,000 for the development, transmission and distribution of electric energy. E. A. Titus, clerk.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co. Annual meeting, Birmingham, Ala., Oct. 23, 1917.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, Arthur Kneisel, 29 South LaSalle St., Chicago, Ill.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 3 West 40th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Annual convention, Pittsburgh, Oct. 3-6.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 3 Nassau St., New York City. Annual meeting, Jan. 14, 1918.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg University of Pennsylvania, Philadelphia.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary-treasurer, Roy B. Fowles, Pine Bluff, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, George C. Holberton, San Francisco, Cal. Annual meeting, New York, Sept. 11, 1917.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, McKeesport, Pa. Annual convention, Philadelphia, Sept. 10-14.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, W. L. Connelly, Gibson, Ind.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, E. Brettell, Electric Supply Company, Ltd., Vancouver, B. C.

CALIFORNIA ASSOCIATION OF CONTRACTORS AND DEALERS. Secretary, James W. Redpath, 505 Rialto Bldg., San Francisco, Cal.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, Alan Sullivan, Excelsior Life Building, Toronto, Can.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col. Annual convention, Colorado Springs, Col., Sept. 20-22.

COMMERCIAL SECTION, N. E. L. A. Secretary, F. D. Beardslee, Union Electric Light & Power Company, St. Louis, Mo.

EASTERN NEW YORK SECTION, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Company, Schenectady, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF CONNECTICUT. Secretary, George M. Chapman, Waterbury, Conn. Annual meeting, New Haven, Conn., May, 1918.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, J. E. Wilson, 263 Summer Street, Boston, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo. Annual meeting, Jan. 19, 1918.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF PENNSYLVANIA. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, J. C. Staff, 578 Jackson St., Milwaukee, Wis.

ELECTRICAL DEALERS AND CONTRACTORS' ASSOCIATION OF ONTARIO. Secretary, E. A. Drury, 45 Murray St., Toronto, Can.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, H. B. Crouse, Crouse-Hinds Co., Syracuse, N. Y.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavelly, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert E. Elliott, 34 Ellis St., San Francisco, Cal.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Affiliated with the N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. E. Chapin,

Directory of Electrical Associations

Printed in the First Issue of Each Month

29 West 39th St., New York. Annual meeting Oct. 5.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, L. W. W. Morrow, Norman, Okla. Annual meeting May, 1918, Oklahoma City.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, Dan Carey, Atlanta Builders' Exchange, Atlanta, Ga.

ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, L. B. Van Nuys, Central Electric Co., Peoria, Ill. Annual meeting Chicago, January, 1918.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, R. H. Abbott, Petersburg, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law, Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skillman, Indianapolis, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 111 Broadway, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Annual meeting, Sept. 11-14, 1917, Niagara Falls, N. Y.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

IOWA SECTION, N. E. L. A. Secretary-treasurer, L. E. Caldwell, Iowa City, Iowa.

JOVIAN ORDER. Jupiter (resident), Henry L. Doherty, New York City; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo. Annual convention, October.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, R. M. Sutton, Wichita, Kan.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan. Annual meeting, Salina, Kan., Oct. 19 and 20, 1917.

KENTUCKY ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, F. F. Valinoti, Louisville, Ky. Annual meeting May, 1918.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 323 Chartres St., New Orleans, La.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Augusta, Me.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Monroe, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, H. E. Young, Minneapolis General Electric Company, Minneapolis, Minn.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, G. M. Jones, 112 South Seventh St., Minneapolis, Minn. Annual convention, Jan. 20, 1918, Minneapolis, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary-treasurer, W. F. Wheeler, Hattiesburg, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord Mass. Annual convention, New York, March, 1918.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, H. C. Brown, 41 Martin Building,

Utica, N. Y. Next meeting, New Orleans, Oct. 10-13, 1917, New Orleans, La.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343-1349 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. P. Egan, Room 201, Union Pacific Building, Omaha, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York. Annual meeting June, 1918.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NORTHWEST SECTION, N. E. L. A. Secretary, J. F. Farquhar, Washington Water Power Company, Spokane, Wash. Annual convention, Spokane, Wash., Sept. 12-15.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, R. N. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRICAL LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus. Annual meeting, Columbus, Ohio, Nov. 15, 1917.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary-treasurer, J. W. Oberender, 301 Dekum Building, Portland, Ore. Annual convention, Eugene, Ore., Sept. 17 and 18, 1917.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, Crossley Building, San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa. Annual convention, Bedford Springs, Pa., Sept. 7 and 8.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, Thomas J. Styles, 152 Beech St., Yonkers, N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa. Annual meeting, Evanston, Ill., June, 1918.

SOUTH DAKOTA ELECTRICAL POWER ASSOCIATION. Secretary-treasurer, Frederick D. Brown, Huron, S. D.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, Thomas W. Peters, Columbus, Ga. Annual convention, Birmingham, Ala., Oct. 23-26.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, H. C. Bower, 602 Metropolitan Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, Forrest E. Baker, 721 First National Bank Building, El Paso, Tex.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, H. S. Ashley, Fort Worth, Tex. Annual meeting, Galveston, Tex., June 15, 1918.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C. Annual meeting, Charlotte, N. C., April, 1918.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt. Annual meeting February, 1918.

VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 Jackson Building, Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis.

14,343. EXTENSION SOCKET; Reuben B. Benjamin, Chicago, Ill. App. filed Jan. 31, 1912. Improvements.

1,237,290. ELECTRIC SOLDERING IRON; George F. Browning, Toppenish, Wash. App. filed March 2, 1917. May be used continuously without requiring periods of heating.

1,237,306. DYNAMO-ELECTRIC GENERATOR; Alfred H. Darker, Blackheath, England. App. filed March 15, 1915. Means for regulating or controlling the generation of current in cases where the dynamo is connected up with a battery or batteries and a consuming circuit.

1,237,320. SIGNAL DEVICE; Gordon Fox and Tony M. Jewett, Cleveland, Ohio. App. filed Aug. 29, 1913. Adapted for use in factories, stores and similar places where it may be necessary or desirable to make signals from one or more points of control.

1,237,329. SYSTEM OF CONTROLLING MOTORS AND THE LIKE; William L. Hamilton, Glasgow, Scotland. App. filed March 29, 1915. The application of the power required for starting the drive in the forward direction may be initially controlled by hand actuation, and the subsequent operations up to and including the stopping of the drive at its termination in the reverse direction may be effected entirely automatically, although, if required at any stage, the drive may be interrupted by hand actuation.

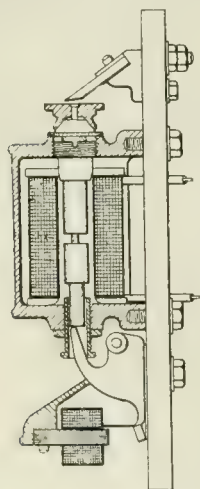
1,237,370. CUT-OUT SWITCH; Thomas E. Murray and Arthur V. A. McHarg, New York, N. Y. App. filed Jan. 10, 1917. So constructed that an aperture in the wall of the casing whereby access may be had to the parts within said casing is closed by a swinging shield when said switch is closed, and opened when said switch is opened.

1,237,371. APPARATUS FOR BENDING METAL PLATES; Thomas E. Murray, Jr., Brooklyn, N. Y. App. filed May 5, 1917. For electrically softening a certain portion of a metal plate and for bending said plate at said softened portion.

1,237,379. METER-TESTING CONSTRUCTION; Clarence D. Platt, Bridgeport, Conn. App. filed Dec. 4, 1916. Contemplates the use of a special type of plug and cords for each set of jaws to be connected to the test meter.

1,237,401. MEANS FOR PREVENTING CURRENT LEAKAGE IN ELECTRIC CABLES; Severn D. Sprong and Walter E. McCoy, New York, N. Y. App. filed Dec. 12, 1916. Pot-head for the end of a high-tension cable, so constructed as to prevent current leakage from the conductors of said cable to the metal of the pot-head.

1,237,411. LAMP HANGER; Allison J. Thompson, Cleveland, Ohio. App. filed Feb. 9, 1914. Applies to devices utilized in supporting a lamp in a manner such that it



1,237,226—Induction-Motor System

may be raised and lowered from the ground by a rope or other similar connection.

1,237,454. MOTOR CONTROLLER; Thomas E. Barnum, Milwaukee, Wis. App. filed May 24, 1915. Means adapted to operate under the direction of a simple push-button station to afford an exceedingly flexible control of the motor, including starting and acceleration thereof to different predetermined degrees by different operations of a single push-button switch.

Record of Electrical Patents

Notes on United States Patents
issued on August 21, 1917

1,237,459. ARMATURE FOR DYNAMO-ELECTRIC MACHINES; Joseph Bijur, New York, N. Y. App. filed Dec. 6, 1913. Provides an armature in which the grooves and teeth are so formed as to permit the use of a greater amount of winding, or more coils, with an armature of a given diameter, than has been possible in armatures as heretofore constructed.

1,237,517. PROGRAM CLOCK; Archie P. Honey, Crosby, Minn. App. filed July 17, 1916. Includes a plurality of signals such as signal bells with means whereby each bell may be energized according to a predetermined program without interfering with any other bell, by this means providing for a change of program at any time.

1,237,518. MOTOR CONTROLLER; Albert J. Horton, White Plains, N. Y. App. filed Jan. 9, 1915. Improvements.

1,237,559. BALANCER; Shiro Sano, Tokyo, Japan. App. filed Aug. 22, 1916. The principle of the "balancer" is to give between the earth-plates and the Wheatstone bridge or any other instrument of similar nature an equal and opposite electromotive force.

1,237,584. SYSTEM OF ELECTRICAL DISTRIBUTION; Percy H. Thomas, Upper Montclair, N. J. App. filed July 12, 1916. Relates to circuits for operating mercury-vapor rectifiers from multiphase alternating-supply circuits.

1,237,592. ELECTRICAL HEATING UNIT; Louis R. White, Bennington, Vt. App. filed Oct. 21, 1915. For domestic purposes.

1,237,611. TERMINAL CONNECTION FOR ELECTRIC LAMPS; Robert B. Brownlee, East Orange, N. J. App. filed Feb. 11, 1914. Improvements.

1,237,638. SYSTEM OF RECTIFICATION; Arthur P. Haase and Frank D. Pearne, Chicago, Ill. App. filed Aug. 5, 1915. Improvements.

1,237,648. ELECTRICAL SYSTEM; John W. Jepson, Depew, N. Y. App. filed Aug. 8, 1912. Improvements.

1,237,649. APPARATUS FOR CONTROLLING ELECTRIC CIRCUITS; Oscar I. Judelson, Brooklyn, N. Y. App. filed July 10, 1915. Provides a casing or box to inclose the electric controlling devices, and is provided with a cover or door that is adapted to control means to prevent operation of the switch arm of the apparatus in the event that the cover be left open.

1,237,653. METHOD OF CLEANING AND RE-NEWING ELECTRIC LAMPS; Frederick G. Keyes, East Orange, N. J. App. filed Jan. 28, 1914. Principle of the method consists in withdrawing the air from the lamp to be treated and forming in situ on the glass walls a volatile compound of tungsten.

1,237,681. INDUCTION MACHINE; Alfons H. Neuland, San Francisco, Cal. App. filed Oct. 2, 1913. Provides an induction machine capable of operating at a variable speed and a variable torque as well as a simple means of starting a motor from rest.

1,237,682. DYNAMO-ELECTRIC MACHINE; Alfons H. Neuland, San Francisco, Cal. App. filed June 17, 1914. Means for substantially decreasing the reaction due to the opposed magnetic flux of inductor alternators with a high frequency per revolution, thereby materially improving their regulation.

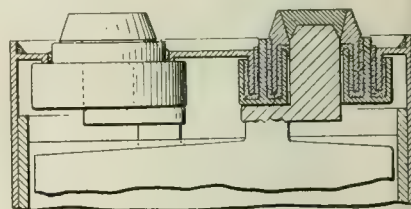
1,237,718. SPRING BATTERY CLIP; Francis H. Speice, Dubois, Pa. App. filed Dec. 30, 1916. Quickly applied to a binding post or removed therefrom, and will produce an excellent electrical connection therewith.

1,237,733. STORAGE BATTERY; Theodore A. Willard, Cleveland, Ohio. App. filed Sept. 30, 1915. Means for sealing the terminal posts so as to prevent leakage of acid to the exterior of the cover, and also for insulating the posts and connectors from the cover.

1,237,775. ALTERNATING-CURRENT ELECTRICAL INSTRUMENT OF THE MOVING-COIL TYPE; Randolph D. Gifford, Chingford, England. App. filed Jan. 18, 1915. In which the moving element consists of or includes a conductor traversed by an alternating current, or a rectified alternating current, or a varying or interrupted continuous current.

1,237,807. SWITCH BOX; Harry O'Connor, Port Huron, Mich. App. filed Sept. 10, 1915. Provides means to prevent persons from connecting into an electric circuit before the passage of the current through a meter.

1,237,810. GUIDING DEVICE FOR WRAPPING MACHINES; Frank M. Pierce, Chicago, Ill. App. filed Feb. 21, 1916. Improvements.



1,237,733—Storage Battery

1,237,811. ADJUSTING MECHANISM FOR WRAPPING MACHINES; Frank M. Pierce, Chicago, Ill. App. filed Feb. 21, 1916. The article may be positioned according to its size to receive a wrapper applied thereon.

1,237,812. PAPER FOLDER; William B. Pierce and Frank M. Pierce, Chicago, Ill. App. filed Jan. 2, 1915. Improvements.

1,237,843. INSULATOR SUPPORT FOR TOWERS; John W. Ward, Latrobe, Pa. App. filed Dec. 24, 1915. Consisting of a series of plates or disks built in combination to form an insulated base for support of heavy towers, and which are constructed of solid material for compressive strength to sustain heavy loads.

1,237,857. ELECTRIC COUPLING; Rex G. Averill, Mansfield, Ohio. App. filed March 16, 1916. Between cars.

1,237,915. ELECTRIC WELDING APPARATUS; Lawrence S. Lachman, New York, N. Y. App. filed Jan. 19, 1916. Means to prevent creeping of the plates when the welding is done consecutively at separate points in the surface of the metal sheets.

1,237,933. MICROPHONE WITH CARBON-POWDER FALL FOR STRONG CURRENTS; Giovanni B. Marzi, Cornigliano Ligure, Italy. App. filed Feb. 12, 1914. Renews continually the carbon which forms the contacts of variable resistance so that it cannot become heated.

1,237,944. INDUCTION DEVICE; Alfons H. Neuland, New York, N. Y. App. filed Sept. 1, 1915. Produces an induction machine in which the rotor when in electrical synchronism with the revolving field has a lower angular velocity than the field.

1,237,953. AUTOMATIC SUBSTATION; Claude W. Place, St. Louis County, Mo. App. filed June 25, 1915. Provides a substation which shall be entirely automatic, thus dispensing with any need for continuous attendance, and shall operate, in accordance with the load conditions of the distribution circuit, when it may be needed.

1,237,973. AUTOMATIC SUBSTATION; Edward Taylor, Chicago, Ill. App. filed July 7, 1915. Sequence of operation of the various switches controlling the rotary transformer is exactly determined, and also that the intervals between the operation of the various switches are properly controlled.

1,237,993. SAFETY BURGLAR-ALARM LOCK FOR WINDOWS; Carl H. A. Bahde, Milwaukee, Wis. App. filed July 5, 1916. Has particular application to means for locking both sashes of the window together in any adjusted position of the sashes so as to prevent relative movement thereof.

1,238,027. ELECTRIC-SIGN SYSTEM; Malcolm E. Launbranch, Chicago, Ill. App. filed Jan. 22, 1916. Improved system of operating and controlling signs of this character.

1,238,066. ELECTRIC SPEED OR PRESSURE-CONTROL DEVICE; Charles A. Mullen, Sistersville, W. Va. App. filed Oct. 5, 1916. Relates to governors for explosive engines responsive to the pressure of fluid delivered by a pump driven by the engine or to speeds of a moving part driven by the engine.

Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN
Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, SEPTEMBER 8, 1917

No. 10

War and Labor

IT IS time the American people fully awoke to the fact that their country is in a war of the first magnitude, and that conditions of business and of labor will undergo profound changes which are already beginning. Unless preparations are made to meet such changes, we shall find ourselves soon in a very unpleasant situation. The effect of the war on the labor situation is likely to be especially serious. Even now there is trouble enough, and presently we must prepare for more. A million and a half men are now being put under arms. This in itself is no serious drain on the country. We lose that number out of the active life of the country every summer, on vacations and otherwise, without realizing the small percentage of loss. But at the present stage of the war it takes about four men at home to keep one man of the fighting force supplied. The ratio early in the war was a little smaller than this, but the enormous use of artillery has brought it to the present figure. Further, only 25 or 30 per cent of the fighting force can be kept on the fighting line; the rest are in the rear, resting, or engaged in various tasks of construction and transportation far back of the trenches.

If we are to put and keep even a million men at the front, a number which may readily prove entirely inadequate to the needs of the crisis, then we must reckon on not less than twelve million engaged in one way or another directly in the tasks of war at home or abroad. This is more than a quarter of the nation's working force; hence, if there ever was a time in the history of industry when the most determined efforts should be made to push production by the aid of every labor-saving device that ingenuity can suggest, that time is now. To keep up the necessary war work not only must a great force of workmen be deflected from other pursuits, but they must have every possible facility to increase the individual output. Factories must be equipped with this chiefly in view, so that mechanism may be made to do a greater share than ever before. This is doubly important, for the reason that it is virtually certain that conditions will call for the employment of a very largely increased number of women, whose lack of brute strength must be compensated for by mechanical aids. As we pointed out some time since, the situation is not one of "business as usual," which is simply a fool's paradise, inviting the devil to break in, but business as unusual, in which every effort must be made to accommodate the industrial situation to real and not to fancied necessities. Between war materials and the huge task of feeding ourselves and the Allies, so large a proportion of our labor is necessarily employed that

other things will have to go by the board except in so far as industry and ingenuity can make one man approach as nearly as may be to doing the work of three. The hour to prepare for this rearrangement of labor and for the intensive use of labor-saving devices is right now.

Street Illuminants

JAMES R. CRAVATH'S article in this issue on the characteristics of illuminants for street use gives a thoroughly up-to-date view of the present situation. At the present moment the sources of real competition for street-lighting purposes are the gas-filled tungsten lamps and the magnetite arcs. Mr. Cravath is quite right in regarding the inclosed carbon arc as practically of only historic interest. We wish that we might say that all extant specimens of this lamp were reposing in collections of old apparatus, instead of being on the street; but in point of fact many thousands are still in use, although practically obsolescent. As regards the flame carbon arc, the case is somewhat different, inasmuch as the influences which have caused its decreasing use have not been inherent but external and accidental. A well-designed flame carbon arc is today so much more efficient in lumens per watt than any other form of illuminant that it would well hold its own had it been possible to bring the lamp in this country to the point of usefulness reached abroad. As a matter of fact, things were going very well with it up to about the time the war broke out, when the natural disturbance of affairs prevented the usual adjustment that takes place between foreign and domestic engineering problems. The difficulty with the globes to which Mr. Cravath refers has been a minor consideration in change of practice, but he is quite right in classifying the flame carbon lamp as on the downward road at present.

The balance between the incandescent and arc lamps at the present day is one not easy to strike. It is a question of the particular lighting problem to be solved, density of service, cost of energy, and the preference of the community and the electric lighting company for one or the other illuminant. Where powerful sources of light are required by the conditions, the arc lamps maintain an advantage in efficiency, and in common estimation in color also, that enables them easily to hold their own, while for general service the incandescent lamps present the advantage of sources of moderate power and yet very good efficiency, so that owing to the advantages of subdivision better lighting can be had by their use than with arcs. Diffusing and redistributing glassware is a useful addition to both,

although the smaller sizes of incandescent lamps are, for economical reasons, not generally so equipped. The main practical difficulty with incandescent lamps seems to be a strong tendency of bulbs to blacken, a tendency much less marked now than in the early days of the gas-filled lamp, but still troublesome, and particularly noticeable in the otherwise very useful incandescents of rather large power inclosed in glassware. By day these may come to present the appearance of a blackish smudge even before the actual light-giving power has been very seriously reduced. It requires vigilance and energy at present to overcome this difficulty, but on the whole the results are very satisfactory.

Give Electrical Contractors Their Due

IN THIS issue we publish two articles which bring into bold relief the policy adopted toward electrical contractors by the government in the great program of cantonment construction now drawing to a close. One, by Colonel Littell, expounds the policy of the Quartermaster's Department on various points, including the one of sub-contracts, which touches so closely the industry of the electrical contractors. The other article, by L. K. Comstock, tells the experiences of a committee of electrical contractors in trying to be of service in cantonment construction. Such service was barred because of the opposition of authorities to sub-contracts. This raises an interesting question of procedure, not because of cantonment construction, for that is past; but for the reason that it may involve future government attitude and the welfare of the electrical contracting industry. If this were a single isolated case, a mere question of military expediency without a long train of possible consequences, it would lack serious importance. It would be set down as an instance where decisions had to be made in haste and somebody's toes had to suffer. But in reality the aggregate work on the cantonments was very large.

It is never a slight thing to disturb the normal channels of trade. In ordinary construction the electrical work is handled by electrical contractors because they are better qualified than any other agency to do the work as it should be done. They are best qualified to do it economically and to do it well. Long experience with men and materials, training in actual construction, knowledge of markets, organization, responsibility are qualifications which the electrical contractors of recognized standing present. Keen in competition, close in bidding, they do the overwhelming bulk of the work in ordinary times. The fact that we are at war makes their skill not less valuable; it makes them more useful wherever there is work to be done of the kind that they are by efficiency best fitted to do.

We believe that the general policy of our government is to use, as far as possible, the existing avenues of trade where they are proved to be the best adapted for the purpose in hand. This policy, we submit, calls for the employment of electrical contractors. They are specialists; they have developed themselves and their

organizations to render effective service along lines which call for technical ability. They are in every way anxious to be of use. We believe that they will be as patriotically ready as any other commercial agency in the country to do what they can. It is a time of historic crisis. They want to have the same part that others have. They are fairly entitled to it.

Engineering a Shift in Coal Supply

A BRIEF paper in our columns gives an account of the very ingenious and successful methods by which the Milwaukee Electric Railway & Light Company has dealt with a change in coal supply. Previously it had been receiving its coal from the Eastern coal districts by water, unloaded at a convenient yard and then moved to the power house along the river on a special self-unloading barge. Now the coal supply comes by rail, and provision had to be made for getting this coal to the power house with the minimum possible trouble. The layout of the new coal-handling plant was determined with reference to the conditions and machinery previously existing, with the pleasant result that all the equipment of the old plant has gone into the new, and the coal supply has been shifted at a minimum cost to meet the new conditions.

Shifting Underground Cables

THAT underground cable work is getting every year upon a sounder and sounder basis is put strongly in evidence by the success of the Commonwealth Edison Company of Chicago in dealing with the problems of shifting old cables from one location to another. It has rather commonly been the notion that pulling long-used cable out of one duct and laying it in another is a very serious undertaking, likely to lead to trouble. At the present time the cost of cable is so great that when new conditions of distribution change the requirements of the underground conductors it is worth while to utilize every foot of usable cable wherever it can be of the most service. The engineers of the Commonwealth company have tackled the job very successfully, so that they are now moving about 75 miles (120.7 km.) of old cable, some of it in use for twenty years, and apparently are making an extremely good job of it. It is found that so long as the lead sheath is in good condition and the insulation undamaged, cable can be drawn out and shifted to a fresh position of usefulness without very serious difficulty. In removing old joints and sealing the ends preparatory to the shift, the condition of the insulation can be determined, and careful inspection will avoid faults with the lead sheath.

One of the very ingenious details of the work is a thorough record keeping of the lengths of cable, together with their respective places, including cable likely to be released by future changes. By filing the pieces of cable according to the length, wastage in shifting can be greatly reduced. It becomes possible readily

to pick out pieces that would fit into the new situation without waste. Further to reduce waste, splices are being pulled into the ducts, a long piece being drawn in until enough is left outside to splice; then the necessary shorter piece is spliced on, with a somewhat smaller lead sleeve than usual, and drawn in, a procedure which relieves the tension in drawing. So far it appears that hardly more than 2 per cent above ordinary wastage has been lost, although as the number of pieces to select from grows smaller this proportion may slightly increase. The net result is that 75 miles of cable will be restored to long-continued usefulness which otherwise would probably have been sold for junk.

Limiting Alternator Short-Circuit Currents

WHEN a large central-station alternator, say of the turbine-driven type, is running under rated load in normal operation, a steady stream of energy is passing through the machine at a great rate. It enters as mechanical power at the shaft, in torque times angular velocity, and leaves as electrical power at the terminals, in voltage times current. The electrical conductors in the machine easily carry the normal mechanical and electrical stresses involved in this steady performance of duty. If, however, a heavy short circuit occurs, say on the feeder system, not far from the station, the electromotive force generated in the armature tends to send through the short a current perhaps hundreds of times the normal strength. The enormous output of current and power may develop disastrous effects in the feeder system, but unless they are instantly checked, the corresponding stresses inside the alternator delivering the short-circuit current may also be so great as to wreck the machine mechanically as well as electrically.

To protect both the alternator and the system from the possible effects of severe shorts, automatic circuit breakers are installed which will promptly open the alternator circuits close to the terminals. Even with such apparatus installed, it may happen that, either by overload of the circuit breakers or before they can operate, the stresses on the alternator may be too severe to be endured safely, especially when several alternators are operating in parallel on the same set of busbars. Large reactors are therefore frequently installed between the alternators and the external system, or between different sections of that system, so that in case of heavy shorts they may automatically set a fairly safe limit to the strength of the short-

circuit currents, independently of and also in support of the circuit-breakers. These reactors are reliable, but they are bulky and awkward devices. They also interfere to some extent with the regulation and efficiency of the system.

In an article in this issue Ralph Bown suggests that something can be done to limit the violence of a short by inserting additional resistance or reactance, or both, in the field circuit, instead of in the armature circuits, of an alternator. The suggestion is based upon experiments made with a comparatively small polyphase alternator, capable of delivering some 1300 amp. peak current on immediate short circuit in one phase. The effect of adding 2.5 henries of external inductance in the field circuit reduced this instantaneous peak current to 1000 amp.

Just how far the suggestion could be practically utilized in central station practice is a question for detailed consideration by alternator designers, with the aid of experimental tests. There is, of course, a very distinct disadvantage in loading the alternator field circuit with extra resistance and reactance. The benefits capable of being secured in this way would have to be sufficiently great to overcome this disadvantage. Different types of machine would be likely to respond in different degrees to this type of protective modification.

Apart from the question of practical serviceability, the article is useful in presenting a simple qualitative theory of some of the salient transient phenomena occurring in an alternator during the first few cycles after a sudden short circuit. The theory is supported by the oscillographic evidence.

It is well known that when an alternator is running steadily under any normal assigned set of conditions the armature behaves as though it possessed a certain reactance, commonly called the "synchronous reactance." This synchronous reactance is partly due to the inductive reactance of the armature, and partly to armature reaction on the rotating magnetic field. On the occurrence of a short circuit the armature current is, unfortunately, not limited by the value of the synchronous reactance but by the value of the much smaller inductive reactance. After the expiration of a certain number of cycles the shorted alternator settles down to a new condition, in which the effective reactance is more nearly equal to the synchronous value. It is just during these first and particularly dangerous few cycles that the internal actions of the machine are relatively difficult to apprehend, and the article throws light upon this subject.

WITH the tendency toward concentration of power generation and the growing use of electric furnaces it has become especially important that the stresses which will be exerted between busbars on short circuit be accurately predetermined in order that they may be properly supported. This subject will be taken up in a very clear manner in the next issue by H. B. Dwight. Some

The Coming Issues

of the problems involved in operating alternators in parallel and what precautions should be taken to prevent "phase swinging" will be discussed in another article. The third article in the series by James R. Cravath devoted to street lighting for small cities will be confined to poles and lamp supports, with consideration given to both overhead and underground construction.

Changing from Eastern to Central States Coal

How the Coal-Handling Equipment and Facilities of a Middle Western Company Were Rearranged and Augmented to Permit Receiving Coal by Rail Instead of by Water Without Losing the Value of Existing Equipment

THE Milwaukee (Wis.) Electric Railway & Light Company found it necessary to considerably revise its coal-handling facilities incident to the substitution of coal from the central part of the United States for coal formerly received from the so-called Eastern district. Due to this change provision had to be made for facilities to receive the coal by rail instead of by water routes, so a new water-side coal yard was erected to store the coal, crush it and deliver it to a specially constructed self-unloading barge designed to deliver coal to the company's power plants. The coal-handling scheme is especially interesting because the methods which were adopted have permitted the company to utilize every piece of equipment which it employed in its former plant. No equipment was scrapped.

Under the old system coal was received by way of the Great Lakes, unloaded and stored in a local coal company's yard, then moved to the power houses on the self-unloading barge. The first problem under the new system was to find a water-side yard large enough to accommodate the storage coal and necessary handling equipment. For this purpose the company vacated its 680-ft. by 280-ft. (207.26-m. by 85.34-m.) general storage yard on the Kinnickinnic River. The yard lies with one of its short sides along the waterfront, and is surrounded by sites already occupied by local industrial plants. For this reason the economical use of the 190,400 sq. ft. (17,750 sq. m.) of space available was especially important.

When coal arrives at the yard it may take one of two courses: it may be unloaded by either of the two electric locomotive cranes and stored in the yard, or it may be taken immediately to a 1500-ton (13500-t.) bunker for filling barges which will transport it to the power

house. This practice will, of course, reduce chances of spontaneous combustion in stored coal.

The general arrangement of the tracks, conveyors, bunkers, crusher and hoppers is shown herewith. When coal is received in bottom-dump cars it is switched over a 41-ft. by 20-ft. (12.49-m. by 6.09-m.) track hopper. Two shakers in the bottom of the hopper driven through eccentrics and reduction gears from a 15-hp. squirrel-

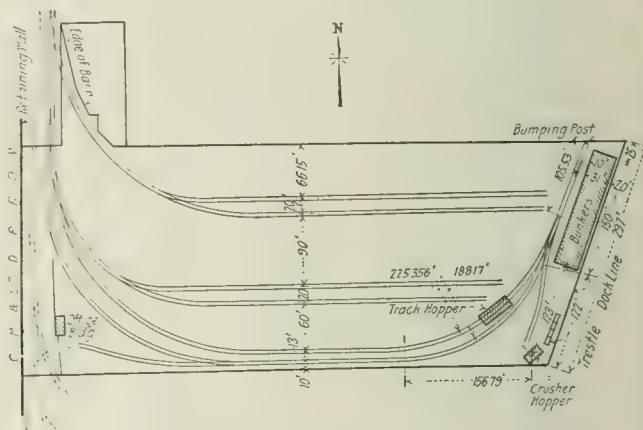


FIG. 2—LAYOUT OF TRACKS WITH RESPECT TO DOCKS, COAL HOPPERS AND BUNKERS

cage motor deliver the coal to a belt conveyor. These shakers have a travel of about 4 in. (10.2 cm.), which for faster operation may be increased to 10 in. (25.4 cm.) by shifting the eccentric settings. The reduction gears cut down the speed from 720 r.p.m. at the motor to twenty strokes per minute at the shakers. A 36-in. (91.44-cm.) belt which operates on 67-ft. (20.4-m.) centers rises from beneath the shakers at an angle of 19.5 deg. to the hopper over the coal crusher. This belt is driven by a 15-hp. motor and is now operating at 240 ft. (73.15 m.) per minute.

Coal which comes to the yard in cars which cannot be dumped is switched to the short siding near the crusher and is transferred to the crusher hopper by a locomotive crane. This hopper has been built with three sides sloping at 45 deg. and one side at 30 deg. in order that coal dropped into it from the belt conveyor will slide readily to the crusher. Coal dropped from the 1.5-yd. (1.15-cu. m.) bucket of the locomotive crane will slide slowly on the more gentle 30-deg. slope. This arrangement prevents unnecessary overloading of the crusher.

A grillage under the hopper separates the screenings and by-passes them around the crusher. This arrangement also tends to prevent clogging of the crusher, which is of the single roll, 36-in. by 36-in. (91.44-m. by 91.44-m.) type. It is driven through a belt at 60 r.p.m. by a 100-hp., 720-r.p.m. slip-ring motor. At this speed it will handle 250 tons (225 t.) of coal per hour, taking in Illinois or Ohio run-of-mine and reducing it to 15-in. (38.1-cm.) sizes. The slip-ring motor was selected for this service because of its better starting characteristics and also to permit reversing the crusher at times to



FIG. 1—LOCOMOTIVE CRANE AND CONVEYOR FROM TRACK HOPPER DISCHARGING INTO CRUSHER

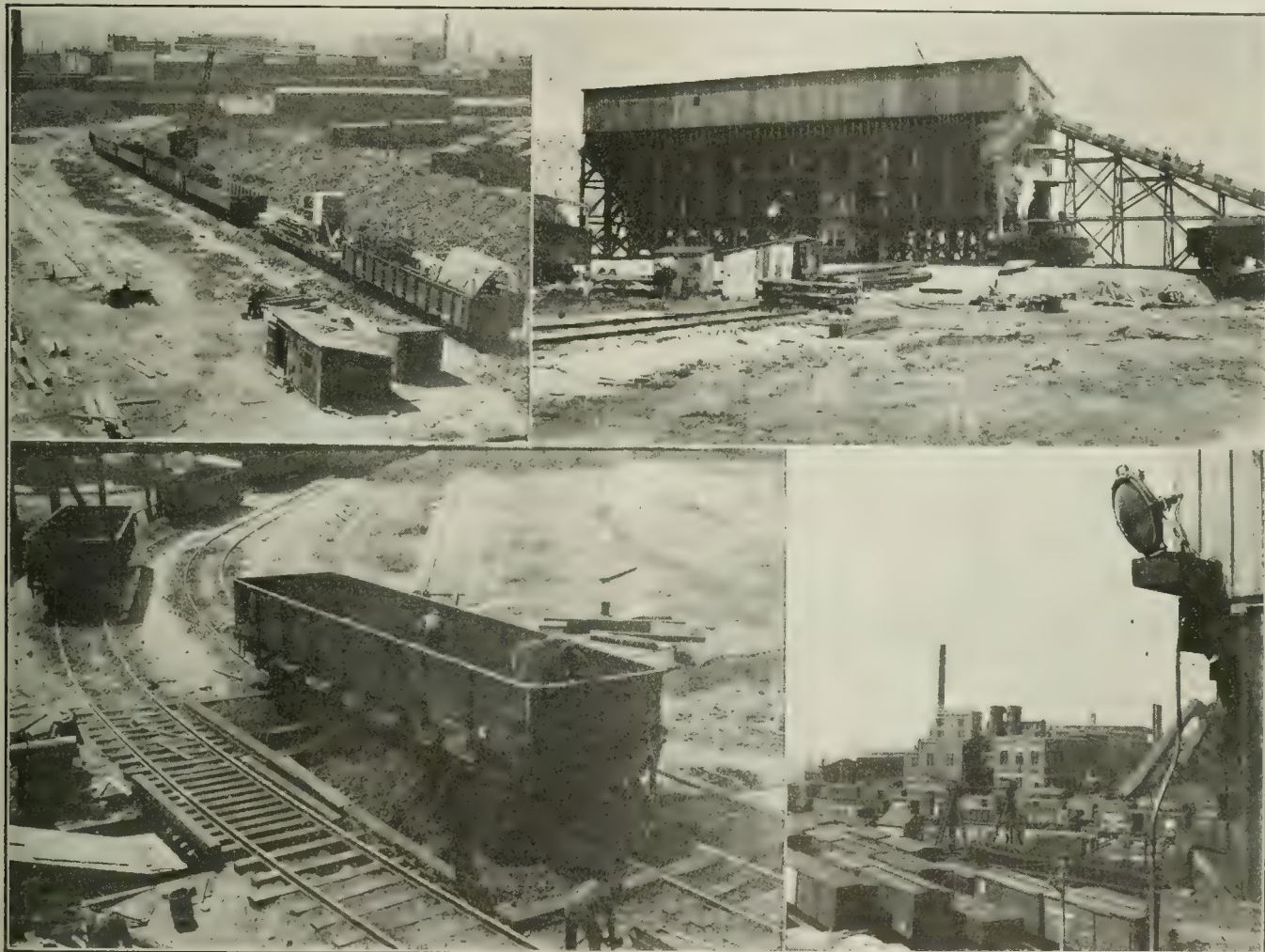
house. The handling of the coal in this fashion is facilitated considerably by a clause in the company's coal contract which provides for separating mine-run coal at the mines into cars of either screenings or lump. This makes it possible, under ordinary circumstances, to store only screened lump coal and to use all screenings

free the rolls. The single-roll type of crusher was chosen because at other plants operated by the company it has given satisfactory service with low maintenance costs even on hard grades of coal.

The fine coal leaving the crusher falls on a 30-in. by 150-ft. (76.2-cm. by 45.71-m.) rubber belt, which ascends to the water-side bunker at an angle of 22.5 deg. A 25-hp., 1800-r.p.m. type I motor drives this belt when it is loaded at 325 ft. (99.06 m.) per minute and delivers the coal to a 30-in. (76.2-cm.) flight conveyor running the full length of the bunker. The flight conveyor, which travels 100 ft. (30.48 m.) per minute, is connected through reduction gears to a 20-hp., 1200-r.p.m. motor. Utilizing the return side of this flight conveyor to trim the top of the coal piled in the bunker

concrete. It measures 150 ft. (45.7 m.) long by 53.75 ft. (16.4 m.) high by 29 ft. (8.8 m.) wide. The substructure is all of mill construction, using mostly 10-in. by 10-in. (25.4-cm. by 25.4-cm.) and 10-in. by 12-in. (25.4-cm. by 30.48-cm.) yellow pine timbers each capped with a 0.5-in. (1.9-cm.) steel plate.

While the usual plan will be for this bunker to deliver coal to a river barge, spouts are provided for dumping into cars as an emergency method. When the barge "transfer" is used the water-side spouts are set and gates are opened by the boat crew from a gallery approximately at deck level. It takes about ninety minutes for the spouts to deliver 1500 tons (1350 t.) to the barge. This self-unloading barge is 200 ft. (60.9 m.) long, 34 ft. (10.4 m.) beam and 14 ft. (4.3 m.)



FIGS. 3 TO 6—LOCOMOTIVE CRANE UNLOADING OPEN-TOP CAR; 1500-TON COAL BUNKER ON WATERFRONT FED BY CONVEYOR; BOTTOM-DUMP CAR OVER SHAKER FROM WHICH CONVEYOR RISES TO CRUSHER, AND METHOD OF LIGHTING GROUNDS

has increased the capacity of the bin by about 150 tons (125 t.). Under ordinary conditions this conveyor and crusher equipment can fill the 1500-ton (1350-t.) bunker in eight hours.

From the water-side bunker coal is delivered by gravity through two sets of spouts into the barge on the river. As may be observed from the accompanying drawing, the floor of the bunker is at an angle of 45 deg. The floor is of double construction. Maple lumber 1 in. (2.54 cm.) thick was used on the inside to provide a smooth sliding surface and to facilitate repairs to the inside of the bunker. The whole structure stands on piles driven 65 ft. (19.8 m.) deep and capped with

deep. It is equipped with a double hopper hold extending longitudinally. Beneath each hopper there are conveyors for carrying coal to two elevators, which in turn discharge into a 36-in. (91.4-cm.) rubber belt. This belt travels over a movable boom which is about 50 ft. (15.2 m.) long and can elevate coal about 26 ft. (7.9 m.). This belt unloads coal into the power-house bunkers at a rate of about 200 tons (180 t.) per hour. The 20-hp. motor which drives this belt and the 65-hp. barge-conveyor motor are supplied with direct-current energy through special water-side connections at the power houses.

At the outset the capacity and length of the bunker

were fixed at not less than 1500 tons (1350 t.) and 150 ft. (45.7 m.) respectively, because of the capacity and length of the barge which the company already owned. The location of the bunker along the water line was determined by the length of the barge, since it was necessary to distribute the coal fairly well in the hold and at the same time keep the barge prow inside the property line. The crusher was located as far south as possible and a 22.5-deg. line, which is about the steepest practical angle at which to elevate coal, was extended upward from crusher dump to determine the height of the top of the bunker. The height of the bottom of the bunker was fixed by the height of the barge as it stood in the river unloaded. With these limits of dimensions and capacity determined and keeping in mind the fact that approximately a 45-deg. angle is required to make coal slide freely the width of the bunker was determined at 29 ft. (8.8 m.).

It was not thought advisable to use an electric car

for switching in the yard because were this done the trolleys would interfere with the free action of the locomotive cranes.

All of the motors except the crane units operate on 220-volt, three-phase, 60-cycle energy and were supplied by the General Electric Company. The locomotive cranes with 1.5-yd. (1.15-cu. m.) buckets were supplied by the Link Belt Company, and the stationary crane with the 1.5-yd. (1.15-cu. m.) bucket was secured from the Browning Company. These cranes are operated by 500-volt railway-type motors. The coal crusher was supplied by the Jeffries Manufacturing Company and the belts were purchased from the B. F. Goodrich Rubber Company. The design and construction of this coal-handling plant was carried out by the company's own engineers under the direction of John Anderson, chief engineer of power plants. The plant complete, exclusive of real estate, represents a capital expenditure of \$75,000.

Reinstalling Old Cable Saves \$200,000 at Chicago

Cables Which Have Undergone Twenty Years of Service Have Been Removed from Original Position and Successfully Installed and Operated in Other Duct Lines at Higher Voltage

PRICES of all materials and equipment are so high that it pays in every case to consider whether the maximum use is being obtained from every invested dollar and if not to reinstall the material and equipment where they will be utilized with the maximum benefit. Indications that it is practicable to remove cable from places where it has been in service and to reinstall it in new positions are given by the fact that the street department of the Commonwealth Edison Company, Chicago, is moving about 75 miles (120.7 km.) of cable from one location to another on its system. This innovation has been brought about principally by the increase of generating capacity in the Northwest Station making it possible to supply energy to all of the substations in its economic territory, whereas heretofore considerable energy had to be supplied to these substations from the Fisk Street and Quarry Street generating stations. About 70 per cent of the cable being moved is three-conductor, paper-insulated, lead-covered transmission cable which operates at 9000, 12,000 or 20,000 volts and at either 25 or 60 cycles. The remainder is four-conductor distribution-line cable for 4100-volt, three-phase, 60-cycle circuits.

The Commonwealth company's decision to reinstall this cable is evidence of the beginning of a change in general underground practice. Some engineers are still prejudiced against using, under any circumstances, cable that has been withdrawn from the conduits. Other engineers will not use cable under such conditions unless it is placed in service at a lower voltage than that at which it was originally used. All such ideas have been gradually eliminated at Chicago, largely by the persistent arguments of the men who were most closely in touch with the work, and by trials made during the past few years.

The contention of the men in the street department is that as long as the lead sheath remains intact and the

insulation of the cable shows no signs of being damaged either by overheating or in any other manner, the cable is in condition to be utilized again after it has been drawn from the conduits. It is further contended that damage to the insulation by overheating or by moisture, or to the lead sheath by cracking, etc., can be easily detected by the men handling the cable if they are on the watch for defects. Paper damaged by overheating is easily detected when removing old joints and sealing the cable ends by the brittleness of the insulation. The company's men have been properly instructed regarding such watchfulness and it is felt that by giving the proper amount of care and attention to such minor details the troubles will be insignificant compared with the saving made by the reinstallation of the old cable. By carefully removing all cables, even from circuits which have been burned out, the portions which are not damaged can be utilized again at another location either on construction or on repair work. Moreover, the company's engineers have no prejudice against using the cable on even a higher voltage than the original if they think that the cable is adapted for service at this voltage.

About twenty years ago the company installed a number of No. 2/0 lines out of Harrison Street station for use on the 9000-volt, 25-cycle system, which was then just being developed. At that time No. 2/0 was the maximum size of cable used. This cable was taken out of service a few years ago when the Harrison Street plant was discontinued as a 9000-volt generating station. Until recently the cable has been in the ground properly sealed so as to protect it from damage by moisture. Now, however, the street department has pulled out between 1 mile (1.6 km.) and 2 miles (3.21 km.) of this cable and moved it to a new location several miles distant, where it is installed and placed in service on the 12,000 volts, 60-cycle system. Now the

One of the problems in connection with the transfer of this 75 miles (120.7 km.) of cable is to keep the waste at a minimum. A system of record keeping has been worked out which is very helpful in solving this difficulty. This system permits lengths of cable from

FORM CU 8		REEL NO. X456		FEET 488		3M-12-17	
W.O.		LINE OR CIRCUIT NO.	SIZE CABLE	FEET CABLE	ASS'Y M Y NO.	DATE	
REMOVED	6476-95C	Ckt.1 Gr	250	488	126	7-27-17	
	LOCATION 36th St.-Al. W. Gage to Al.E.						
INSTALLED	7366-95C	T.L.2		486	430		
	LOCATION Paulina St.-Flournoy St. to Polk St.						
	LOCATION						
INSTALLED							
	LOCATION						
INSTALLED	LOCATION						
INSTALLED	LOCATION						

FIG. 1—TYPICAL CARD FROM RECORD USED TO REDUCE WASTAGE
AND TO KEEP TRACK OF CABLE

To reduce wastage further splices are being pulled into the ducts. It is the practice in such cases to select a long and a short piece of cable for splicing to the desired length. The longer piece is pulled into the duct until only enough remains outside the manhole to facili-

RECORD OF CABLE REMOVAL													
REMOVAL										INSTALLATION			
LINE NO.	ON	FROM	TO	REEL NO.	S.E. NO.	REEL NO.	S.E. NO.	ON	FROM	TO	REEL NO.		
206	35th St.	31st W	32nd W	11270	188	188	188	Paulson St.	Flourtry	Polk St.	420		
207	"	31st W	32nd W	11270	188	188	188	"	"	W.B.	420		
208	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
209	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
210	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
211	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
212	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
213	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
214	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
215	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
216	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
217	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
218	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
219	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
220	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
221	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
222	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
223	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
224	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
225	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
226	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
227	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
228	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
229	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
230	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
231	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
232	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
233	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
234	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
235	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
236	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
237	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
238	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
239	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		
240	35th St.	Morgan St.	32nd W	11270	188	188	188	"	"	W.B.	420		

FIG. 2—RECORD USED FOR FOLLOWING JOB IN DETAIL

tate splicing. The splice is then made on the street level above the manhole and the splice and shorter piece are pulled in. This procedure, of course, reduces the tensile strain on the splice. About twelve such high-tension splices are now operating satisfactorily. Wire grips are used for pulling cables in and out, and it is the rule never to have more than one splice per run.

The company's records to date, with the work about one-third completed, indicate that the wastage of cable is not more than 2 per cent above the ordinary wastage due to cutting off each length. As the work draws nearer to a finish it is expected that the wastage will increase to 3 per cent or 4 per cent since near the end of the job there will be fewer lengths to choose from.

The financial aspects of this job are particularly interesting and are especially important now. If the company's rules had prevented the removal of cable from one location to another it would have been necessary to have ordered new cable for all installations made this year. In all probability the old cable would have been pulled out and disposed of as junk. If this plan had been followed the increase in cost to the Commonwealth Edison Company would have been upward of \$200,000.

This transfer of cable is being carried out for the Commonwealth Edison Company by D. W. Roper, superintendent of the street department, and N. E. Buck, superintendent of underground cable work.

Neon Tubes Employed for Lighting Purposes

In suggesting the employment of neon tubes for lighting purposes George Claude of Boulogne, France, in patent No. 1,231,494, proposes using mercury-vapor tubes in conjunction therewith in order to correct for the predominance of the neon red rays. The requisite correction can be obtained by introducing a few drops of mercury into a neon tube and then passing an alternating current through it to volatilize the mercury till the neon radiations completely disappear. The radiations of this corrector tube are then added to the red radiations of an adjoining neon tube, giving a greatly improved resultant light. It is obvious, though, that in

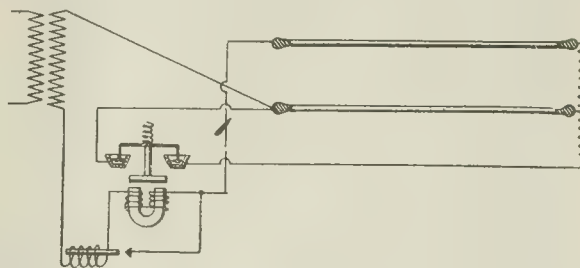


DIAGRAM OF CONNECTIONS

order to make the correction as perfect as possible the red light of the neon tube and the blue light of the neon and mercury tube must be suitably proportioned. It has been found that if the red tube and the blue corrector tube have the same diameter and the same current is passed through both, the blue tube should be about twice as long as the red one.



Government Policy in Cantonment Contracts

Labor Situation, the Basis of the Contracts, Sub-Contracts and the Method of Financing Were Problems for Which Solutions Had to Be Arranged

BY COL. I. W. LITTELL, QUARTERMASTER UNITED STATES ARMY IN CHARGE OF CANTONMENT CONSTRUCTION

SO MANY erroneous statements have been made and so much misinformation seems abroad with reference to cantonment construction that I assume the ELECTRICAL WORLD would be glad to publish the information which ought to clear up misapprehension.

In a work of such magnitude, aggregating all told sixteen camps, eighteen cantonments and thirty-two auxiliary remount depots, with an approximate expenditure of \$150,000,000, and with the war condition facing us and the necessity for speed as the first essential, it can easily be seen that much disturbance would arise in the industrial world if the plans for letting of the contracts and financing them were not carefully laid and exactly carried out.

In the first place, there was the necessity to secure proper contractors, and this was done through the wise assistance of the Council of National Defense, which investigated and passed upon the ability and trustworthiness of the various contractors. After careful analysis sixteen of such contractors were selected and the sixteen National Army cantonment contracts were entered into on the "cost plus" basis. This form of contract was also carefully passed upon by the Council of National Defense, and the best advice in the country was obtained with reference to its requirements.

The second consideration that arose and which involved much time and thought and study to adjust satisfactorily was the labor situation. It was realized that if men were to be attracted from one camp to another by the paying of higher wages, the government would be bidding against itself and to its detriment; accordingly a policy was adopted of paying the regular union rate of wages in force on June 1, 1917, in the locality in which the camp was situated.

The third question had to do with the question of subletting contracts. The main contractor was chosen with the idea that he was big enough to do the entire work, but if for reasons of speed as well as economy it was found that specialized constructions—such as electrical wiring, water and sewer systems, heating, plumbing and so forth—should be sublet, such items were sublet, the sub-contractor on such contracts to be paid a per-

centage established by the contract and the main contractor to be paid 5 per cent of the sub-contractor's cost.

The fourth general question requiring considerable thought and study had to do with the financing of the work. The plan finally adopted and which practically results in the United States financing these huge projects was as follows:

1. The contractor was to be paid for all material received at the camp just as soon as the United States took title thereto, and to accomplish this proper forces at each camp and cantonment were organized so that cars would be unloaded immediately, and as soon as they were unloaded and the material inspected the United States took title.

2. For purchases made f.o.b. manufactory or mill, upon proper information to the constructing quartermaster that the material had been delivered to a common carrier, and to protect the government in taking discounts, the contractor was obliged on receipt of such information to discount his bills. As soon thereafter as he presented the shipper's or vender's receipt for his expenditure he was promptly reimbursed therefor by the government.

3. The contractor is paid weekly to cover his payroll as soon as he presents to the quartermaster a properly receipted and certified roll showing that he has made the expenditures in question.

4. On the ninth of each month the contractor receives the portion of his fee which has accrued to him under the contract as soon as he presents a proper statement showing total disbursements, and in addition he receives reimbursements for such other expenditures as he has made during the prior month and on which there were no discounts.

From the above I think you will see that, so far as it was humanly possible, and keeping ever in mind the speed required in this construction and the further fact that if quick preparedness shortened the war by one day most if not all of the cantonment cost would be equalized, all interests, both of the government and of the people, have been fully and amply protected.

Contractors Ready to Serve the Government

Are Given No Opportunity to Bid on Cantonment Construction Because of Instructions of Quartermaster's Department that "Sub-Contracts Are Not Looked Upon with Favor"

BY L. K. COMSTOCK

THE President's address to his fellow countrymen on April 16, 1917, called to the colors an army of civilians anxious patriotically to support the government behind the lines in its effort to prepare for the great crisis. The President said: "The eyes of the country will be especially upon you. This is your opportunity for signal service, efficient and disinterested. The country expects you, as it expects all others, to forego unusual profits, to organize and expedite shipments of supplies of every kind . . . with an eye to the service you are rendering and in the spirit of those who enlist in the ranks for their people, not for themselves."

On May 7 the Institute of Electrical Contractors passed a resolution offering to co-operate with the government on any terms the government might elect. The resolution also provided for a committee of four to proceed to Washington at once to communicate this action to those governmental departments and officials interested in the kind of service offered. When the committee reached Washington it soon discovered that all roads led either to the Council of National Defense or to the Shipping Board. A little later it recognized the truth of the old saying that all governments produce "either an ordered universe or else a welter of confusion."

The institute committee found its way to the Munitions Board, presided over then by Frank A. Scott. When Mr. Scott learned of the committee's mission he praised the industry and the institute for its loyalty and patriotism and eagerly accepted the co-operation offered, and turned the institute committee over to W. A. Starrett, chairman of the sub-committee on emergency construction and engineering. This sub-committee was occupied chiefly at that time with the work pertaining to the selection of camp sites for the National Army and the planning and building of the cantonments, in co-operation with the Quartermaster's Department.

The institute committee was told that it had reached Washington at exactly the right time to be of great assistance in this work, and if the institute could show

that it was representative of the industry throughout the country, the Munitions Board would be glad to give it representation in the board as an electrical sub-committee. The institute committee could not and did not so qualify, but in the belief that the government needed the aid such representation in the Munitions Board could give it undertook to bring to Washington a committee which could truly qualify as being representative of the industry at large.

CONVENTION FORMS COMMITTEE

There being no existing mechanism for creating such a committee in an emergency, a convention was called to meet at French Lick Springs, Ind. To this convention were invited those contractors most accustomed to executing large contracts at points more or less removed from their home offices.

This convention appointed a committee of seven to proceed forthwith to Washington to resume the work where the institute committee had left off. This committee of seven included the former committee of four.

The chairman of the Munitions Board was then advised that a committee of seven had been appointed to advise with the Council of National Defense; that it had been appointed by a convention called for that purpose, by a convention made up of representatives from thirteen of the largest cities in the country.

Representation was immediately provided for this committee in the Munitions Board. But simultaneously the Council of National Defense, consisting of six Cabinet officers, had resolved that no more sub-committees should be established; therefore the action of the Munitions Board was killed by the simultaneous action of the council.

This situation, however, did not mean that we had less service to offer than before, nor that we offered it less patriotically. It did mean, however, that we were less frequently called upon and we had no formal standing. This committee of seven believes that the Munitions Board and its sub-committee on emergency construction were sincerely desirous of the services the



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contractors' committee had to offer; but the Quartermaster's Department, with which the Council of National Defense was co-operating, could see no value in these services.

ELECTRICAL CONTRACTORS SHUT OUT

The Quartermaster's Department did not care for advice from the committee of seven, and in the "Instructions to Constructing Quartermasters on Cantonment Work" occurs the following clause: "Sub-contracts are not looked upon with favor." This clause was interpreted, all but universally, by constructing quartermasters and general contractors to mean that such work as is usually sub-contracted could not be sub-contracted under the rulings of the Quartermaster's Department. The rule is equivocal, but its effect has been to shut out the electrical contractor in most cases. Why has the electrical contractor been shut out? Surely not on account of his demand for exorbitant profits, because he never got to the point of discussing costs, to say nothing of profits. It has been stated that the government wanted unit responsibility. It has been stated also that the government desired to save a sub-contractor's profit.

The claim is made that unit responsibility is gained only by letting contracts to general contractors who can perform all or most of the branches of work.

This claim is not valid, because responsibility is passed on to the sub-contractor precisely in the same manner that one or more employees of the general contractor would assume their proportion of the unit responsibility.

It is a noteworthy fact that most electrical installations of importance in normal times have been executed by electrical contractors working directly for owners, including the United States government, or indirectly through general contractors, a fact which argues strongly for the electrical contractor and in support of his claim for efficiency, economy and speed.

Whence it follows that the general contractor normally unaccustomed to such work has not built up, and does not maintain, electrical organizations. He is convinced that it does not pay to do so because he does not have continuously enough of this class of work to justify the expense. These considerations have brought about the all but universal custom among general contractors of subletting electrical and other mechanical work. But the government's recent interpretation of the term "general contractor" seems to be such as to force the general contractor into the unaccustomed and embarrassing situation of executing work ordinarily done by sub-contractors.

THEORETICAL PROFIT SAVED, COST INCREASED

From what precedes it is not difficult to see that placing electrical work in unskilled and inexperienced hands, because of an almost total lack of preliminary training in normal times, will not be accompanied with economies and efficiency, particularly when the time element is so important. A theoretical profit only is saved, which is much more than counterbalanced by a cost increased by lack of training and experience, by lack of precise knowledge of labor and market conditions.

By ignoring the expert electrical contractor, the government is not only failing to reap an advantage from a great industry willing to perform patriotic services, but is lending its influence to the destruction of that indus-

try which under normal conditions has demonstrated as much right to live under the just and benign influence of the government as those industries now enjoying governmental patronage.

The committee of seven does not think it failed in any essential particular, and yet it failed to convince the Quartermaster's Department that electrical work should be done by those most accustomed to it and therefore most expert in it. The committee failed to convince the Quartermaster's Department that mastery of technique is efficiency, a truth requiring only statement to gain instant acceptance among most people.

Notwithstanding the experience that electrical contractors have had up to this time with the Quartermaster's Department, they still hold themselves in readiness to perform any services which they may be called upon to perform. There is no thought on the part of the various organizations in the electrical contracting industry of doing otherwise than performing patriotically every service it is within their power to perform which may be required by the government.

PRODUCING ELECTRICITY DIRECT FROM COAL GAS

Electricity Is Produced Directly from the Oxidation of a Fuel in a Battery Containing a Fused Electrolyte

S. Albert Reed of New York City, in patent No. 1,225,175, discloses an electrolytic cell which amounts substantially to the production of electricity direct from coal gas. The principle of the method is to dissolve in an electrolyte of fused borax the oxide of a metal such as manganese, which forms easily two or more oxides of different degrees of oxidation and readily passing from a lower to a higher degree of oxidation when in contact with air and from a higher to a lower when in contact with a reducing agent, such as fuel gas. When the solutions of a higher and a lower oxide are brought into liquid contact at any point a difference of electrical potential results, and if an appropriate electrode is immersed in each of the solutions a current of electricity will pass in a conductor joining them, so long as the difference of oxidation respectively in the two solutions is maintained. The current obtained when the electrodes are of platinum and the metallic oxide in solution is an oxide of manganese is approximately 1 volt, and current is furnished from 15 amp. per square foot of active surface and upward.

In a heated chamber is placed a shallow dish of refractory earthenware, within which there is contained a smaller shallow dish of similar material forming a reduction chamber. A tube for supplying fuel gas is led into the inner chamber and vent holes are also provided for the products of combustion. The electrodes are placed in the inner and outer portions of the borax electrolyte containing the separate forms of manganese oxide. So long as fuel gas is supplied to the tube the normal differentiation of the two oxides is maintained and a current flows continuously through the circuit. The oxygen which oxidizes the fuel is actually supplied electrolytically from the air taken up at the outer extended surface, such air being present inside the heated chamber.

Street-Lighting Units in the Smaller Cities

A Discussion of the Characteristics of Gas-Filled Incandescent Lamps and Magnetite-Arc Lamps, and of Available Accessories, Together with Some Operating Cost Data

BY JAMES R. CRAVATH

In this article, the second in the series on street lighting for small cities and towns, the characteristics of the available lighting units for use in this connection are discussed in great detail. Particular attention is given to lamp rating, and to the relative value of different accessories under certain conditions of spacing and type of street. The relation between first cost and operating cost of gas-filled incandescent lamps and magnetite arcs is emphasized. In addition to the article and that in last week's issue on general principles and objects of street lighting, the series will include four other articles which will take up in order posts, residence streets, business streets, and finally municipal relations.

AT PRESENT the only two illuminants in the electrical field to be considered for street lighting in small cities are the gas-filled tungsten incandescent lamp and the luminous or magnetite-arc lamp. The inclosed carbon arc lamp is now virtually a matter of history, and the flame carbon arc likewise. The latter, although of very high efficiency when first trimmed, does not maintain its efficiency throughout the life of the carbons because of the thick deposits on the globe.

Electric lamps are now rated according to their light output in lumens. The lumen is a shorter, and in many ways a more convenient, term than the mean spherical candlepower. A lumen is equal to 12.57 times a mean spherical candlepower. Thus a lamp of 100 mean spherical candlepower gives out 1257 lumens. One lumen is the quantity of light which will illuminate a surface 1 ft. (30.48 cm.) square to an illumination or flux density of one foot-candle.

Series incandescent lamps for street-lighting purposes are still given a nominal candlepower rating by the manufacturers because many street-lighting contracts are in existence which call for a certain candlepower of lamp. The manufacturers arrive at this nominal candlepower rating by dividing the lumens rating by 10. The mean spherical candlepower is found by dividing the lumens rating by 12.57. In making new street-lighting contracts it is important that central station men understand clearly this situation, so that specifications may be drawn that are not ambiguous.

In making contracts which call for incandescent lamps the established policy of American lamp manufacturers regarding changes in efficiency should be kept in mind. When changes are made in the efficiencies of series lamps used for street-lighting service the lumens outputs are not changed for the various sizes of lamps, but the wattage is reduced. A contract calling for lamps of a certain watt rating on a series circuit, therefore, is likely to make trouble for the central-station company whenever lamp efficiencies are increased. On the other hand, multiple lamps are kept at the same wattage by the manufacturers, and the output in lumens increased as efficiencies change. Therefore, contracts for multiple lamps should not be on a candlepower or luminous-output basis.

Table I gives the common standard sizes of gas-filled

tungsten incandescent lamps for series circuits. The lumens output of each lamp is, of course, that of the bare lamp, without any accessory for controlling or diffusing the light. There are practically no cases in street-lighting practice where the use of some kind of an accessory is not advisable. It is always necessary, therefore, to go several steps further in judging the relative merits of an illuminant as compared with some other illuminant than merely to look at the output in lumens of the bare lamp. The amount of light absorbed by whatever reflector, globe, refractor, or other

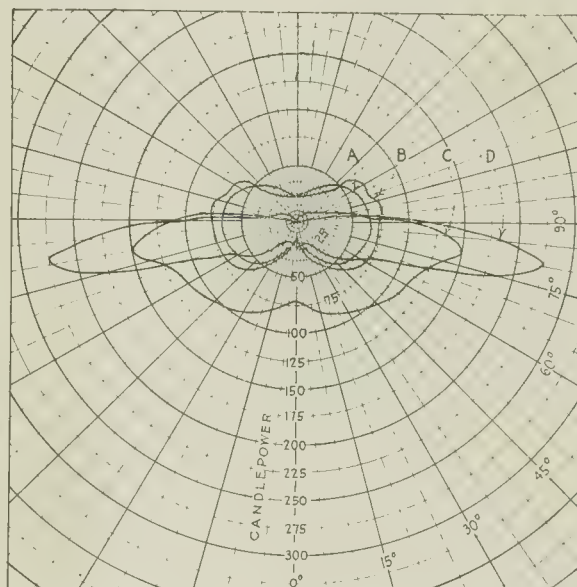


FIG. 1—LIGHT DISTRIBUTION FROM A SERIES 1000-LUMEN GAS-FILLED TUNGSTEN LAMP

A. Diffusing globe (Carrara) upright post-head type. B. Diffusing globe (Alba) upright post-head type. C. Radial wave reflector. D. Bowl refractor (plain pendant).

accessory, is used must first be deducted from the output of the bare lamp. Both of these steps, however, are but preliminary, because the final test is the distribution of illumination on the street and objects thereon.

Fig. 1 gives the approximate distribution of candlepower about a 1000-lumen gas-filled tungsten lamp with four different accessories in common use, two being of recent design. The light distribution of the bare lamp, being of no practical interest, is not given. For all locations where maximum economy of light is desired the bare lamp involves the wasting of too much light upward, while for ornamental lighting, where some upward light may be desirable for lighting buildings, it is not only not ornamental but is too crude and glaring.

In Fig. 1, curve A is the light distribution with a common form of white diffusing glass (Carrara) inclosing globe on a common one-lamp post-head type of standard now much in vogue. With such a globe the

diffusion and ornamental effects are good. For the particular globe shown the total absorption was about 31 per cent.

Curve B is for a similar-shaped globe (Alba) which is not quite so absorbent. The total absorption with this globe is about 25 per cent.

Curve C is the light distribution with a radial wave

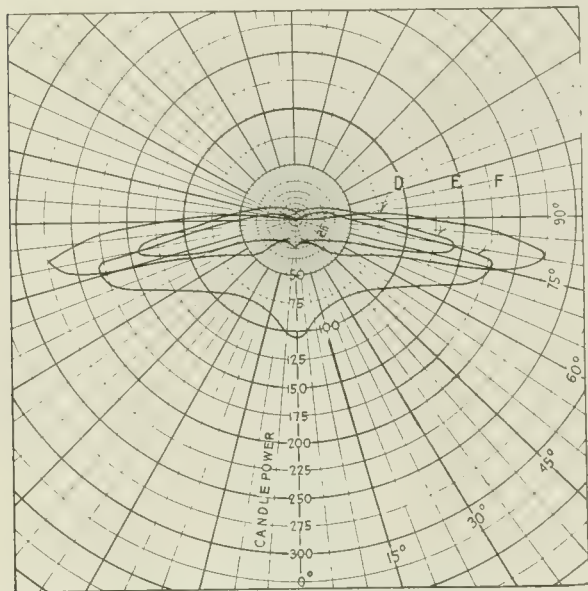


FIG. 2—LIGHT DISTRIBUTION WITH REFRACTORS ABOUT A 1000-LUMEN SERIES GAS-FILLED TUNGSTEN LAMP

D. Plain bowl refractor (pendant). E. Band refractor above horizontal, diffusing globe below (ornamental post-head fixture). F. Refractor and stippled inclosing globe (pendent fixture).

or flat-fluted reflector. This reflector is of value in catching the upward light and directing it slightly below the horizontal, so that the maximum is about 80 deg. from the vertical. The light absorption is from 12 per cent to 21 per cent, depending on the size of the reflector and the relative position of the lamp filament. For locations where the radial wave reflector is suited, a high candlepower at 80 deg. from the vertical is more important than the matter of total absorption. This type of reflector, however, absorbs the least of any of the common street-lighting accessories. On the other hand, with it the lamp filament is fully visible, so that the glare is practically the same as with a bare lamp as far as the light direct from the lamp is concerned. Sweet's experiments on glare indicate that attempts to diffuse the light from the filament are of little avail in reducing the measurable blinding effect, although the glare from a large globe is less annoying than that from a bare filament of the same candlepower, even though the blinding effect may be the same.

Curve D is typical for a refractor globe so placed with reference to the lamp filament that the maximum candlepower is given at 80 deg. above the vertical, which is the usual adjustment for refractors. By slightly lowering the refractor with reference to the lamp filament the maximum candlepower can be obtained at lower angles, even as low as 65 deg. from the vertical. The absorption of light is from 31 per cent to 39 per cent for a plain bowl-type refractor.

The prominent fact about the candlepower distribution with a refractor is the high candlepower obtainable at angles slightly below the horizontal for the purpose of increasing the illumination midway between

lamps spaced a considerable distance apart. As a general rule, a plain refractor equipment gives a maximum candlepower equal to somewhat more than one-fifth the lumen output of the lamp.

UNITS DESIGNED TO SHED MORE LIGHT NEAR LAMP

The action of the refractor is both to diffuse and redirect the light. Some felt that the earlier forms of refractors accomplished the concentration of light in the 80-deg. zone too well and took too much light away from points near the lamp. Later designs, however, have corrected this by allowing a larger percentage of light to fall near the lamp, so as to produce a more brightly lighted street surface for silhouette effect and to mark street intersections.

Until recently refractors have been largely used on residence and other streets where lamps must be placed a considerable distance apart. Now they are being used in fixtures adapted to more ornamental classes of work with shorter spacings. In Fig. 2 are shown light-distribution curves with two recent types of this class, and, for comparison, curve D of Fig. 1 is plotted also on Fig. 2. Curve E is for an ornamental post-top fixture with upright lamp. A band type of refractor extends from a plane horizontal with the lamp filament upward to the top of the fixture. Extending down from the point where the refractor leaves off is a (Carrara) diffusing globe. The function of the refractor is to redirect the upward light, making the maximum candlepower about 80 deg. from the vertical. The object of the lower diffusing globe is to illuminate the street near the lamp. The entire arrangement absorbs considerably more light than a diffusing globe alone would

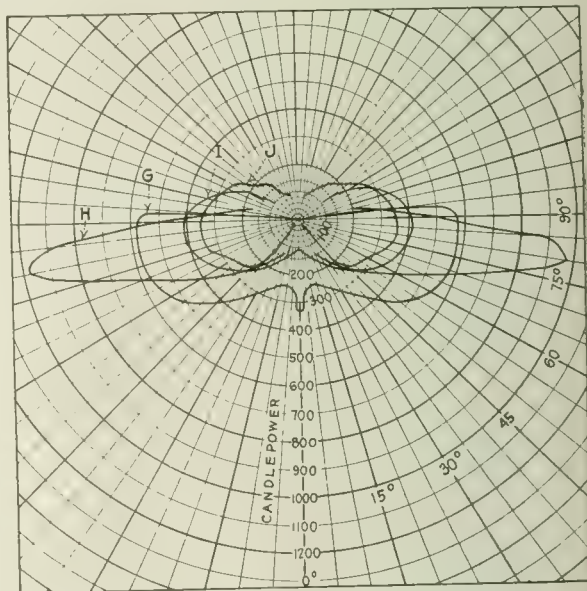


FIG. 3—LIGHT DISTRIBUTION WITH 4-AMP., 310-WATT MAGNETITE LUMINOUS-ARC LAMPS; LONG-LIFE, LOW-EFFICIENCY ELECTRODE

G. Clear globe, small internal reflector. H. Clear globe, band refractor. I. Opal globe. J. Light Alba globe, ornamental post-head-type lamp.

do, but for certain locations where lamps are spaced long distances apart, and where an ornamental post-head is required, its use is justified. It is preferable to any attempt to put a diffusing globe outside of a refractor unless the diffusing globe be of a character which accomplishes but little diffusion, such as the stippled globe.

Curve F, Fig. 2, shows the light distribution about a new type of fixture which has a band type of refractor, shaped something like a dome or bowl reflector, immediately over the lamp. Outside of this refractor is a stippled glass globe of very slight diffusing quality. That is, the glass is slightly irregular in its surface, so as to produce a slight breaking up of parallel rays,

TABLE I—SERIES GAS-FILLED TUNGSTEN LAMP SIZES AND EFFICIENCIES

Amp.	Nominal Rated Cp.	Total Lumens	Average Volts	Average Watts	Watts per Spherical Cp.	Lumens per Watt
5.5	60	600	8.5	46.8	0.98	12.82
5.5	80	800	10.8	59.5	0.93	13.51
5.5	100	1,000	13.0	71.5	0.90	13.96
5.5	250	2,500	29.7	163.0	0.82	15.32
5.5	400	4,000	47.4	260.0	0.82	15.32
6.6	60	600	7.1	46.8	0.99	12.69
6.6	80	800	9.1	60.0	0.94	13.37
6.6	100	1,000	10.9	72.0	0.90	13.96
6.6	250	2,500	23.5	155.0	0.78	16.11
6.6	400	4,000	37.1	244.0	0.77	16.32
6.6	600	6,000	55.7	368.0	0.77	16.32
7.5	60	600	6.4	48.0	1.00	12.57
7.5	80	800	8.0	60.0	0.94	13.37
7.5	100	1,000	9.6	72.0	0.90	13.96
7.5	250	2,500	19.6	147.0	0.74	16.98
7.5	400	4,000	30.5	228.0	0.72	17.45
7.5	600	6,000	45.8	344.0	0.72	17.45
*15	400	4,000	15.3	230.0	0.72	17.45
*20	600	6,000	15.5	310.0	0.65	19.33
*20	1000	10,000	25.9	520.0	0.65	19.33

*For use on alternating-current circuits with compensator at lamp.

but not enough to change greatly their directions. The result, as seen, is a light distribution midway between that obtained by the radial wave reflector and the bowl refractor. This is well suited to some classes of work. The total light absorption of the accessory is only about 25 per cent. The fixture is of the pendent type, however, which necessarily involves less obstruction of the light than an upright fixture which has the post top below and a ventilator cap above to obstruct the light.

All of the types of light distribution illustrated in Figs. 1 and 2 have their legitimate places in street lighting. Whatever is said here as to the proper places for the different types of distribution will apply to both the magnetite-arc lamp and the incandescent lamp, provided always, of course, that a unit as large as an arc can be maintained.

In the lighting of business streets the common demand is for an ornamental effect, obtainable only with lamps at intervals of less than 150 ft (45.72 m.). On such streets the uniformity obtainable with diffusing globes is sufficient, so that there is no unpleasant contrast between maximum and minimum illumination on the street surface. The ornamental effect of the diffusing globe is desirable, and the fact that it throws considerable light above the horizontal upon buildings is by no means detrimental.

For residence streets, on the other hand, where maximum economy in construction and operation is demanded, long intervals between lamps are necessary, and distributions like those obtained with the refractor and radial wave reflector are desirable. The street-surface brightness midway between lamps, as compared with points under lamps, will at best present consider-

ably more contrast than is desirable, so that the increasing of the illumination midway between lamps can well be done at the expense of that under the lamp. Incidentally, it may be said that the enormous contrasts produced by a light distribution which throws too much illumination immediately under the lamp are bad in themselves, in spite of the silhouette background which they offer, because the eye adapts itself to the brightly lighted portion of the street surface, and the portions between appear much darker by contrast than if the differences in brightness were not so great. There are many streets occupying a position between the two classes already outlined where some ornamental effect is desirable, or where the lamps can be spaced frequently enough so that it is not necessary to make extreme sacrifices to deliver as much light midway between lamps as possible. For such streets, intermediate distribution, such as shown on curves *e* and *f* of Fig. 2, would represent good practice.

Table II shows the sizes and efficiencies and luminous output of the common types of 110-volt multiple tungsten lamps which are sometimes used for street lighting in business streets, and should, therefore, be compared with series lamps for which Table I is given. By means of accessory appliances these multiple lamps can be made to give nearly the same distributions as the series lamps, although the greater concentration of the filament on the series lamps makes light control somewhat more accurate.

It will be noted that the series lamps are always more efficient than the multiple lamps, as they have shorter, thicker filaments, adapted to higher efficiency in gas-filled lamps. The question of series versus multiple lamps for a given piece of street lighting is partly one of electrical distribution and partly one of efficiency.

MAGNETITE ARC ACCESSORY CHARACTERISTICS

Table III gives data on the magnetite or luminous arc lamp in various sizes, with various globe equipment. It will be seen that these lamps are made for use with two grades of electrodes, one known as the long-life, or standard, and the other as high-efficiency. There is a great gain by the use of the high-efficiency electrode,

TABLE II—MULTIPLE GAS-FILLED TUNGSTEN LAMP SIZES AND EFFICIENCIES, 110-125 VOLT

Watts	Watts per Spherical Cp.	Lumens per Watt	Total Lumens
75	1.09	11.53	865
100	1.00	12.57	1,260
150	0.93	13.66	2,050
200	0.86	14.61	2,920
300	0.78	16.11	4,850
400	0.82	15.32	6,150
500	0.78	16.11	8,050
750	0.74	16.98	12,800
1,000	0.70	17.95	18,000

as can be seen from these tables, a gain which much more than offsets the additional cost of trimming labor and electrodes. Frequent trimming is conducive to higher efficiency, in that it makes possible the cleaning of the globe at more frequent intervals.

Fig. 3 shows the light distribution obtainable with common accessory equipment of luminous arcs. All of

these curves are based on a 4-amp. lamp with long-life electrodes.

Curve G is for an ordinary pendent type of lamp, with clear globe, and a small white-enameled reflector immediately above the arc.

Curve H, Fig. 3, shows the same type of lamp with a band refractor instead of a reflector for catching the upward light. The refractor intercepts only the light which is emitted above the horizontal.

Curve I, Fig. 3, is for a similar lamp equipped with an opal globe of the pendent type.

Curve J, Fig. 3, is for an ornamental post-head type of lamp with an Alba diffusing globe.

COMPARISON OF FIRST AND OPERATING COSTS OF INCANDESCENT LAMPS AND MAGNETITE ARCS

Comparing the light output of the magnetite-arc and series incandescent lamp, we see when the losses in the accessories are taken into account that the magnetite arc is somewhat more efficient in large units. However, they are sufficiently close together in performance so

TABLE III—SERIES LUMINOUS OR MAGNETITE ARC LAMP SIZES AND EFFICIENCIES WITH VARIOUS EQUIPMENT

Amperes	Magnetite Electrode Life, Hours	Globe and Reflector	TERMINAL		Lumens	Lumens per Watt	
			Volts	Watts			
A—Plain Pendent Types	4	250	Clear globe and small internal reflector	68	272	3142	11.5
	4	350	Clear globe and small internal reflector	77.5	310	3320	10.7
	4	350	Carrara globe, small internal reflector	77.5	310	3190	10.3
	4	350	Prismatic refractor, clear globe	77.5	310	3260	10.5
	4	150	Carrara globe, small internal reflector	77.5	310	5010	16.2
	4	150	Clear globe, refractor	77.5	310	5030	16.2
	4	150	Clear globe, small internal reflector	77.5	310	5320	17.2
	5	225	Carrara globe, small internal reflector	77.5	388	5090	13.1
	5	225	Clear globe, refractor	77.5	388	5170	13.3
	5	225	Clear globe, small internal reflector	77.5	388	5350	13.8
	5	120	Carrara globe, small internal reflector	77.5	388	7260	18.7
	5	120	Clear globe, refractor	77.5	388	7260	18.7
	5	120	Clear globe, small internal reflector	77.5	388	7650	19.7
	6.6	125	Carrara globe, small internal reflector	77.5	510	8800	17.3
	6.6	125	Clear globe, refractor	77.5	510	8960	17.6
	6.6	125	Clear globe, small internal reflector	77.5	510	9300	18.3
B—Orna-mental Post-Head Types	4	350	Alba globe	82.5	330	3220	9.75
	4	180	Alba globe	82.5	330	4970	15.1
	5	237	Alba globe	80.5	403	5020	12.5
	5	137	Medium-density diffusing globe	80.5	403	7640	19.0
	6.6	112	Medium-density diffusing globe	80.5	532	9120	17.1

that in nearly every case where units large enough to employ arcs are required the entire cost of service must be figured up for the two types.

For incandescent lamps it is customary to figure upon three renewals per year when lamps are operated upon a 4000-hour, all-night, every-night schedule. Lamps are made to operate at an efficiency which will give an average life of about 1350 hours. Current prices for lamps can be obtained from the manufacturer, and it is then a simple matter to figure the lamp renewal cost per hour of operation. This cost is a very large item in the total cost of street-lighting service with this kind of lamp. To the cost of lamp renewals must be added cost of cleaning and repairs. Cleaning should be done once a month, although frequently on incandescent systems it is done less often. Reliable figures, based on extensive experience with cleaning in an incandescent lamp system are difficult to obtain, but for small cities

a cost of 5 cents to 10 cents per cleaning per lamp will probably suffice. The cost of inspection for burned-out lamps and the cost of renewal will depend much on local conditions and the thoroughness and frequency of the inspection. In many small cities this cost is very small and the amount of attention given to inspection is proportionately small, as city night watchmen reports are largely relied upon to locate burned-out lamps. It would be unsafe to name a figure on this without knowing local conditions. As to renewals of glassware, such as globes and refractors, and repairs to lamp fixtures, it would seem from experience in larger cities that 50 cents per lamp per year would suffice, without much regard to the type of globe, because while refractor globes are much more expensive than other types they are also much heavier and less liable to breakage.

In figuring the cost of delivering energy to the lamp it must be remembered that for the sake of getting high lamp efficiency with incandescent lamps a constant current circuit of 6.6 amp. rather than less is advisable, while with magnetite arcs 4-amp. circuits may have to be adopted to get a small enough source of light. Now since nearly all systems of series circuits are of No. 6 wire, for mechanical reasons the same size of wire would be used whichever lamp is adopted and the line loss would be greater at 6.6 amp. than at 4 amp.

At the power station there is a difference in favor of the incandescent lamp because it is operated on alternating current direct from constant-current transformers. Unless such transformers are very much underloaded the efficiency can be kept between 85 per cent and 95 per cent. The power factor will run from 90 per cent to 95 per cent. To supply magnetite arcs, however, a rectifier must be used in addition, which, if we assume transformer and rectifier nearly loaded, will cause approximately an additional 5 per cent loss and a decrease in the power factor to about 65 per cent at full load and 50 per cent at three-quarters load. The generating apparatus investment caused by this low power factor is chargeable to the magnetite-arc system.

The cost of trimming and maintenance of magnetite-arc lamps, including everything necessary for the maintenance of the lamp and its glassware, but no line maintenance, is about \$3.25 in one medium-sized city where accurate records have been kept. In small cities in the past this cost has probably run from \$5 to \$6.

The investment in station apparatus and lamps is easily obtained from electrical manufacturers. During the past few years magnetite lamps with the necessary rectifiers and transformers, if the lamps are of the plain center suspension type, have cost around \$50 per lamp, of which roughly half is for the lamp and half for the station apparatus.

An item of operating cost with the magnetite system, which, although a station cost, is usually included in the lamp-year estimate, is that of rectifier tubes. In small systems this runs from \$3 to \$4 per lamp-year.

The cost of the lamp-supporting pole and the cost of the line, being usually very large proportions of the total investment, impose fixed charges which are a large item of the total yearly costs.

LABORATORY VERSUS ACTUAL CONDITIONS

Because of the great differences in maintenance conditions no rule can be laid down for figuring any differences between laboratory and street performances, but

it would seldom be safe to count on less than 25 per cent loss due to globe dirt and bulb blackening, and in many cases this will be 50 per cent. While blackening may amount to 20 per cent toward the end of the life of a lamp, the average loss from this would not be over 10 per cent. Bulb blackening is of course entirely beyond the control of the operating man. Light loss from this cause, however, can be lessened by renewing lamps when they become blackened rather than by waiting for them to burn out. Globe and reflector cleanliness is entirely within the control of the operating man.

In the case of the luminous-arc lamp loss of efficiency in service as compared to laboratory conditions is almost altogether a matter of maintenance. This type of lamp makes a very excellent showing when well maintained and a very poor showing when not so maintained. The luminous arc is unsteady and subject to very sudden variations in light caused by shifting of the arc. Feeding also causes variations. This, of course, detracts from the value of the laboratory rating, but is to some extent offset by the blackening of the tungsten lamp when the two lamps come up for comparison.

Limiting Alternator Short-Circuit Currents

Resistance Added to Field Circuit Causes Rapid Decline of Transient Short-Circuit Current, While Self-Inductance Reduces the Initial Value Thereof

BY RALPH BOWN

Department of Physics, Cornell University

A LONG with the development of modern alternating-current generating units of large capacity has come the problem of protecting them against the destructive effects of accidental short circuits. The enormous forces on the machine and its equipment resulting from short circuit occur with the first transient values of the short-circuit current and so cannot be obviated by any circuit-opening device so far in practical existence. Recourse has generally been had to reactance coils, placed in series with the generator, so as to limit the maximum value of the current which could flow. Introducing extra reactance or resistance in the power circuits has some disadvantages, however, such, for instance, as spoiling the regulation.

Since it has been suggested that placing reactance or resistance, or both, in the field circuit of the alternator might have the desired effect on the transient current and still leave the normal operation unchanged, the author of this paper will discuss the theory of such an arrangement in a more or less qualitative way. First its possibilities will be analyzed. Then some preliminary data which have been obtained by actual experiment will be presented in connection with a few general remarks which may be of aid to any one desiring to make more extensive and conclusive tests than could be carried out by the author with the facilities at his command.

The short-circuiting of a polyphase alternator brings into play a complicated set of actions and reactions which are so interdependent and interrelated that anything like a simple explanation is difficult. However, the results may be considered as due to several causes acting together. These causes may be treated separately and their resultant effects determined more or less closely by the superposition of the separate effects. On this basis a qualitative theory is built up which seems to explain all the facts.

When the terminals of the alternator are brought into contact, forming a short circuit, the armature current is established as in any polyphase circuit containing resistance and self-induction. The transient current is of much the same nature as that which flows when an induction motor is connected to the line and

the rotating field built up. In the present case the rotating field is the armature reaction, which is fixed in space, but rotates synchronously backward with respect to the armature. The electric and magnetic conditions are somewhat the same as those which would exist if the machine were running idle with no excitation and suddenly had impressed on its terminals full synchronous voltage from an outside source. That the likeness exists only for a very short time, however, will soon become evident.

Since the armature current is at first limited largely by the true armature reactance, this current will lag

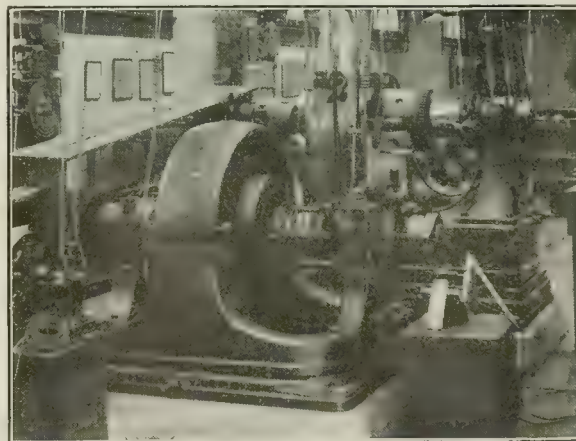


FIG. 1—TEST ALTERNATOR EQUIPPED WITH AUTOMATIC DEVICE FOR CLOSING CIRCUIT AT SAME POINT IN CYCLE EACH TIME

nearly 90 deg., and thus its magnetomotive force will act in opposition to that of the field. That is, the armature reaction will have the same space relation to the field poles as it has when the machine is running normally with a low lagging power factor, though it will have a greater intensity. The effect of this large bucking magnetomotive force is immediately to cause a reduction in the main field flux. According to Lenz's law a reduction in the flux induces an electromotive force in the field winding tending to establish a current which will stop the reduction. In short, the field current is suddenly increased until the field magneto-

motive force equals the magnetomotive force of armature reaction.

Everything is now in a steady state except that the main flux is slowly decreasing, due to the armature reaction, at a rate just sufficient to induce the electromotive force which drives the extra field current. The extra field current means extra FR loss, and thus the magnetic energy of the field is being dissipated as heat in the field resistance. The reduction of the main flux causes a reduction of the generated voltage, and this in turn decreases the armature current, or what is proportional to it, the bucking magnetomotive force. The additional field current now required is less than before, and the rate of decay of the main flux becomes correspondingly less.

The result is that all of these factors, armature current and voltage, flux and field current, which are mutually productive and at the same time mutually destructive, die away together until a permanent state has been reached where the field current is normal and the magnetomotive force of armature reaction leaves

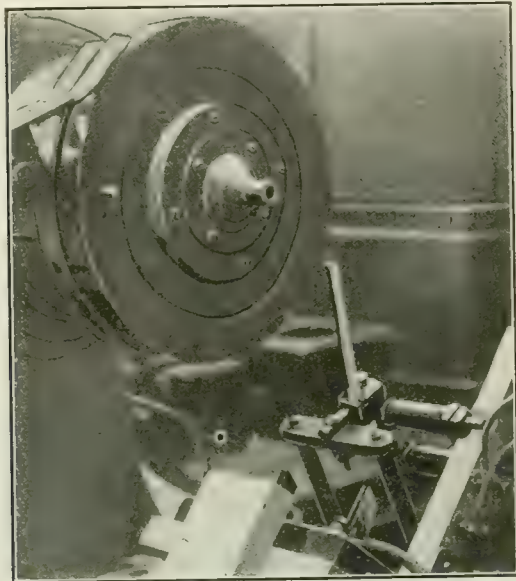


FIG. 2—CLOSE VIEW OF SWITCH CLOSED BY PIN ON END OF GENERATOR SHAFT

just enough flux to produce the voltage which drives the armature current. From these considerations it becomes evident why different machines act differently under short-circuit conditions.

If the generator has salient poles with large spaces between them, the armature is able more quickly and easily to rid itself of the main flux by forcing it out into the air-leakage paths. Furthermore, if the poles are laminated, as is often the case, the reduction of the flux is not opposed by eddy currents. The worst condition seems to obtain in the compact turbo-alternators with non-salient poles which are formed by embedding the field coils in a solid cylinder of forged steel. The flux must largely remain linked with the field and armature conductors in undergoing its reduction. Moreover, the reduction is seriously hindered by the eddy currents induced in the solid mass of the steel core. Against such conditions it is probable that very little can be done to reduce the momentary short-circuit current except the introduction of series reactors.

It is of interest now to consider the effect produced

on the first-mentioned type of machine by a modification of the field-circuit constants so as to make the function of this circuit abnormal. The use of a mechanical circuit breaker of any kind is undesirable, and the results must be sought by purely electrical means.

The introduction of external resistance into the field circuit should have little or no effect on the initial

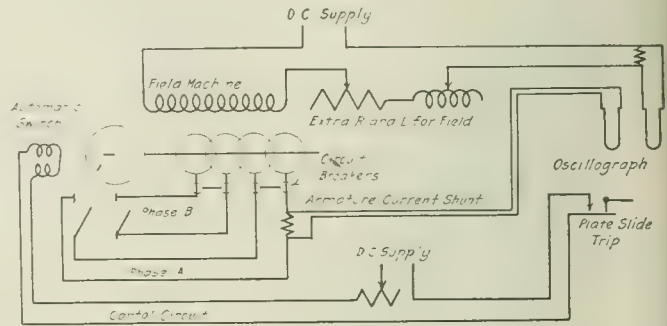


FIG. 3—CONNECTIONS USED IN SHORT-CIRCUIT TEST

value of the armature current. The latter might be reduced slightly, since a greater rate of reduction of the main flux is required to give the electromotive force in the field necessary to drive the extra current. However, since the increased FR loss will dissipate the field energy faster, it is to be expected that the total transient will be of shorter duration as the field resistance becomes greater. That is, the permanent short-circuit current will be reached sooner than in the case of the normal field circuit. Such a reduction of the time constant of the transient would have the effect of reducing the heating energy which could be delivered to the short-circuited conductors, but would probably have little effect on the mechanical stresses brought about in the conductors by the initial rush of the current.

If inductance be introduced externally into the field circuit, the sudden increase on the field current at short circuit will be attained only by the production of a very large electromotive force in the field circuit, which in turn will necessitate a large rate of decrease of the main flux and consequently a swift reduction of the generated voltage. Since the worst conditions are prob-

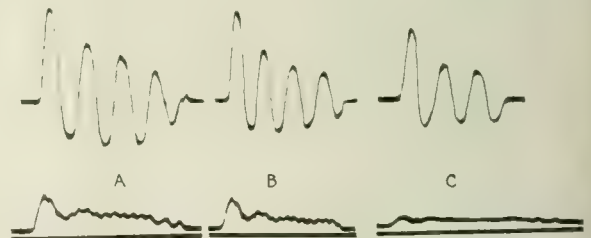


FIG. 4—OSCILLOGRAMS OF ARMATURE AND FIELD CURRENTS DURING SHORT CIRCUIT

The upper oscillograms refer to the armature currents on the asymmetric phase, and the lower oscillograms are the corresponding field currents. A is for normal conditions; B shows the effect of increasing the field resistance to 340 per cent of the normal value without changing the field current; C was taken with an increase to 340 per cent of normal in the field resistance and an increase of 220 per cent of normal in the field inductance, also with normal field current.

ably found in the case where the short circuit occurs at such a time that the current in one of the phases has maximum asymmetry, attention may well be concentrated upon this case as the first one to be considered.

A careful analysis of the relations between the field poles and armature conductors and the transient cur-

rent flowing in them, which may be best carried out by a series of consecutive sketches, will reveal the fact that the phase position of the armature reaction is such that, for the first half cycle after an asymmetric short circuit, the field flux is powerfully bucked by the armature magnetomotive force. Therefore, the flux must have undergone a considerable reduction before the time at which the armature current arrives at its maxi-

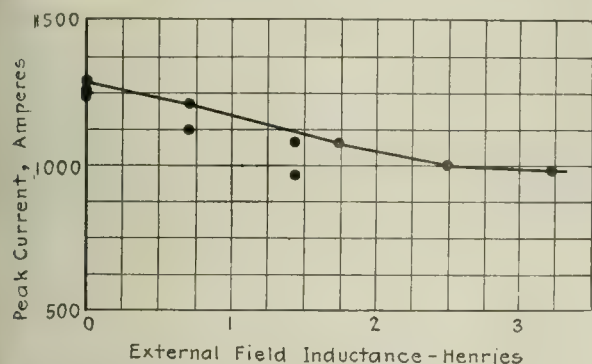


FIG. 5—EFFECT OF EXTERNAL FIELD INDUCTANCE ON SHORT-CIRCUIT CURRENT

mum asymmetric value. That this has been the case is furthermore manifested by the increase in the field current, which, as is shown by the oscillograms to be discussed later, has happened immediately on the closing of the armature circuit. Thus it is not at all impossible that the effect of added inductance in hastening the reduction may make itself felt in time to reduce materially even the first current peak.

It now remains to be shown that the above ideas may be experimentally verified. In running the tests it was necessary to have the conditions identical for each short circuit with regard to the phase position of the circuit closure. This condition was obtained, after considerable trouble with different schemes, by building an automatic, remote-control, synchronous, short-circuiting switch (Fig. 2) which could be closed repeatedly at any chosen point in the cycle. A heavy, non-inductive shunt was placed directly in the armature circuit of one phase and a twin cable of twisted conductors, which eliminated the possibility of inductive interference, was led to a Duddell oscillograph element. The field current was run through another shunt to a second oscillograph element. The photographic plate-slide recording device was so arranged that it automatically closed the control circuit of the synchronous switch at the proper instant so that the plate would receive an impression of the resulting action. Inductance for the field circuit consisted of a number of air-core coils, some semi-closed iron-core coils and the field circuit of another machine which was well below saturation.

After the automatic switches had been set, the generator brought up to full speed and voltage, and the oscillograph adjusted, an observation was taken by merely closing the switch which started the motor running the photographic plate slide. Other operations followed automatically, and the plate registered what happened in the field and armature circuits from the time the short circuit occurred until the circuit breakers on the generator panel were able to clear it. The synchronous switch was so adjusted as to cause a current of maximum asymmetry in the phase being investigated. The data resulting from the tests are represented by the curves in Figs. 4, 5 and 6. In all

cases the machine was under no load and at normal frequency and voltage when short-circuited.

The curves serve to check the theory advanced in the first part of this discussion. Curve B, for increased field resistance, starts at about the same maximum value as the normal curve, A, but the decrement is higher and it reaches the steady state considerably before A. Curve D, for the increased resistance and inductance, has a lower initial value and drops more sharply, finally flattening out to join B, with which it coincides after the field flux has been reduced to its final value and the action of the inductance has ceased. Curve C is for less inductance than Curve D. The envelope of the permanent short-circuit current, toward which the curves all converge asymptotically, is indicated by the dashed lines on the right of Fig. 6.

Some tests were also taken, varying the extra inductance in the field circuit, while the field current was kept constant. As shown by the plot (Fig. 5) of the peak value of the initial asymmetric armature current against increased external field inductance, a total reduction of about 25 per cent is obtainable before the curve flattens out. Further reduction by this method is impossible because, as is shown by oscillogram C (Fig. 4), the field-current variation is already reduced practically to zero.

All of the foregoing data were taken with simultaneous short circuits of both phases. A few tests for single-phase short circuit, while not so complete, showed that the effect was of the same nature and of approximately the same order of magnitude.

From the practical standpoint, it is not impossible that there are cases where the introduction of inductance into the field circuit to limit the short-circuit current would be good engineering. The question of whether it may be available in the larger installations where series reactors are now used is one which requires considerable further investigation. The large increase which the field current experiences in the case of some types of big alternators on short circuit indicates that there might be some use for the scheme, but before its economic value can be really determined tests

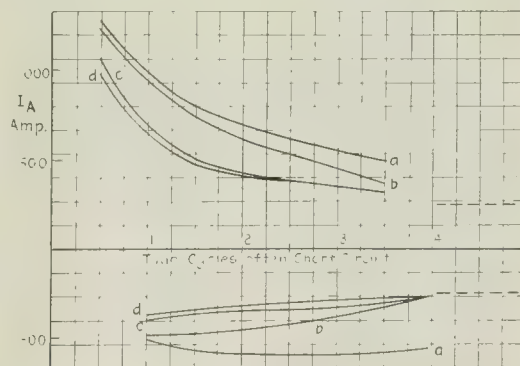


FIG. 6—COMPARISON OF THE ENVELOPES OF THE OSCILLOGRAMS SHOWN IN FIG. 4

on a number of different machines under standard operating conditions are necessary.

The inductances used in the present work were unavoidably of much higher resistance than would be commercially allowable, and the cost of building large inductances of low resistance would be an important economic factor. The results of the present investigation are conclusive in an academic sense only.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

STATIC VOLTMETER USED FOR PHASING OUT LINES

High-Voltage Lines Phased Out with This Instrument—Condensers and Voltmeter Suspended from a Switch Stick Near Ground

BY J. R. BALDWIN

A central station company in the South has found that a static voltmeter is a handy apparatus for phasing out high-voltage lines of 50,000 volts and under. Two 22,000-volt lines connected to the same bus at a substation were to be connected together by a 10-mile (16.1-km.) branch line running between substations on each line. The substations are about 15 miles (24.1 km.) from the main distributing point. The branch line was closed at one end and the corresponding phases were tested at the other end, the lines of the same potential showing zero voltage. One terminal of the voltmeter was connected to one wire of the branch line by means of a wire fastened to a switch stick. The other side of the voltmeter was connected by a switch stick to the different wires on the main line until the correct one was shown by the voltmeter reading zero. Three tubular condensers were connected in series and the voltmeter was connected across the middle condenser.

The condensers and voltmeter were suspended from a switch stick near the ground, and two lines were strung between suspension insulators from the tower to supports on the ground. Taps were made from these lines to the meter and the wires fastened to switch sticks were tapped to them on the tower. This made it safe and easy for the linemen.

REGULATOR CONNECTIONS THAT HELP OPERATING CONDITIONS

Switching Arrangements Permitting the Quick Disconnection of Regulator from Circuit in Case Failure Occurs

To prevent outages of any duration in case a regulator should burn out the Pacific Gas & Electric Company has connected its feeders and regulators by double-pole, double-throw disconnecting switches, the series feeder leg being connected to the center of blade, one pair of jaws to the regulator itself and the other pair short-circuited. When it becomes necessary to cut out a regulator, the oil switch is first opened, "killing" the feeder. The double-throw knife switch is then thrown from the regulator side to the short-circuited jaws. Upon opening the primary or teaser switches the regulator is entirely cleared from the circuit and the oil switch can be operated safely. All these operations should not require more than thirty seconds at the most.

This use of the double-throw knife switch was adopted after trouble from regulators burning out

which necessitated disconnecting the leads at the regulator itself and short-circuiting the feeder by connecting the two parts where the feeder left the regulator. This operation required the use of tools and insulation, and on some occasions, owing to the misplacing of a wrench or a pocket knife, consumed forty-five minutes

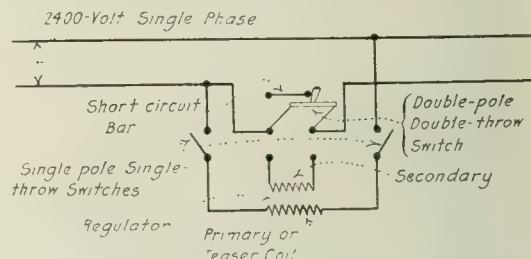


FIG. 1—CONNECTION OF REGULATOR SWITCHES

as against thirty seconds with the knife-switch connection now used.

The present method, however, was developed only after an intermediate step had been tried out. At first one side of the primary or teaser coil was connected directly and permanently to the series leg of the feeder itself, while the other leg of that phase was connected through a link box. Experience showed that with this permanent connection of the teaser coil to the series leg it was not feasible to kill the feeder from a manhole

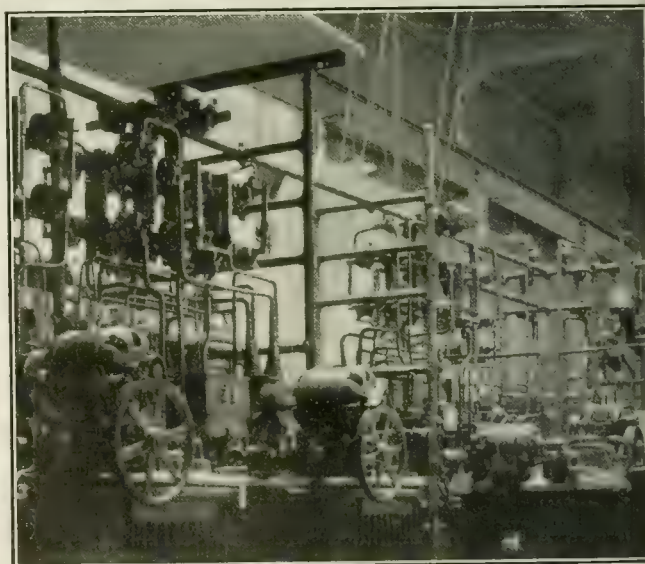


FIG. 2—SWITCHES EMPLOYED TO CUT OUT REGULATORS

junction box because of the dangerous inductive "kick" caused by the primary and secondary being in series when the feeder was energized from another source while the oil switch was open in the particular station in question. To obviate this trouble the permanent connection was done away with and each primary circuit was run through an ordinary knife disconnecting

switch, as described, thus giving the operator control of all connections to the regulator itself.

Important considerations in the reconstruction were additional safety and accessibility. As originally installed above the regulators the switches projected over the passageway, and their combined width, as measured across the power house, was such as to render the operation of the overhead crane in their vicinity dangerous. As reconstructed the spread of the connections is longitudinal with the power house, and the arrangement was made much more compact by placing the switches back to back so that no "live" parts project.

Furthermore, with this construction it was feasible to provide a framework supporting an overhead asbestos panel, which constitutes protection for the entire area occupied by switches and exposed live parts. By making this asbestos cover $\frac{5}{8}$ in. (15.9 mm.) thick and keeping the span down to 3 ft. (91.4 cm.), it is safe to allow workmen to stand on the panels when handling crane chains or carrying on other work in which a position above the switches expedites operations.

It is believed by the company that this type of construction will have a lower first cost than that which it replaces, and in building new stations the new arrangement is used.

SAVING RECORDING

INSTRUMENT CHARTS

Using Same Chart Twice and Substituting Transparent Paper for Ruled Sheets Is Economical and Convenient

The Rockford (Ill.) Electric Company for some time has been following two plans to reduce the expense for charts for recording instruments. Voltage charts and the like are used twice. For instance, all of the charts used in 1916 were carefully filed and preserved. Now, in 1917, these same charts are being used, with different colored ink, to receive 1917 records from the same instrument and for the same day on which they were used last year. This plan, in addition to effecting some economy, is also advantageous in that it provides each day a record for the station operating force to excel. For some instruments blank sheets of a semi-transparent nature are purchased. These are regularly employed in recording the lines of the instrument pen. Then, if it becomes necessary to read values from the record, the transparent sheet is placed over a ruled record, from which values may be read.

COLD-WEATHER PRECAUTION FOR HYDROELECTRIC PLANTS

Cold Air and Spray Prevented from Entering Gatehouse by Adjustable Barriers Reaching Almost to Water Level

For many winters one Maine hydroelectric plant was bothered with frozen gate riggings. The pond above the gatehouse was wide and long and the cold wind had a clean sweep from three points of the compass. Spray was carried in under the fore-beams of the gatehouse, where it was deposited on the racks and pinions, so that when the remote-control apparatus was energized to raise or lower the gates the motors were usually burned out.

To avoid endless repetition of this trouble a heavily cross-barred door of sheathing was installed so that it can be slid up and down between narrow strips on the up-stream side of each bay. Ropes from each door pass over pulleys to counterweights within easy reach of the station operator. On each shift the door is adjusted to within a few inches of the water, this distance being allowed for variation of head.

The protection afforded by this simple arrangement makes the gatehouse reasonably warm throughout the coldest days and nights, and gate riggings are never frozen now.

CHANGING HORIZONTAL MOTOR TO VERTICAL IN EMERGENCY

Thrust Bearing Made and Lubrication of Bearings Carried Out Without Damaging Windings in 200-Hp., 1800-R.p.m. Motor

When the No. 1 Mine of the American Zinc Company of Tennessee at Mascot was accidentally flooded last spring, suitable pumps were immediately available, but vertical motors to drive them were not to be had any place in the district. Some horizontal motors were available, however, so it was decided to adapt these to vertical operation. The two important problems that presented themselves were how to obtain a suitable thrust bearing to carry the rotor and how to lubricate the bearings in such a manner that the oil would not get into the windings of the motor.

To support the rotor it was first necessary to splice the rotor shaft to make it extend through the end-shield. Accordingly a suspension stud was fitted to the shaft with a right-hand taper thread (the direction of rotation

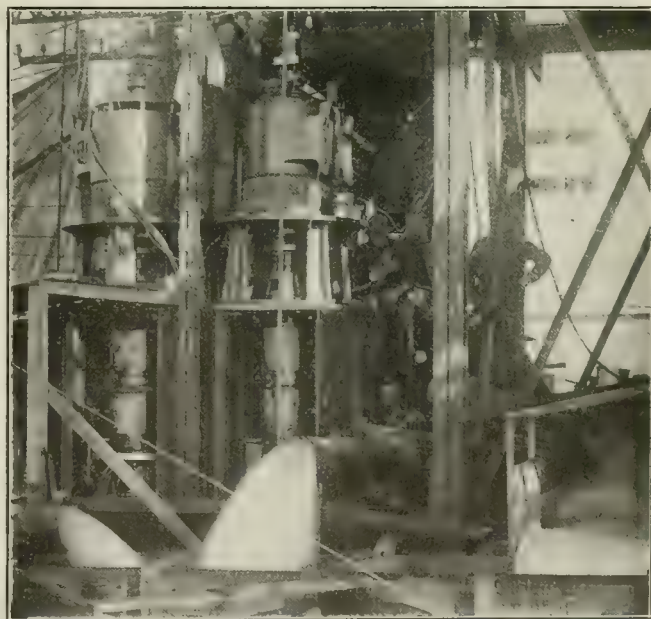


FIG. 1—HORIZONTAL-TYPE MOTORS ADAPTED TO DRIVING VERTICAL-SHAFT PUMPS

of the rotor was opposite). The body of the stud was made the same size as the motor shaft, while the upper end was threaded to receive the suspension nut which carried the rotor. For the thrust bearing a No. 715 U. S. K. F. self-aligning ball bearing was selected. The internal diameter of the ball races was considerably larger than the body of the stud, but a bearing of the

right dimension to carry the load at this speed was not available, and in order to center the ball bearing a shoulder was turned on the suspension nut to take the upper ball race. This was made a snug fit and the bearing performed nicely. The self-aligning washer rested on the end-shield, which was already machined.

Arrangements were made to lubricate first the thrust

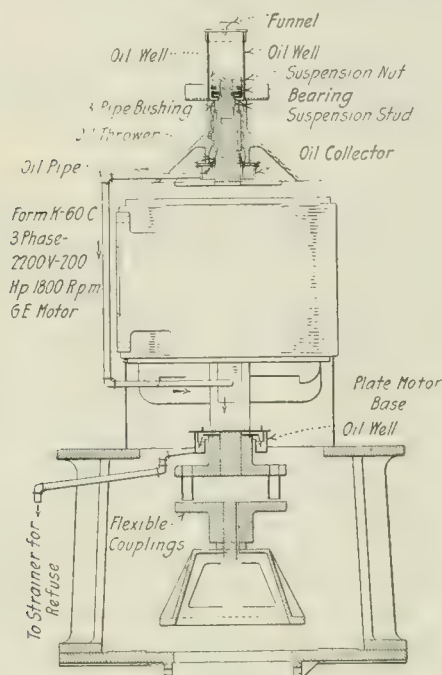


FIG. 2—CHANGES MADE IN HORIZONTAL MOTOR TO PERMIT OPERATION IN VERTICAL POSITION

bearing, then the upper motor bearing, and finally the lower motor bearing. An oil well was made of a short piece of 5-in. (12.7-cm.) pipe screwed into an 8-in. (20.3-cm.) channel to prevent any splash. The channel was bolted to the end-shield with U-bolts that were passed around the arms of the shield. A hole was drilled in the cover of the oil well to receive a funnel-shaped pipe, the bottom of which entered a hole in the suspension stud. The oil supply was taken from an overhead tank and regulated with a petcock. On entering the stud the oil was thrown into the balls of the thrust bearings through a $\frac{1}{4}$ -in. (0.6-cm.) hole. It was then dashed against the wall of the oil well by the revolving parts of the thrust bearing, from which it trickled down into the upper motor bearing.

To prevent oil running over the outside of the bearing bushing and consequently finding its way into the windings, a piece of 3-in. (7.6-cm.) pipe was bored and turned to fill the space between the end of the bushing and the inside of the end-shield casting. The slots in the bushing for the oil rings were filled with babbitt metal. Oil following the rotor shaft is thrown off by a centrifugal device into an oil collector. From this point the oil is piped to the lower bearing.

The oil-ring slots in the lower bearing were also filled with babbitt metal, and a hole was tapped in about the middle of the bushing for the oil pipe coming from the upper bearing. A spiral oil groove was cut in the babbitt to lead the oil to the upper end of the bearing, from which it was allowed to run down the shaft to an oil thrower. The oil which is drained off is filtered and used again. Albert Wettengal and R. P. Immel of the American Zinc Company of Tennessee worked out the foregoing arrangement.

MAKING UPPER SWITCH

COMPARTMENTS ACCESSIBLE

Sockets in Facing Switch Structures Support Pipes Carrying Platform—Cleats on Latter Prevent Endwise Slippage

The upper tiers of the switch cells of the Pacific Gas & Electric Company's stations are made accessible by planks supported on $1\frac{1}{4}$ -in. (3.2-cm.) pipe spanning the aisle between tiers and resting in sockets embedded in the concrete. Riveted in the ends of these pipes are bolts with projecting heads which fit into the sockets and hold the pipe firmly in place. This method makes it possible to work on the upper tiers without obstructing the passageway beneath. If the pipe supports are found in the way at any time they can be readily removed without tools. A pair of cleats on the bottom of each plank prevents it from slipping endwise along the pipe.

REPORT ON TRANSMISSION

LINE TELEPHONE STATIONS

Ohio Electric Light Association Makes Recommendations for Protection and Use of Telephones on High-Voltage Lines

In the recent report of the transmission and distribution committee of the Ohio Electric Light Association, the following recommendations for telephone stations were brought out. It was pointed out that a telephone station should be located about every 5 miles (8 km.) and at points easily accessible. The station should be so constructed and located as to make it unnecessary for the operator to use an insulated platform before using the telephone circuit. Each station should be kept under lock and key in order that trespassers may in no way come in contact with it.

To obtain the greatest degree of protection the following apparatus should be added:

1. Insulating transformer at each station.
2. Combined double-pole fused switch and lightning arrester at each telephone station on the line side of the insulating transformer.
3. Double-pole horn gap across line at each station on the line side of all apparatus for protection of the insulators in the telephone circuit in case of cross between power and telephone circuits after series fuses are blown.
4. Drainage coils should be installed with fuses at each end and the middle of the line.

RULES FOR USING TELEPHONE

1. The telephone set, when not in use, should be left connected by a double-pole switch from the circuit.
2. The telephone set should be so connected to the line as to permit the station to be called without having the set connected permanently. This is to be accomplished by an extension bell, removed from the telephone set.
3. The telephone line should be transposed about every 8 miles (12.9 km.) but truly equidistant.
4. The telephone user should be instructed to avoid all metal parts of the telephone set at all times.
5. The power linemen should consider the telephone circuits with the same respect as the high-tension circuits.

CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

TO TRY OUT NEW CAMPAIGN IN TYPICAL TEST DISTRICT

Representative Section Has Been Selected by Louisville Company to Obtain Experience with 3-Cent Excess Consumption Campaign

Part of the electrical appliance sales campaign which has been begun by the Louisville (Ky.) Gas & Electric Company in connection with the 3-cent rate on excess consumption beyond a given figure (reported in the *ELECTRICAL WORLD* for June 30 last, page 1263) will be in the rural districts served by the company. In order to obtain the experience likely to insure success for this portion of the drive, the company has selected a small section typical of the greater part of the area concerned, and will give the plan a thorough test there. It is the expectation that the farm and country homes should not only furnish good prospects for the sale of household appliances such as are being sold to the people in the city but that there are many other articles in which the country resident can be interested. Electrically driven pumps, among other things, will be a feature of the drive, while the solicitors will undertake whenever they come upon a gasoline engine to replace it with a meter that will do the same work.

OFFICE ECONOMIES FOR LIGHTING UTILITIES

**Savings Effected in Billing Customers' Accounts,
with Plan Found Effective for Checking
Up Delinquents**

BY J. C. M'LAUGHLIN

Manager Commercial Department Potomac Electric Power
Company, Washington, D. C.

In the office end of a light and power utility there are opportunities to effect economies. The only possible way to reduce costs in the office is to simplify and to standardize.

Until recently we billed the service for electric energy on the usual blank with a detachable cashier's voucher. The appliances were billed separately. The energy bill has usually been delivered by hand; the supplies bill has gone out by mail. Sometimes two weeks elapsed between the rendering of one bill and the rendering of the other. This meant that in many cases the energy bill would be paid and the supplies bill could go over a month or more. It meant two accounts and the consequent expense attendant upon a duplication of records.

Now we bill both electricity and supplies on a single blank. It means, obviously, reducing the work in the office by one-half and a considerable savings on paper and printing.

A year or so ago we also inaugurated the system of not sending receipted bills except on request. If re-

ceipt is desired, the entire bill must be sent with the remittance. If no receipt is desired, the coupon alone will suffice.

We decided upon this plan because of the increasing popularity of paying bills by check. It saves us a great deal of clerical work and a considerable amount in postage. As the indorsed check is evidence of payment and the customer has been provided with a blank at one corner of the bill proper for his own record (showing number of check, name of bank and date), there can be no question of error or misunderstanding if all records are correctly made. Likewise it enables the office staff to trace all bill complaints or inquiries more efficiently.

The system of payment by check is affected by the usual, if somewhat small, percentage of returned checks. Often they are returned by the bank because incorrectly made out, but the usual reason is "insufficient funds." As is known by most business men, the overdraft is chronic with some individuals and must be met as such. Our cashiers in due time become familiar with this class of offenders, and all their checks are laid aside, banked separately, and no bill is receipted until the check has been paid. This avoids the confusion which arises from unpaid accounts marked paid and leaves the matter in the status of "bill rendered" until the bank has accepted the check.

A NEW SYSTEM FOR DELINQUENT ACCOUNTS

We have also devised a new system for delinquent accounts. To begin with, delinquents may be negligent, absent, slow pay or bad pay. Our motto is to pay little attention to the consumers who are really responsible, no matter if in arrears, if the amount is reasonable. It often happens that collection totals look well when our collector's day's work is done, but we judge collections not by total but by the individuals who have paid. If a man who is bad pay has satisfied his bill in full, even though the amount is not more than \$10, we consider it better work than if the collection included, instead, a payment of \$50 by a man whom we know to be good pay.

"Customers who pay," we say to our collectors, "will pay, sooner or later. It is lost time to go after them so long as there are stubborn cases of bad pay which require your attention."

This question of arrears we have simplified by a new method of checking up which we are now using and which has the advantage of rapidity, efficiency and dependability.

Instead of going over our books at the close of each discount period, as formerly, to see what bills remained unpaid, and making a list of them, tabulating them and sending them to our collection manager—all of which required time and trouble and was not error-proof—we have devised an extra perforated coupon on our bill blanks. In billing, accounts paid up involve no trouble

H. On front of postal in the portion at the left which may be used for correspondence is printed a list of the banks and pay stations at which bills may be paid. Occasionally this space is used for an appliance advertisement.

A CENTRAL STATION COLD-WEATHER SERVICE

Experience of Duquesne Light Company with Electrical Water-Pipe Thawing in Pittsburgh in the Winter of 1916-17

BY JOHN M. ORR

An unusual, unadvertised service is being rendered Pittsburgh people by the Duquesne Light Company. It is seasonal and is, therefore, not so well known by the public as is the furnishing of industrial power, residential or street-lighting service, and its seasonal nature is liable to create a demand which exceeds the means to supply it. That service is electrical water-pipe thawing.

Three or four years ago the light company built a special experimental transformer in its laboratory for pipe thawing and, as the subsequent experiments proved successful, more transformers were added, until now there are six of them distributed within its service radius. These were always sufficient to take care of the work before this year, the winters being comparatively mild, but in February of 1917—during which month the mercury constantly hovered close to the zero mark—so many demands were made by the public that some had to be refused for lack of equipment to do the work.

Electrical thawing is absolutely safe. There is no danger from fire or falling plaster, no dirt to contend with and no delay, and this is how it is done:

The transformer, which is rated at 25 kw., has a ratio of forty to one. The primary side is connected to the regular 2200-volt, single-phase lines, giving the secondary side a capacity of about 450 amp. at 52 volts, on full load. The pipe to be thawed, the gage and a choke coil which limits the current so that a direct short circuit is not caused are connected in series with the secondary of the transformer. The pipe connections are made by attachment to the pipe so as to include the frozen part in the circuit. In an inside freeze one connection is made where the water enters the cellar and one in some other part of the house. In an outside freeze one connection is made in the house and one to the outside line, usually connecting to the water line in the next house, or it has been made in some cases to an adjacent fire plug. It is very important in all cases to have good, firm connections, as a large amount of current flows and high conductivity is essential. Thawing an ordinary house freeze, either inside or outside, is accomplished usually in from two to five minutes.

The degree of heat of the pipe which is being thawed is indicated by a gage, which consists of a piece of lead pipe about 8 in. (20 cm.) long, mounted on the transformer and inserted in the secondary circuit. This is the same size as the pipe used in the house and shows the attendant very accurately the condition of the house pipe, which is never hotter than is comfortable to the touch. No voltmeter or ammeter is used, so that it

is impossible to say just how much current flows, but one of the transformers was burned up on a job, which seems to indicate that a considerable amount is used. The spigots are left open, so that the water will flow readily when the ice melts.

Sixty-four thawing jobs were contracted for during February last in the company's service radius, only one of which took an unusually long time, and the supposition is that the pipe was so corroded in the ground that its conductivity was little better than that of the ground.

A few of the unusual and most interesting cases handled by the company follow:

The United States Glass Company requested the company to thaw out an 8-in. (20.32-cm.) water main, 65 ft. (19.81 m.) long. This was frozen rather tight, and it required about six hours to get the water to flow.

A 4-in. (10.16-cm.) water main, 200 ft. (60.96 m.) long, was thawed in twenty-five minutes in Beaver Falls. The ground at that time was frozen to a depth of 2 ft. 10 in. (86.36 cm.). The Aspinwall-Delafield Land Company had about 1500 ft. (457 m.) of 2-in. (5.08-cm.) main to thaw in its lot plan. It required about three days to get the water flowing.

Another customer wanted the company to thaw an iron gas line, 800 ft. (243.84 m.) in length, on his farm, but this could not be handled, there being no transformers available at the time of the request.

The Denny Methodist Episcopal Church had planned to hold a big supper in the church and realized just about two days before that the water was frozen. A plumber was called, and he worked for a day and a half without success. The light company was then called, just after the crew in that district had left on its afternoon's work. After much telephoning, the crew was located at 3 o'clock and recalled. A thawing transformer was put on the truck, rushed to the church and water was flowing at 4.45 o'clock, thus enabling the members to hold the supper as they had planned.

One residence was thawed three days in succession. This customer purchased water on a meter basis and was unwilling to allow it to flow all night.

These illustrations show that electrical thawing is past the experimental stage.

Some persons have expressed the opinion that electrical thawing has a bad effect on the pipe, *i. e.*, that it will corrode it or shorten its life in some way. This is not so, inasmuch as electrolysis, which is the cause of pitting and corrosion in pipes, has no chance to take place in such a circuit, it being dependent upon a difference in potential between the conductors, while in the short short-circuit used little or no drop in potential is evident. The opinion as to injuring the pipe has been confirmed, probably, by the fact that in the case of some pipes thawed it was found that they had burst in the ground. As soon as the ice melted the water would run from the leak and, in the absence of a better cause, electricity was blamed. As these cases occur, it is evident that the company is justified in including in its thawing agreement a clause to the effect that it is not responsible for any damage to pipes which may prove defective after thawing.

Summarizing the situation, electrical pipe thawing is desirable business for the central station. It is a true public service and one that is sincerely appreciated and valued by the customer.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Design of Electromagnetic Machines.—STANLEY PARKER SMITH.—Continuation of article started in the June 2, 1916, issue of the *Electrician*. This installment contains discussions on the effect of coil-span factor, distribution factor and group factor on the induced emf. of three-phase windings. Suppression of the third harmonic and tooth effects, the effect of number of slots and phase spread on distribution factor, calculation of the interlinked or terminal pressure, and the virtual value of the induced emf. are other subjects taken up.—*London Electrician*, Aug. 10, 1917.

Lamps and Lighting

Photometric Tests of Floodlighting Projectors.—S. L. E. ROSE.—The author outlines commercial tests essential to the determination of the beam candlepower distribution of floodlighting apparatus, and tabulates constants necessary for calculating beam flux in lumens under various conditions. There are two methods that may be used to obtain the distribution of candlepower across the beam: First, the projector may be kept stationary and the photometer moved across the beam from one side to the other. Second, the photometer may remain stationary and the projector be turned on a vertical axis through the light source until the beam has traversed the photometer test plate. Where frequent tests will be required, and especially indoors, the second method will be found preferable. The equipment necessary for the second method is a portable photometer with accessories, a test table adjustable for height and fitted with a revolving top upon which to mount the projector, a curtain or light-colored surface upon which to focus the beam, and necessary screens, ammeter and voltmeter.—*General Elec. Review*, September, 1917.

Road Illumination by Means of Automobile Headlamps.—H. P. GAGE.—This article deals with the distribution of light and the intensity of light from the automobile headlamp. Illumination of the road without glare to approaching drivers is the problem that is considered. A number of photographs show the distribution from various headlighting equipments. The author suggests that the regulations governing the glare from headlamps should not only specify the limitations of glare, but also what devices can and what devices cannot be made to eliminate glare when properly adjusted and installed.—*General Elec. Review*, September, 1917.

Generation, Transmission and Distribution

Utilization of Brown Coal.—J. L. STEVENS.—First of a series of articles dealing with economical methods of burning lignite as practiced in different parts of the world. This article deals with the subject generally and opens up the question of briquetting. A subsequent article will deal with the use of lignite as a boiler fuel. In central Europe and in Texas lignite is an impor-

tant fuel, but in other countries where lignite exists and where black coal is relatively cheap and accessible it is not considered important for that use. The erection of an electric power station on the Morwell (Victoria) brown coal field and the driving of the dynamos by engines with some form of lignite is contemplated to supply Melbourne's needs.—*Mining and Engineering Review*, July 5, 1917.

Utilization of Waste Products and Low-Grade Fuels for Power Generation.—JOHN B. C. KERSHAW.—Careful study of fuel combustion, says the author, has shown that practically every variety of combustible material can be burned and its heat value converted into the thermal energy of steam, provided, first, that the combustible matter exceeds 65 per cent; second, that the furnace is correctly designed, and, third, that the air supply is properly distributed and proportioned to the needs of the fuel. Methods of securing the last two requirements are discussed and data are presented on actual results obtained with coke and coke-breeze firing.—*Met. and Chem. Eng'g*, Sept. 1, 1917.

Installations, Systems and Appliances

The Vamma Power Station in Norway.—This plant is now being further increased so as to raise the maximum output from the present value of 36,000 hp. up to 60,000 hp. This article describes the region in which the plant is situated and gives a history of the installation. The power station is built on the down-stream side of the dam, to which it is parallel throughout its length. It has been designed to accommodate fifteen main generating units. A by-pass for surplus water is situated to the south of the power station. It consists of a weir with a total length of about 100 m. (328 ft.), part of which is occupied by two roller weirs respectively 20 m. (65.6 ft.) and 28 m. (91.8 ft.) long, which are used to regulate the water level in the reservoir. An additional fixed overflow weir with its crest at a somewhat higher level is also provided. At present the power station will accommodate six 12,000-hp. turbines and two excitation turbines. Three 12,000-hp. turbines and one 500-hp. auxiliary turbine are in use, and two additional 12,000-hp. turbines are being installed. In future developments the power station can be carried further along the dam. The building for instruments, transformers, etc., makes a right angle with the axis of the power station. In the central portion between the two buildings are workshops, storerooms and offices. There will be no difficulty in extending them longitudinally when the necessity arises. The buildings are built entirely of concrete with ferro-concrete roofs.—*London Engineering*, Aug. 10, 1917.

Electrode Cooling.—HAAKON STYRI.—A simple arrangement for cooling electric-furnace electrodes by water. The cooling water comes through the armored hose to a distributing box, fastened on the outside of

the columns for the electrode holders. Only three pipes go out from the distributing box—one to each electrode—each of which is furnished with a regulating valve. Where the pipe passes the roof ring a piece of rubber hose is inserted for insulation and connected with a union to the pipe which goes to the cooling ring. The return pipe from the cooling ring is connected with a

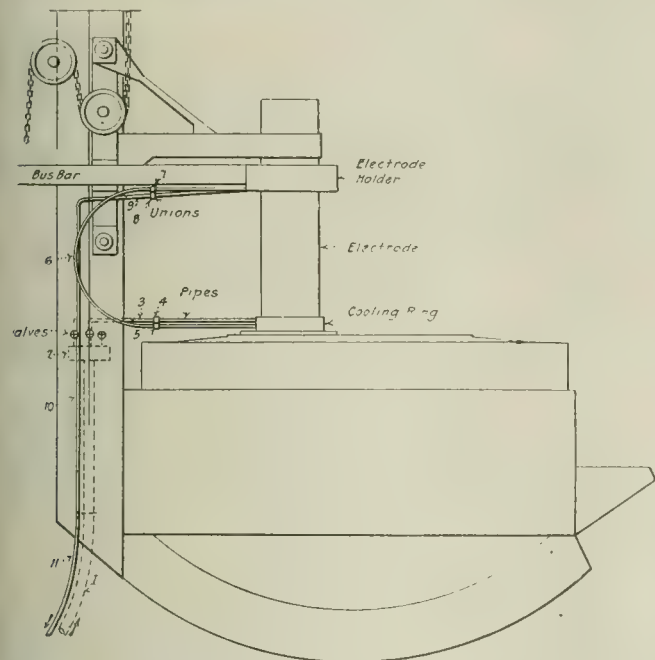


FIG. 1—METHOD OF EQUIPPING ELECTRIC FURNACE ELECTRODES SO THEY MAY BE COOLED BY WATER

union to the rubber hose, which is sufficiently long to allow for total electrode movement and some surplus to prevent kink. This rubber hose is again, by means of a union, fastened to the pipe leading to the electrode holder, and the return pipe from this is, by means of union and rubber hose, connected to the downflow pipe, which is fastened to the electrode carriage. From this pipe the armored rubber hose leads to the common waste-water box.—*Met. and Chem. Eng'g*, Sept. 1, 1917.

Electrophysics and Magnetism

Ionization and Excitation of Radiation by Electron Impact.—BERGEN DAVIS and F. S. GOUCHER.—Description of apparatus and method of conducting experiments to determine the ionizing potentials of mercury vapor and hydrogen and to ascertain whether effects occurring below 10.4 volts are due to ionization or to the emission of ultra-violet light from bombarded atoms. From the experiments with mercury vapor it was concluded that (a) radiation is emitted without ionization at an impact voltage of 4.9 volts. This voltage corresponds to the frequency of the first line $\lambda = 2536.7 \text{ \AA}$ of the Paschen combination $v = 2p - mS$, as has previously been pointed out. (b) An increase in the intensity of the radiation takes place at an impact voltage of about 6.7 volts. This voltage corresponds to the frequency of the first line ($\lambda = 1849 \text{ \AA}$) of the principal series $v = 1.5S - mP$ of this combination. (c) Ionization by impact, without an apparent increase in radiation, occurs at an impact voltage of about 10.4 volts. This voltage corresponds to the head or shortest wave length of this same principal series. From experiments with hydrogen it was concluded that (a) both ionization by impact and emission of radiation occur

at 11 volts; (b) a second type of ionization by impact without increase of radiation occurs at about 15.8 volts; (c) a second type of radiation without an increase of ionization is emitted at 13.6 volts.—*Phys. Review*, August, 1917.

Methods for Efficiently Utilizing Fuel Resources.—V. Z. CARACRISTI, S. NAKAYA and J. R. BLAKESLEE.—The first-mentioned author reviews the advantages of pulverized fuel for generating steam, outlines the basis for comparing the cost of this method with the methods more commonly used, and discusses the problems incident to its application to boiler furnaces. The last two authors describe a very interesting power plant where the coal is burned in by-product gas producers in order to recover the large nitrogen content in the form of sulphate of ammonia—a valuable fertilizer. A unique feature is the method of obtaining a supplementary supply of low-pressure steam from turbines, for cooling the producer fires and generating ammonia vapor. This plant supplies electric power for lighting the colliery and for mining purposes.—*Gen. Elec. Review*, September, 1917.

Electrochemistry and Batteries

Electrolytic Zinc.—E. P. MATHEWSON.—(Abstract of paper presented in bulletin of the Canadian Mining Institute.) Western metallurgists now estimate that they can treat the so-called complex ores by the new method, crediting to the process the value from the sale of silver, gold, copper and lead, and producing zinc at a price that will compete with the retort process under normal conditions. The directors of the Anaconda Copper Mining Company were so impressed with this belief that they authorized a series of experiments and constructed a plant that produced 10 tons (9 t.) of zinc per day and later increased this to a capacity of 35 tons (31.5 t.). They then decided to build a modern plant close to the source of power, as this is the principal item of cost in the process, erecting the largest electrolytic zinc refinery in the world at Great Falls, Mont. The plant, as designed, will consist of five units. Late in December three units were in operation, producing 95 tons (85.5 t.) of metal per diem, assaying 99.92 per cent zinc. The completed plant will have a capacity of 160 tons to 175 tons (144 t. to 157.5 t.) of zinc daily. During the experiments in the test plant at Anaconda the process originally proposed by Laist and Frick was much simplified. Some of the details are given in the original paper.—*Mining and Engineering Review*, July 5, 1917.

Electric Steel.—In the July 14 issue of *La Nature* a description is given of the work being carried on at the Keller factory at Livet for the production of "synthetic pig iron." Measured quantities of carbon and silicon are introduced into a molten bath of steel turning to obtain a steel with a carbon and silicon percentage higher than that finally required. The steel which is worked up is transferred to a refining furnace. With the new method the advantages are two. In the first place, the desulphurized and supercarburized steel, containing any required proportion of silicon, is obtained by continuous fusion, with maximum thermal efficiency, in the electric furnace. The work does not require the employment of specialists, and the energy consumption per ton does not exceed 600 kw.-hr. Second, the refining furnace gives a good yield per hour. The dephosphor-

ization process is carried out in a second operation. A national factory has recently been erected somewhere in France to produce 300 tons per day.—*London Electrician*, Aug. 10, 1917.

Units, Measurements and Instruments

A Condenser Transmitter as a Uniformly Sensitive Instrument for the Absolute Measurement of Sound Intensity.—E. C. WENTE.—A description is given of a transmitter of the electrostatic type which is especially adapted for measurement of sound intensities over a wide range of frequencies. The apparatus when once adjusted may be used for the measurement of the intensities of sound at any frequencies throughout a wide range (0 to 10,000 cycles per second) without further special adjustment. Owing to the uniform response through this wide frequency range it will be possible to secure correct indications of complex wave forms and to determine not only the relative intensities of the components but also their phase differences. When properly calibrated this apparatus can be used as a precision source of sound.—*Phys. Review*, July, 1917.

A Study of Electromagnet Moving-Coil Galvanometers for Use in Alternating-Current Measurements.—ERNEST WEIBEL.—The author discusses mathematically the principles underlying the construction of moving-coil instruments for alternating currents and describes the construction of four different galvanometers of this type. Finally he discusses their values as detectors, for the measurement of inductance and capacity and other special uses.—*London Electrician*, Aug. 10, 1917.

Influence of Radiation on Fire Temperature.—DEINLEIN.—For a given rate of combustion the radiation ratio σ is practically independent of the fuel. When the rate of combustion is 100 kg. per sq. m., $\sigma = 27$ per cent (ca.); i.e., about 27 per cent of the thermal value of the fuel is conveyed to the heating surface by radiation. At 25 kg. per sq. m. the radiation ratio increases to 44 per cent. The radiation ratio is higher the lower the rate of combustion, and from the relation between fire temperature and radiation ratio it follows that the latter (for a given fire temperature) is higher the better the fuel used. A formula is given in the original paper whereby this ratio may be calculated from easily obtained measurements.—*Science Abstracts*, Section B, May, 1917. (Abstracted from *Zeits. d. Bayerisch. Revisionsver.*, July 31, 1916, and *Elektr. u. Masch.*, Jan. 7, 1917.)

Telegraphy, Telephony and Signals

Multiplexing in Cable Telegraphy.—GEORGE D. SQUIER.—Plan proposed for using two separate cables, one for sending and the other for receiving, thereby removing the difficulties from balancing and greatly increasing the working capacities of the cables. Local transmitting circuits are coupled to the cable, the frequency of each transmitter being different from any one of the others, say, 6, 8 and 10 cycles. In each local transmitting circuit two loop circuits are included which are separately tuned to the frequencies of the other two transmitters, offering thereby a high impedance to the current flow at these frequencies, thus preventing the transfer of current from one transmitting circuit to the others. To further check any transfer of current from one local circuit to another, intermediate circuits are introduced through which emfs. of opposite phase

to that induced by cable transformers are made to balance any residual effect. Each receiving circuit is coupled to the cable through an intermediate circuit. In each intermediate circuit two loop circuits are included which are separately tuned to the frequencies of the signals which are to be excluded from that particular receiver, each receiver responding accordingly

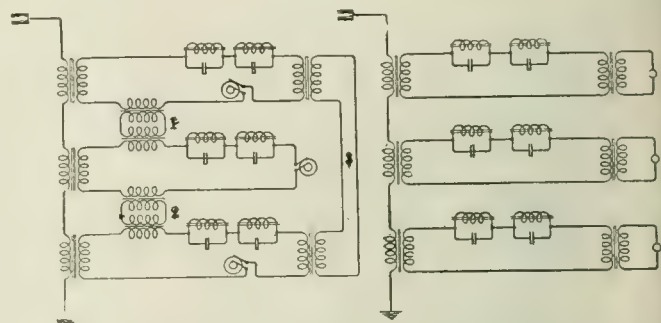


FIG. 2—ARRANGEMENT OF SENDING AND RECEIVING TERMINAL EQUIPPED FOR MULTIPLEX TELEGRAPHY

only to a signal of one predetermined frequency and excluding the others. Loop circuits may also be introduced in the receiver circuits, and thus further increase the selectivity of the method.—*Journal of the Franklin Institute*.

Miscellaneous

Reflecting Power of Tungsten and Stellite.—W. W. COBLENTZ and W. B. EMERSON.—This paper gives the results of a critical examination of the reflecting power of tungsten in the region of the spectrum from 0.5μ to 6μ . The reflecting power of tungsten in the form of plain, highly polished mirrors is determined by comparison with silver and by a new method employing a total-reflection prism. The results obtained are based upon an examination of three samples of pure tungsten and a sample of unknown purity. All samples show a marked depression in the reflectivity curve at 0.8μ . A similar indentation occurs at 1.3μ in the reflectivity of the pure metal, but it is absent in a sample of impure tungsten. The reflecting power curve of pure tungsten rises abruptly from 50 per cent at 0.5μ to 90 per cent at 2μ , beyond which the reflectivity increases gradually to about 96 per cent at 6μ . The bands of selective reflection at 0.8μ and 1.3μ render tungsten conspicuous as being the only pure metal thus far investigated which has bands of selective reflection in the infra-red region of the spectrum. The minimum of reflection at 0.9μ causes a perceptible protuberance in the emission spectrum of an incandescent tungsten filament. The reflecting power of stellite rises gradually from 65 per cent at 0.6μ to 88 per cent at 9μ .—*Scientific Paper No. 308*. Bureau of Standards.

The Thermophone as a Precision Source of Sound.—H. D. ARNOLD and I. B. CRANDALL.—The writers have found that the thermophone, together with a suitable supply of alternating current, can be used conveniently as a precision source of sound energy. A description of a simple thermophone structure is given, together with the theory of its operation. From experiments therewith the authors are led to believe that the thermophone is adapted to two classes of service: (a) As a precision source of sound at any frequency; (b) as a source of sound of known relative loudness at different frequencies throughout the acoustic range.—*Phys. Review*, July, 1917.

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

OPPORTUNITIES IN RUSSIA FOR ELECTRICAL MATERIALS

**M. A. Oudin, Returning from the Far East, Believes
that with Stable Government the New
Republic Offers Great Prospects**

M. A. Oudin, manager foreign department General Electric Company, has returned recently from a trip to Russia, Japan and China. He was away from home seven months and was in Petrograd at the time of the historic revolution.

Mr. Oudin made his trip in order to investigate the possibilities of Russian markets for American electrical apparatus. In the past the market in Russia for American products has been very limited on account of the proximity of Germany to that country. Germany's commercial domination over Russia was almost complete. Electrical industries, both manufacturing and selling, were almost entirely in the hands of the large German companies.

"Now," said Mr. Oudin to a representative of the ELECTRICAL WORLD, "all of the German interests in every line have been liquidated by the Russian government and Russian industry is completely free from the stigma of German influence.

"Russia is destined to be free from the German yoke in every possible way and is encouraging American capital and American business methods. Russia invites the technical experience and assistance of the United States to help in developing its industries and resources.

"I think that the field for American electrical manufacturers in Russia will be extended very widely as a result of the revolution and the elimination of Germany. The Russian market is not different from any other European market; its possibilities have to be developed in the same way. At present all exports to Russia are hampered badly by lack of tonnage and distribution facilities. Russian progress is handicapped tremendously by lack of railway equipment. For instance, the port of Vladivostock is glutted with supplies. The Stevens railway commission is effecting rapid improvement, however, in that situation.

"It seems to me that after the war the recuperation of Russia from the ravages of the conflict will be as rapid as that of any nation in Europe. Given a stable government and fixed national policies, I believe that Russia will have a very great industrial expansion. This means that the electrical requirements of Russia will approximate those of the United States twenty-five years ago. Electrical development in Russia will follow lines parallel with those of our own development in the last decade of the nineteenth century. Russia must have capital for development of its industries, and the country which promises the most capital on the easiest terms will be favored with the corresponding business.

"Always predicating forecasts upon the continued existence of a stable government, it is my opinion that almost any well-conceived and well-managed industrial enterprise in Russia will succeed. There may be ups and downs in the progress of such enterprises, but eventually they should be successful."

Mr. Oudin said that with the people of Russia the revolution is the great fact, the war is an incident. He walked in the crowded streets of Petrograd, where there were occasional clashes and many people were killed, but said that in its almost instantaneous accomplishment the revolution resembled more a coup d'état than anything else. The situation is apparently improving, Mr. Oudin added, because the solid element in the cities and the country is beginning to assert itself. He believes that this movement will influence those who are in power so that they will realize that all the people are not extreme socialists.

In speaking of the great stimulus to industry which has been given to Japan by the war, Mr. Oudin said: "Japan appears to be and in reality is to-day a most prosperous country, notwithstanding that it is engaged in war. It is estimated that the war has made fifty millionaires in Japan. The importation of electrical machinery of large size is extensive, and the output of factories of all kinds has practically doubled in the last two years. In many lines the efforts of Japan are confined mostly to meeting internal demands, but when the requirements of its domestic markets are lessened it will be more strenuous than ever in the markets of the world.

"The results of the war will be of very great advantage to China, because it is now arrayed on the side of those nations that have declared for the democratization of government and have maintained that weaker countries should be permitted to carry on their own national life unmolested."

MUNICIPAL ELECTRICIANS ARE TO HOLD CONVENTION

**International Association Will Meet in Niagara Falls
Sept. 11 to 14 and Discuss a Number
of Topics**

The convention of the International Association of Municipal Electricians is to be held at the International Hotel, Niagara Falls, N. Y., on Sept. 11 to 14. Among the subjects on the program are: "Practical City Street Lighting," "Renewable Type of Inclosed Fuses," "Growing Tendency Toward Surface Wiring for the Sake of Flexibility and Economy in Many Classes of Buildings," "Fire Hazards of Domestic Electrical Appliances," "Flashlight Signal Systems," "Wireless Apparatus," and "Police Signaling as Affecting the Municipal Electrician."

EXCESS PROFITS TAX IN WAR REVENUE BILL

Speaker Clark of House of Representatives and Senator Simmons Think that Industry Will Not Be Halted

The Senate has got through with the excess profits section of the war revenue tax bill. The result is that, according to the best judgment obtainable in Washington, the House of Representatives will not alter the proposed law as the Senate has framed it.

Champ Clark, Speaker of the House, explained through the Washington correspondent of the ELECTRICAL WORLD during the last week that no one can tell what the House may do in regard to the war revenue bill when it comes across from the Senate.

"This bill," the Speaker said, "left the House of Representatives containing taxes of about 16 per cent on excess profits, considering deductions and exemption. No human being knows what the House of Representatives will do about anything. It is my personal opinion that the majority of the members of the House believe that every manufacturer in the United States is now making a profit of 100 per cent. Of course this is not true. We intend in the House, when the war revenue bill reaches us, to be very careful to see that there shall be enough money left for the maintenance of industry, no matter what the taxes which shall be imposed may be."

Senator Simmons, chairman of the Senate finance committee, explained to the correspondent of the ELECTRICAL WORLD that the committee had again obtained control of the Senate, notwithstanding the remarkable debates on the Senate floor during the last few weeks. Under some of these debates, during which Senator La Follette and other Senators proposed to tax industry to the extent of 80 per cent, it was thought for a time that industry might be halted.

"When we finally passed the excess profits tax provision of the war revenue bill," Senator Simmons said, "we did so after having voted down every amendment that Senator La Follette and other Senators tried to fasten to this bill. The excess profits tax as it stands in the Senate bill now ranges from 12 to 60 per cent. We believe that we have done the very best we can to protect industry."

CANADIAN INVESTIGATION ON HYDRO-ELECTRIC POWER

Commissioners Appointed to Report on Energy and Sale Questions Affecting Electrical Development Company of Ontario, Ltd.

Under the public inquiries act three commissioners have been appointed to investigate and report on the Electrical Development Company of Ontario, Ltd., as follows: Chief Justice Sir William R. Meredith, Justice R. F. Sutherland and Justice T. Kelly.

Their report is to cover the quantity of water in cubic feet per second which the Electrical Development Company is entitled to divert or use, the amount of power in horsepower which such company is entitled to generate or develop, the extent, if any, by which the capacity of the works installed or equipped by such company may be developed, and the price and terms and conditions upon which the power to the extent of

such excess should be delivered to the Hydro-Electric Power Commission of Ontario.

The appointment of the commission by the Attorney General of the Province of Ontario follows the statement that engineers for the Hydroelectric Commission and the Ontario government have reported an alleged illegal diversion of water from the Niagara River at Niagara Falls, Ont., by the Electrical Development Company and the Canadian-Niagara Power Company of that place.

ELECTRIC CAMP SERVICE AT HATTIESBURG, MISS

Local Company to Supply Militia Camp with Lighting Service and Energy for Pumping Water—Output Doubled

The Hattiesburg (Miss.) Traction Company, a subsidiary of the Doherty organization, will supply the militia camp at Hattiesburg with lighting service and power for pumping water.

Present plans call for a 250-kw. power load with an 80 per cent load factor and a lighting load of 400 kw. There will be 300 mess halls, 10,800 electric light outlets, and 200 street series lamps of 100 cp. This means that the Hattiesburg plant will take on an additional load equal to the one it was furnishing to the city before the cantonment was constructed. As the plant has ample generating capacity, the 100 per cent increase will be made without difficulty.

WAR CONTRIBUTIONS FROM THE INDUSTRY

Additional Figures Showing Liberty Loan and Red Cross Subscriptions and Number of Registered Men

In addition to the figures published in last week's issue of the ELECTRICAL WORLD showing the subscriptions of the electrical industry to the Liberty Loan and to the Red Cross funds, together with the number of men registered under the selective draft, the following figures were received. The figures from the six companies give a total of \$120,900 Liberty Loan subscriptions, \$2,128 to the American Red Cross, and 311 men registered. Already these companies have lost eighty-one men who have entered national service.

Name of Company	Liberty Loan Subscription	Red Cross Subscription	Registered and
Albert Emanuel Properties, Dayton, Ohio.	\$3,600	\$762	27
Central Illinois Pub. Ser. Co., Mattoon, Ill.	3,800	516	..
Pacific Gas & Electric Co., Phoenix, Ariz.	1,500	..	..
Puget Sound Elec. Ry. Co., Tacoma, Wash.	11,500	750	..
Rome (Ga.) Railway & Light Company..	500	100	..
Utica (N. Y.) Gas & Electric Co.....	100,000	....	..

Consolidation of Mansfield Properties of Cities Service Company

The Cities Service Company, which controls the Mansfield (Ohio) Electric Light & Power Company, has bought control also of the Mansfield Railway, Light & Power Company. These properties will be combined with the gas utility, which is also controlled by the Cities Service Company.

OUTLOOK FOR COAL SUPPLY IN CITY OF INDIANAPOLIS

**Merchants' Heat & Light Company, Although Near
Indiana Fields, Will Try to Start Winter
with Thirty to Forty Days' Supply**

G. W. Hubley, general manager and chief engineer Merchants' Heat & Light Company, Indianapolis, in writing to the *ELECTRICAL WORLD* in answer to an inquiry about the coal situation, says:

We have joined with the other companies of the Indiana association in asking authority to make a temporary surcharge upon all our electric and heating service bills. This matter has had hearing before the Public Service Commission, and its decision is expected to be given at an early date. [As reported in this issue, some relief has been granted. —EDS.]

In making new contracts for large power business, however, we have developed a "coal clause" for protection of both the consumer and the company in case of variation of the prevailing contract rates for coal. The basis of this "coal clause" recognizes that the cost of coal represents two-thirds of the cost of the energy at the switchboard, and the rate is based squarely on this premise; therefore the rate for service to be billed to the consumer will automatically adjust itself according to the cost of coal.

In view of our experience last winter in which we had many difficulties in the matter of coal deliveries, we are apprehensive of similar troubles in the coming cold season, and especially in view of the railroad operating conditions and the possible complications that may result from the war movements.

Just now we are at the easiest point, but with the approach of the heavy fall traffic and the more serious conditions of operation during the winter months, in addition to the unknown effects of abnormal movements that may occur as a result of the war situation, the prospect for coal supply is not an encouraging one.

However, we are making preparations and taking every precaution to protect ourselves against embarrassment, even under conditions of stress or unusual demands, and it will be our effort to provide a sufficient supply of coal at the start of winter to take care of our requirements covering a period of from thirty to forty days by having about 30,000 tons placed in storage, and with such a reserve, in view of the fact that our plants are so near the coal fields of Indiana, we feel that we shall be amply protected to take care of the demands of our service.

WASHINGTON RATE REDUCTION HALTED BY COURT INJUNCTION

**District of Columbia Supreme Court Directs Com-
pany to Keep Record of Differences Until
Higher Courts Pass on Valuation**

An injunction has been issued by Justice Gould in the District of Columbia Supreme Court restraining the Public Utilities Commission from enforcing new rates until the courts have passed upon the appeal of the Potomac Electric Power Company from the valuation of its property by the commission. The company is directed to keep a record of the differences between the rate charged and that ordered by the commission and to refund this to consumers, plus 6 per cent interest, if the valuation is sustained by the higher courts.

Justice Gould pointed out that if the new rate, reducing the cost from 10 to 8 cents per kilowatt-hour to the individual consumer, should be found unreasonable by the United States Supreme Court, and no temporary injunction had been issued, the company would have been compelled to receive each year approximately \$350,000 less, and since the final settlement might re-

quire as much as three years, it would lose \$1,000,000 or more which it would have no means to recover except through individual suits against 30,000 or more consumers.

PROBLEM OF POWER

IN KANSAS CITY, MO.

**Meeting of Company Officials with Business Men
and City Authorities for the Purpose of
Considering Shortage of Energy**

The right of a public utility to expect sympathy and help from the public in working out problems that affect the public as much as the company was declared at a meeting of business men and city officials with officials of the Kansas City Railways and the Kansas City Light & Power Company in Kansas City on Aug. 28. The meeting was called by Acting Mayor Albert I. Beach, at the instance of Clyde Taylor, acting president Kansas City Railways.

The Railways company had taken off sixty-five cars in order that a small amount of energy might be available for large power users at the morning and evening peak hours. There had been a disposition to charge improper motives. It was shown that of the 39,000 kw. produced by the Railways company plants only 1280 kw. was taken by large power users in the morning and evening, some of them taking scarcely 5 per cent of their normal requirements, and all of them shifting work and reducing production so that cars could be run.

The large power users had made the sacrifice because it was impossible to reduce the consumption of residences and small plants, and it was not feasible to cut car service further. By Nov. 1, with new equipment now being delivered and installed, the Light & Power company will be able to care for most of its load. Temporarily the company continues to get most of the energy for its customers from the Railways company.

The problem, as presented by several speakers, resolved itself into a question of justice and expediency as between deprivation of the large power users and the electric railway patrons. It was pointed out that if power users were cut off many thousand men would be idle and there would be less need for cars. To give power users a small amount of energy meant simply inconvenience for passengers. The committee, headed by R. L. Redpath, which had worked out the schedule for use of specified amounts of energy at various hours by large industries, was asked by those who attended the meeting to confer with the board of control of the railway and arrive at a just distribution between power users and railway patrons of the additional energy which it is expected will be available, through repairs and new installations, during the next four weeks.

During a review of the efforts of the Light & Power company to get equipment, President Lucas touched on the dilemma in which the company found itself because of war conditions. He told of the purchase of a site for the new power plant. Then he intimated that if the Public Service Commission, upon having the subject presented, should indicate that it would later allow full value in capitalization for equipment bought at present prices, the company might proceed at once with plans for the station. He intimated that without some such assurance it would be hazardous to spend now twice as much money as the equipment might cost later.

POWER INTERCONNECTION IN GREATER NEW YORK

Recommendation to Public Service Commission by
Gibbs & Hill for Interconnection of New
York Edison and Railway Systems

A recommendation for interconnection of the power houses of the New York Edison Company, the Interborough Rapid Transit Company and the Brooklyn Rapid Transit Company properties has been made by Gibbs & Hill. As advisers on power matters to the New York Public Service Commission, First District, they made this recommendation some time ago, and the fact was brought out at a hearing on Sept. 4 at which questions connected with the suspension of subway operation on Aug. 25, because of coal shortage, were considered.

The commission will pass an order requiring the Interborough company to maintain a reserve of at least 4000 tons (3600 t.) at the East Seventy-fourth Street power house, which supplies the elevated lines.

CONSERVATION IN GEORGIA BY HYDROELECTRIC CONSTRUCTION

President Arkwright of the Georgia Railway & Power Company Shows Great Value
of Water Power

Fuel conservation through hydroelectric construction was urged by P. S. Arkwright, president Georgia Railway & Power Company, in his presentation before the Georgia Railroad Commission of the development plans for which it is asking authority to borrow \$2,500,000. Mr. Arkwright said in part:

The nation's most urgent needs at the present time (and for some time past) are conceded to be coal, labor or man power, transportation facilities and food. These needs have been intensified and rendered more acute by reason of the country's having been drawn into war.

It is constantly being impressed upon the people that it is absolutely essential to the success of the nation in the conduct of the war to increase and conserve its fuel supply and food supply and to conserve its labor supply and transportation facilities, as under present conditions the latter two cannot be increased materially, at least during the period of the war.

The Georgia Railway & Power Company proposes to add to its hydroelectric generating capacity 195,530,000 kw.-hr. per annum. An idea of what this means in the conservation of coal, the release of transportation facilities and the conservation and release of labor or man power, which could be more advantageously used in other industrial and agricultural pursuits, may be had from the following:

In the average central steam generating station in the Southeast it requires approximately 3 lb. (1.3 kg.) of coal to produce 1 kw.-hr. of electrical energy. On this basis, 195,530,000 kw.-hr. would equal the available effective energy of 293,295 tons (263,966 t.) of coal, or 7332 cars of 40 tons (36 t.) each.

Assuming that a coal car will make one round trip per month between the mine and the point of destination of the coal (which seems to be a liberal estimate of the performance on an average, when allowance is made for delay in transit, loading at mines, unloading at destination and the time necessary for repair and return of car to mines), it would take 661 coal cars in regular service to haul the coal necessary to produce the energy that the proposed additional water-power capacity will be capable of producing.

According to the statistics of the Bureau of Mines, it is estimated that the total labor required for the consumption of every 1000 tons (900 t.) of coal in central steam stations

on the basis of one year's time is 2.78 men. This means that from the mine to the final landing of the coal in the ash pile it would require 823 men, working regularly every day, to handle the coal necessary to produce in central steam stations the power that the proposed new developments will be capable of producing. It will require about twelve men to operate the proposed new developments, so that the annual saving in man power by the proposed developments will be at least 811 men. The total saving would be:

In coal per annum, tons.....	293,295
Release of coal cars (611 per month).....	7,332
Release of locomotives.....	245
Release of labor, regularly, number of men.....	811

ATTACK ON AMERICAN ENGINEER HAS INTERNATIONAL INTEREST

J. E. Popper, in Charge of Government Electric Central Station at Mukden, Assaulted by Japanese Coolies, Fails to Receive Satisfaction

A case of international interest and importance, involving an American engineer who was assaulted by Japanese coolies, has been taken up with the State Department at Washington.

J. E. Popper, an American engineer and official in the employ of the Chinese provincial government of Mukden, was assaulted by Japanese coolies on Aug. 30, 1916. He is in charge of the operation of the government electric central station at that point. While riding in a jinrikisha he saw that several linemen in the employ of the Mukden Electric Works were being molested by Japanese coolies. He warned the assailants to stop, and they turned on him, clubbing and beating him until they were frightened away by the appearance of the American Vice Consul, who had been called by one of the workmen.

The American and Japanese Consuls General corresponded about the incident. The latter offered an apology, which would have been accepted, but it was never made. The Japanese Consul General then asked Mr. Popper to try the case in the Japanese Consular Court.

Before trial of the case in court the official interpreter and a Japanese lawyer whom Mr. Popper had secured after difficulty asked if there was any way by which the case might be settled without trial. Mr. Popper did not wish to have the men unduly punished, but said that the attack had been unprovoked and that since all foreign and American residents were interested he would prefer that the trial go on.

To the amazement of Mr. Popper the court was adjourned immediately after it had been convened. Mr. Popper's attorney declared to the court, so Mr. Popper who does not understand Japanese, learned afterward that his client had withdrawn the charge. The American Consul, on hearing of this collusion, demanded reconsideration of the case. The Japanese Consul General said that this was impossible, as the case had been closed. After some correspondence the Japanese Consul General finally advised the American authorities that the time within which Mr. Popper might have appealed had gone by and that nothing further could be done. As similar efforts at Tokio yielded no satisfaction, the case has been taken up directly with the State Department at Washington.

Foreigners in the Far East are watching this case as its disposal will indicate the character of the justice to be expected of Japanese officials in Manchuria.

HOUSTON COMPANY WORK TO SERVE CAMP LOGAN

General Superintendent Frank G. Frost Gives Details of Construction and Service Plans for National Guard Cantonment

A letter to the *ELECTRICAL WORLD* from Frank G. Frost, general superintendent Houston (Tex.) Lighting & Power Company 1905, gives the following details of work on Camp Logan, the National Guard cantonment at that place:

Houston was selected as one of the sites for a National Guard cantonment, which was named Camp Logan, on June 12. This company was not able to learn the electrical requirements until July 16, when we were advised to prepare for maximum demand of 600 kw.

Camp Logan is west of the city limits and approximately 8 miles (12.8 km.) from our power station, and it was necessary to build a new line to provide 600 kw. demand at the camp. The company had in stock practically enough wire to build this line, but it was necessary to place an order for a few long poles and transformers for the camp end of the line. It is proposed to transmit this power at 11,200 volts to a substation in the camp grounds, using 6600/2200-volt transformers, Y-connected on the high side and delta-connected on the low side and from the substation, to transmit energy for lighting and power in the camp grounds at 2200 volts. Orders were placed on Aug. 18 for all material that could not be obtained from the company's storeroom.

When the order was placed for transformers and other material for a line from our power station to Camp Logan, there was talk of National Guardsmen beginning to assemble at the camp about the middle of August, and it was realized that it would be impossible for the new line to be completed in this time. This company had service to the camp site, but the circuit serving this territory was loaded to the limit and the branch line to the camp was inadequate to carry sufficient energy for any considerable quantity of camp lighting or power. Also, the city of Houston was drilling a well for water supply for the camp just inside the city limits and approximately 100 kw. would be required at this well. By increasing copper in an adjacent circuit load was taken from the circuit to the camp, additional copper was put up on the branch line to the camp, arrangements were made for approximately 400 kw. at the camp, and the first service connection was made on the evening of July 28.

The new line to the camp will be completed about Sept. 20, and we are advised by the cantonment construction quartermaster that 400 kw. demand will be sufficient for their requirements until the new line is completed.

A contract was made between this company and the cantonment construction quartermaster on July 30 to construct all lines, wire all buildings, tents, street lighting, etc., that will be required inside the camp grounds. There will be a total of 295 mess halls, 295 shower baths, 295 latrines, 30 warehouses and 4222 tents to be wired. All the mess halls are 20 ft. (6 m.) wide and range in length from 49 ft. to 133 ft. (14.9 m. to 40.5 m.), and they will have from eleven to nineteen outlets in each building. The shower baths and latrines will have from one to two outlets in each building. Each tent will be provided with one outlet. There will be approximately 145 100 cp., 6.6-amp. series lamps to light the roadways throughout the camp. These series lamps will be served from constant-current pole-type transformer.

The camp site is covered with a sparse growth of pines which will make suitable poles for line construction, but treated poles will be used for corners and transformer poles. On the morning of July 31 laborers were put to work cutting these trees, shaving and framing them for the pole lines throughout the camp. On the morning of Aug. 1 groundmen were started to work digging holes, and the line work and building wiring have been progressing steadily.

This company does not make a practice of doing inside wiring, but on this job as soon as the contract was entered into all of the available inside wiremen in Houston and vicinity were requisitioned and put to work wiring mess

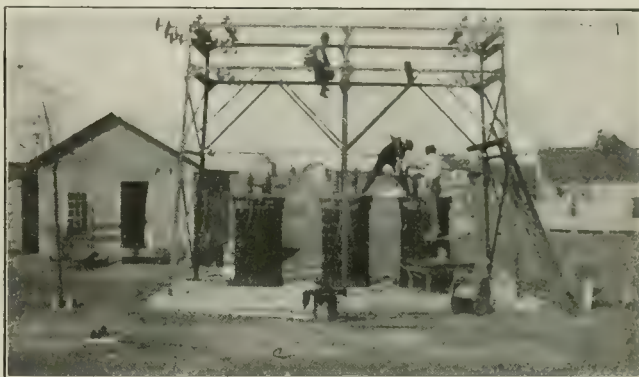
halls, shower baths and latrines. Since work was started inside the camp all men have been worked ten hours per day, including Sunday, overtime being allowed for all over eight hours' work. It is now estimated that construction work inside the camp grounds is approximately 70 per cent completed, and the cantonment quartermaster and other government officials have stated that they are well satisfied with the progress.

The greater portion of all the material for the lines inside the camp grounds was purchased locally by the company's purchasing department. Every employee connected with the company has been busily engaged since work was started on lines and service for the cantonment.

ELECTRICAL CONSTRUCTION AT THE DEMING (N. M.) CAMP

Manager James A. Shepard Says that Owing to Delay in Securing Material Work Has Not Progressed Rapidly

J. A. Shepard, manager Deming (N. M.) Ice & Electric Company, in a letter to the *ELECTRICAL WORLD* gives the following information in regard to the elec-



TYPICAL EXAMPLE OF RAPID CONSTRUCTION WORK FOR UNITED STATES CANTONMENTS

trical work in connection with the National Guard camp at Deming:

Owing to the delay in securing material the electrical construction has not advanced very rapidly and not very much difficulty has been experienced in securing enough labor for the small gangs needed.

The boundary of the camp is only about five-eighths of a mile (1 km.) from this company's power house, the camp extending about 2 miles (3.2 km.) farther. This company did quite a little work in covering a portion of the camp last year, when 3000 National Guard troops were here during the Mexican trouble, and all of the work done then was available for temporary lighting and the contractors' power requirements.

Our plans are to install two separate circuits supplying current at 2300 volts, the same to be metered and controlled at the boundary of the reservation. The government will take care of all distribution at this point. The preliminary estimate called for a connected lighting load of about 375 kw. and a power load of possibly 100 kw. connected, consisting altogether of pumps for water supply and fire protection. The Mountain States Telephone & Telegraph Company has installed a two or three position switchboard and office on the reservation and has built most of the distributing system in cable. The pole line of this company follows the main highways throughout the camp and is built of 35-ft. (10.6-m.) poles. The government will use this pole line jointly for the main distributing system.

So far we have been able to take care of all requirements for service and believe that we shall be able to get through satisfactorily, although it involves the installation of some 400 hp. in additional boilers.

INDIANAPOLIS RATES RAISED BY THE INDIANA COMMISSION

Small Consumers Not Affected, but Temporary Surcharge of 5 Mills per Kilowatt-Hour Put on Large Customers

The Indiana Public Service Commission, in an order which takes up the underlying reasons for high operating costs, has granted the petition of the Indianapolis Light & Heat Company and Merchants' Heat & Light Company of Indianapolis for authority to increase revenues. While the commission denied authority to add a surcharge to the 50,000 small consumers each month, it granted a horizontal increase on large power and light consumers.

E. I. Lewis, chairman of the commission, summed up points in the opinion in part as follows:

The commission refused to permit any surcharge or change of any kind to be made in rates of the 50,000 small consumers of electricity, the residents and small office users of electricity for light and limited power, who are now and will remain under the 7-cent rate with a 50-cent minimum per month charge.

The commission likewise refused to permit any surcharge or charge of any kind to be made on suburban lines.

The commission did, however, grant a horizontal increase in the case of all of the large light and power users of electricity. A surcharge of 5 mills per kilowatt-hour is granted for a period extending to the end of the present fiscal year, June 30, 1918. This surcharge will vary in percentage of increase. Those, for example, having a 5-cent rate will be increased 10 per cent for this limited period; those having a 2½-cent rate will be advanced 20 per cent, and those having lower rates will have higher percentages of advance.

The commission also granted a surcharge of 25 per cent to be added to all bills for steam and hot water heating for this season, ending next spring.

It is specifically provided that the present schedule of rates is in no wise to be considered changed; that the surcharge is granted only as an addition and to be charged as a separate item, and for the period ending June 30 next—a period which will carry the company through the heavy winter season, both as to light and heat operations, and which, it is hoped, will bridge the period of extraordinary costs of production.

The commission finds that the petitioners in their hearing on Aug. 8 proved beyond any possibility of doubt that they are facing heavy financial losses and that they are now showing heavy deficits. The commission holds, however, that the petitioners have only proved their case in so far as the cost of production is concerned, in which item coal is the largest element. The commission holds that they did not show any material increases in cost of distribution and other incidentals in conduct of the business, including collections, etc. For these reasons, if for no others, the commission finds that it would be unjustified at this time in levying the surcharge on the small consumers, whose 7-cent rates are little influenced by increased costs of coal and other production costs, and whose rates are made high to cover costs of distribution, collections, etc.

The commission includes in the list of those power and light users on whom the surcharge is granted the city of Indianapolis. It was found to be one of the largest lighting consumers in the city, and it enjoys on its large contracts a rate of approximately 2½ cents. Legal counsel of the city had extracted from the petitioners a promise that they would not ask the application of a surcharge to the municipal bill, and on this score the city made no appearance at the hearing and filed no protest or objection on any grounds to the petition for relief. The commission points out that the date of the hearing, Aug. 8, was set specifically to suit the convenience of the city's legal representatives. It holds that any agreement entered into between the city and the petitioners is not binding on the commission, and that there could be, in the working out of justice and equity, no solution except to include the city in the group of large light

and power consumers on whom the surcharge is authorized. It is further pointed out that the public utility law does not contemplate, and that it specifically prohibits, discrimination as among certain classes of users of service. It further appears that notwithstanding the fact that the Merchants' Heat & Light and the Indianapolis Light & Heat companies have surrendered their Indianapolis franchises and are operating under indeterminate permits, they have continued to pay to the city franchise and gross earning taxes, and that these payments to the city, which will probably aggregate \$75,000 during the coming year, will be more than double any temporary relief that is thus provided.

The commission also states that it does not in this order grant as great a degree of temporary relief as it might have done had not there been failures on coal contracts, resulting in higher coal costs for the operating companies. The commission takes the ground that it is not a court for adjudication of failures on contract, and that it will not be placed in the position of levying on consumers a tax to make good losses incident to the failure of coal-contracting and other companies to meet their contract obligations; that it does not in this order levy on the consumer a rate to absolve the coal companies of contracts or obligations, and that further relief must be sought by appeal to the courts on contracts and other points of controversy.

In making its estimates on which the decision of the commission is rendered, coal estimates are predicated on the recent prices for coal that have been set by the President. The commission by its report reveals that it has conducted independent investigations. It finds that there has come on to the public utility companies a great load caused by manufacturers, large building managers and other large users of power and light abandoning their own individual power plants. The investigation reveals that this is the result of the high prices of coal and increasing costs of labor and the scarcity of both. The result of this shifting of great industries to the central power station load has been to decrease by 3 mills the revenue per kilowatt-hour of the companies—this caused by the great increase in consumption of electric energy at the low or lowest rates, which, according to testimony, in some instances are actually "cheaper than the cost of coal itself."

TESTIMONY IN OTHER CASES

In testimony before the commission on other cases the following points have been made:

J. A. Browne, Browne-Mills Electric Company, North Manchester, testified that for the year ending June 30, 1914, his coal bill had been \$4,836; for 1915, \$6,514; for 1916, \$6,815, and for 1917, ending June 30, it had been \$10,104. His bills had shown a marked advance since his coal contract expired on Aug. 1. Labor and other material costs had made a distinct advance recently.

M. F. Tennis, general manager Madison Light & Railway Company, which had been obtaining river shipments of coal, said that it had been purchased at the following prices: July and August, 1916, \$2.15 a ton; September, 1916, \$2.25; Jan. 1, 1917, \$3; March 12, \$3.50, and June 1, \$4.50. The company had notice last week that coal would cost \$4.50 a ton delivered at the plant. He estimated that for the coming year coal at \$4.50 a ton would cost \$8,245 in excess of the expense for last year. His estimate of the excess cost of labor was \$1,200. After questioning the witness in regard to power rates, Chairman Lewis said that the company was not charging for power on a systematic basis and indicated that this matter might receive attention later. It was also brought out that the company is operating its electric railway at a loss, but its franchise with the city of Madison compels operation of the railway.

George W. Clark, secretary Oakland City Light & Power Company, which is in the midst of the coal fields, said that on April 1 his coal bill jumped from \$1.25 a ton to \$2.40 a ton.

WORK OF THE SOCIETY FOR ELECTRICAL DEVELOPMENT

"Industrial Heating as a Central Station Load" Supplements the Earlier Study of Electric Furnaces—3000 Uses for Electricity

The Society for Electrical Development has issued part two of its study of "Industrial Heating as a Central Station Load." It deals with the utilization of the heat of electrical energy. It supplements the specific applications of the electric furnace set forth in part one, "Electric Furnaces." The intention was to include in the second part applications other than those mentioned specifically in the first part.

"The society is publishing the information because," it says, "while it feels there is a large and profitable load to be obtained from the applications of the electric furnace, it recognizes that the greatest opportunity for the central station to acquire its ideal load lies in the bigger and broader field of general industrial heating on account of its magnitude as well as the large variety of industries to which it already has been and can be applied. . . . Study the proposition with all of the facts before you, and if in doubt consult the manufacturers of the apparatus involved. This is of the utmost importance."

A revised edition of the booklet "More Than 3000 Uses for Electricity" has been issued by the society, as the first edition was exhausted.

UNIVERSAL MILITARY TRAINING IS NEEDED, SAYS H. M. BYLLESBY

"We Must Never Again Be Caught So Completely Unready to Defend Ourselves," Says Utility Operator

Henry M. Byllesby, founder of H. M. Byllesby & Company, makes the following statement on "The Great Issue":

The supreme and overshadowing issue before the American people is to win the war and secure the safety of our national life. Nothing must stand in the way of this. We face the most cruel, the most desperate and the most efficient foe that ever waged war, one whose preparation for the conflict was complete to the last detail. The war was of the Kaiser's seeking. He planned and prepared for it for years, and he was the only one ready when the crisis came. Therefore, at the start, being ready, he swept everything before him, and now at the close of the third year his line is strongly intrenched in the west, where he holds Belgium and a considerable part of France, and so far the Allies have not been successful in dislodging him, except here and there. In the east, Russia is falling back. The Kaiser holds in brutal subjection ravished and ruined Serbia, Montenegro and a part of Rumania. If the drive of the Central Powers continues, they will soon tap the wheat and oil fields of the Black Sea country and then their two great needs, food and oil, will be relieved. This will enable Germany to continue for a long period.

To win, the Allies must smash Germany's line, and to do this requires a greatly superior force to that needed to hold an intrenched position. Let us not deceive ourselves or be misled by fake overtures of peace that shall in any way abate our activity. This war must be fought out and be won or lost in Europe. It will require desperate fighting on land, on sea and in the air. Without us the Allies cannot win. We must quickly grasp and fully meet the situation. Our response must be prompt and to the utmost of our ability. We must strengthen the lines. Should Russia be out of it, we must go in with 1,000,000, 2,000,000 and perhaps 3,000,000 men. We must prepare for this. We

must have a plan ready, one as big as the project and one that will produce results quickly.

In brief, we must immediately provide for universal military training as a definite and fixed policy of this government, and as soon as the cantonments now under construction have been vacated by the men called by the selective draft they must be filled with other men to receive intensive military training for at least six months. If they are not then needed, send them home and fill the quarters with younger men coming on, until every man physically fit, as he reaches a given age, shall undergo this training. If the country needs him, he can respond efficiently. If it does not, he is a stronger and better man for the training. It will help him to fight his own battles in life with greater success; it will give him a stronger physique and a better conception of what our government means and of his obligation to it. Training these young men in advance will add immeasurably to their efficiency as soldiers and teach them how to protect themselves in action. Such training will save tens of thousands of lives that otherwise would be sacrificed and billions of money that otherwise would be wasted. Our boys must meet trained and seasoned soldiers, and the only way to do this successfully is by thorough training, and only by so doing will our boys have the opportunity to meet the foe upon equal terms. We must never again be caught so completely unready to defend ourselves. Our motto must be, "Safety first and safety always."

N. E. L. A. COMMITTEE URGES CORRESPONDENCE COURSES

Every Company Should Begin Immediate Active Preparation by Appointing an Educational Director, Says Chairman F. R. Jenkins

Fred R. Jenkins, chairman committee on education of salesmen of the Commercial Section of the National Electric Light Association, has issued a notice calling attention to the educational courses. It says that every company should begin immediate active preparation by appointing an educational director, that a number of subscribers are women who are preparing themselves for every possible emergency, and that the unprecedented existing conditions demand that others prepare themselves to assume the duties of those called away.

The notice calls attention to the three courses, practical electricity, commercial engineering, and accounting. The course of ten lessons in practical electricity, inaugurated recently, has already over 500 subscribers. The lessons are written without the use of advanced mathematics, the object being to give a practical knowledge of the fundamental principles of electricity and magnetism and the construction and use of electrical apparatus.

Conducted for almost two years and with over 1500 subscribers the commercial engineering course comprises seventeen lessons. It is intended to assist the student to keep pace with the rapid development in applications of electricity and thereby to enable him to prepare himself for advancement.

Accounting courses are two in number, elementary and advanced. A course of seven lessons covers elementary bookkeeping and accounting. The advanced course is a highly specialized course in electric public utility accounting, consisting of thirty-six lessons, covering all phases of bookkeeping and accounting, applicable to large and small companies, following closely the N. E. L. A. classification of accounts and the most approved practices. The elementary course already has over 300 subscribers. This course or its equivalent is a prerequisite for enrollment in the advanced course.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Gas & Electric Securities Company Two-Year Notes.—An issue of \$1,000,000 collateral trust 6 per cent two-year notes, dated Sept. 1, is being offered by the Gas & Electric Securities Company at 98½.

Electric Bond & Share Company Stock Issue.—Stockholders of the Electric Bond & Share Company, New York, have authorized an increase in stock from \$16,000,000 to \$20,000,000, of which \$2,000,000 will be common and \$2,000,000 preferred.

Professor Clewell to Lecture at Yale.—Prof. C. E. Clewell of the University of Pennsylvania will deliver on Sept. 10 his fourth annual lecture on the fundamental principles of natural and artificial factory lighting before the junior students in electrical and mechanical engineering in the summer term of mechanical technology at the Sheffield Scientific School of Yale University. This year's work during the four weeks' summer term is under the direct supervision of Prof. Herbert L. Seward of the mechanical engineering department and under the general supervision of Profs. Charles F. Scott and L. P. Breckenridge, heads of the departments of electrical and mechanical engineering at the Sheffield Scientific School.

Electric Vehicle Appreciated in Siam.—J. L. Hansen of the Siam Electricity Company of Bangkok, Siam, on a visit to this country informed the National Electric Light Association that his company has a fleet of five electric vehicles, two of which have been in use since 1904. The thirteen-year-old vehicles are used for lamp delivery, while the larger trucks are used by wiremen and for various other purposes. The vehicles are operated successfully by unskilled natives and are found to be as economical in Siam as in this country. The Siam Electricity Company uses rice husks in place of coal, and this fuel is obtainable in almost unlimited quantities at small cost. In the event that there should be a shortage of rice husks, the company keeps an oil tank for reserve fuel, but it is rarely needed.

Continue Special Military and Naval Instruction at Massachusetts "Tech."—Plans have been prepared at the Massachusetts Institute of Technology for continuation of special military and naval instruction after the school year opens this fall. During the summer a large amount of extra work has been conducted by the regular staff on a volunteer basis in preparing specially qualified students for war service of various kinds. Co-ordination of instruction is now required as the regular sessions approach, and to meet the conditions in sight instructing forces have

been reassigned and the whole campaign for the coming year made as definite as possible. The special instruction required is likely to be continued far into the future. In aeronautics alone there are three special schools of enlisted men under way—the Cadet School of Army Aeronautics, the Cadet School of Naval Aeronautics and the School of Ensigns. Soon after Sept. 1 it is expected that from 600 to 700 men will be taking these special courses. For the School of Ensigns the instructors are naval officers; the other two schools are instructed by the institute regular technical staff and by such military and naval instructors as are required in addition. The various courses include instruction in radio, internal combustion engines, signaling and other subjects directly related to war work. Valuable work is being done at the institute also in preparing qualified students to become engineers in the enlarged merchant marine, and a number of graduates are now attached to navy yards and shipbuilding plants.

Reorganization of Reading Properties Approved in Pennsylvania.—As a result of mergers approved by the Pennsylvania Public Service Commission, the Reading Transit & Light Company has come into the ownership of properties that supply electricity for power and lighting in Reading, Lebanon and adjacent territory, and also becomes the owner of virtually the entire electric railway system of Reading and its suburbs, heretofore operated under leaseholds. One of the features of the change is that hereafter the Reading Transit & Light Company will operate as an electric railway company instead of a leasing company. By the mergers just approved the Metropolitan-Edison Company will acquire the properties of the Metropolitan Electric Company, the Edison Electric Illuminating Company at Lebanon and the Lebanon Valley Electric Light Company (which operates in Myerstown), subject only to a prior lien of \$2,726,000 first mortgage bonds of the Metropolitan Electric Company. This new company will have a controlling interest in the Pennsylvania Utilities Company of Easton, which furnishes electric light, power and gas in that city, Phillipsburg, N. J., and adjacent territory. Thus the Metropolitan-Edison Company will cover one of the most highly developed and widely diversified industrial sections of the country, serving a population of about 300,000. The Metropolitan-Edison Company in turn will be controlled by the Reading Transit & Light Company through ownership of its common stock. The mergers will make Reading one of the greatest electrical centers in the East. A 33,000-volt transmission line to connect the West Reading power plant with the Lebanon plant is being built at a cost of \$60,000, and its completion in the near future will mean one of the largest power services in eastern Pennsylvania. A number of large power systems then will be run together, and any one of them will be able to use the surplus capacity of another in an emergency.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Institute of Radio Engineers.—A paper on "Oscillating Audion Circuits," by Prof. L. A. Hazeltine, of Stevens Institute of Technology, Hoboken, N. J., was read at a meeting of the Institute of Radio Engineers on Sept. 5.

Baltimore Section, A. I. E. E., Elects Officers.—The officers of this section for the coming year are as follows: Chairman, J. B. Whitehead; secretary-treasurer, L. M. Potts; executive committee, A. S. Loizeaux, A. T. Clark, W. H. Swift, R. C. Faught, F. A. Allner, C. G. Edwards and H. B. Stabler.

Convention of Purchasing Agents.—The annual congress of the National Association of Purchasing Agents, which is to be held in Pittsburgh on Oct. 9, 10 and 11, is taking on an importance that is impressing itself nationally. For the first time since the association's organization five years ago the importance of participation in a "clearing house" of information has impressed itself not only on the members but also on the firms and industries with which they are connected. The details of the convention are being worked out by Robert F. Blair, Pittsburgh Gage & Supply Company, chairman of the convention committee. E. L. McGrew of the Standard Underground Cable Company is the National association president.

Association of Iron and Steel Electrical Engineers.—The eleventh annual convention of the Association of Iron and Steel Electrical Engineers will be held at the Bellevue-Stratford Hotel, Philadelphia, Pa., Sept. 10 to 14. The papers to be presented are as follows: "Safeguarding Electrical Equipment," by Walter Greenwood; "Heroult Electric Furnaces," by Walter C. Kennedy; "Factors Relating to the Economical Generation and Use of Electric Power in the Steel Industry," by Brent Wiley; "Central Station Power Supply to Iron and Steel Industry," by Joseph McKinley and R. L. Baker; "Electrical Reversing Blooming Mills," by R. D. Nye; "Electric Drives for Reversing Rolling Mills," by D. M. Petty; "Fuel Economy by Co-operation in Establishing a Better Practice in the Operation of Stokers and Boilers," by J. G. Worker; "Turbogenerators," by R. H. Rice; "Manufacture, Selection and Use of Carbon Brushes," by E. H. Martindale; "Grab-Bucket Coal Hoists Operated by A-C Motors with Dynamic Braking and Regenerative Braking," by James Farrington and R. H. McLain, and "Tool Steel Gears and Pinions for Mill and Industrial Service," by E. S. Sawtelle. Standardization committees on motors, control and crane standardization will also meet.

W. E. Firth, safety engineer for a number of years with the Midvale Steel Company, has resigned to take a vacation of indefinite duration.

G. W. Johns, formerly with the Boonton (N. J.) Gas, Light & Improvement Company, has been appointed manager of the Newton (N. J.) Electric & Gas Company.

Lloyd R. Hunt has resigned as superintendent of the Lexington (Ky.) light and water department to become connected with the Tallassee Power Company, Baden, N. C.

Monroe J. Frankel has been appointed gas and electrical inspector of Louisville, succeeding the late R. M. Parks. Mr. Frankel had been chief deputy under Mr. Parks.

L. W. Dickson, formerly of the new-business department of the Denver (Col.) Gas & Electric Light Company, is now assistant new-business manager of the Empire District Electric Company at Joplin, Mo.

William J. Lynch has been appointed general manager of the Quebec Railway, Light, Heat & Power Company, Ltd., of Quebec, Canada. Since the death of H. G. Matthews Mr. Lynch has been acting as treasurer and controller of the company.

J. E. Van Hoose has been appointed superintendent of the Lexington (Ky.) light and water system, to succeed L. R. Hunt. Mr. Van Hoose was formerly in charge of the city light and water department of Tupelo, Miss., and also that of Brandegee, Ala.

L. J. Lemen has been appointed new-business manager of the Massillon (Ohio) Electric & Gas Company. Mr. Lemen was previously connected with the new-business departments of the Montgomery Light & Water Power company and the Toledo Railways & Light Company.

Frank I. Hardy, formerly general manager of the Chicago, South Bend & North Indiana Railway, has been appointed general superintendent of the Northern Ohio Traction & Light Company, Akron, Ohio. Mr. Hardy has been engaged in electric railway work for the past twenty years.

W. M. Tait, former superintendent of power with the Glenwood Light & Water Company, Glenwood Springs, Colo., has resigned his position with that company and accepted a position with the Intermountain Railway, Light & Power Company as superintendent and manager of the Scottsbluff (Neb.) district, including Scottsbluff, Gering, Mayard, Melbeta and Minatare.

Thomas Ewing has resigned as Commissioner of Patents and will again practice law in New York City, as he did prior to his appointment as commissioner. Mr. Ewing was an assistant examiner at the Patent Office from 1888 to 1890. From 1891 to 1913 he practiced law in New York, making a specialty of patent law, during which time he solicited some well-known patents, including the Sprague patent on multiple-unit system of electrical train operation.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

C. L. Brower, formerly connected with the Oregon Power Company, has been appointed chief engineer of the Prosser plant of the Pacific Power & Light Company, succeeding H. C. Holt, resigned.

E. V. Pryor has been appointed new-business manager of the Jefferson City (Mo.) Light, Heat & Power Company, succeeding Norman Olson. Mr. Pryor was formerly connected with the Illinois Traction Company in campaign work.

M. L. Derge, former general superintendent of the Trumbull Public Service Company, Warren, Ohio, succeeds J. E. Harsh as general manager of the Salina (Kan.) Light, Power & Gas Company. Prior to going with the Trumbull company Mr. Derge was superintendent of the Milligan Company of Elyria, Ohio.

R. B. Stearns, vice-president of the Milwaukee Electric Railway & Light Company, has been elected senior vice-president in charge of operation of the Bay State Street Railway Company, Boston, Mass. Mr. Stearns, who is a graduate of Purdue University, became assistant manager of the Milwaukee property in 1911 and vice-president a few months later.

J. E. Harsh, general manager of the Salina (Kan.) Light, Power & Gas Company, has assumed a similar position with the Lincoln (Neb.) Gas & Electric Light Company, General Manager George A. Montgomery being in poor health. Mr. Harsh was treasurer and new-business manager of the City Light & Traction Company of Sedalia, Mo., before going to Salina.

Duncan T. Campbell, vice-president and manager of the Scranton (Pa.) Electric Company and past-president of the Pennsylvania Electric Association, has suffered a severe bereavement in the death of his wife last week. Expressions of sympathy have been extended to him, for Mrs. Campbell shared with her husband a great popularity in the industry, particularly throughout Pennsylvania.

Harold V. Bozell, for the last nine years professor of electrical engineering at the University of Oklahoma and who has been spending the past year at Yale University on Sabbatical leave, has resigned the Oklahoma position to become assistant professor of electrical engineering in the Sheffield Scientific School of Yale University. Professor Bozell was very active in engineering affairs of a public nature in Oklahoma. He was representative of

the A. I. E. E. on the Oklahoma committee on industrial preparedness and also chairman of the Oklahoma board of preparedness directors. Besides, he was one of the organizers of the Oklahoma Electric Railway Association, of which he served for a number of years as secretary. He was graduated from the University of Kansas in 1908. For the last nine years he has been connected with the University of Oklahoma where he built up the department of electrical engineering from a small beginning.

Dr. H. B. Shaw, former dean of the School of Engineering of the University of Missouri, has been appointed supervisor of the Doherty cadet school. Dr. Shaw's duties will include the selection of men from the universities of the country to become Doherty cadets, to supervise the courses and to recommend cadets for regular posts in the organization. He will make his headquarters, it is expected, in Toledo, Ohio. Dr. Shaw was born in Winslow, Me., in 1869. He was educated in the private schools of Tarboro, N. C., and was graduated from the University of North Carolina in 1889 with the degree of A. B. He received a B.C.E. from there in 1891 and an A.M. from Harvard in 1894. From 1889 to 1913 he served as instructor, assistant professor and professor in mathematics, surveying and drawing at the University of North Carolina, Harvard University and the University of Missouri. At the latter university he was dean of the School of Engineering and director of the engineering experiment station at the time of his appointment to the Missouri Public Service Commission in April, 1913. Dr. Shaw has written several engineering books and has had much practical engineering experience. He was with the Phoenix Iron Company in 1892, in street railway work in Jersey City, N. J., Newark, N. J., and Pittsburgh in 1896, and did miscellaneous engineering work from 1899 to 1913, having been consulting engineer for Columbia, Mo., and having designed the water and light plant and had charge of other engineering projects for the University of Missouri. He also suggested and developed the engineering experiment station (1909-1913) and was editor of the Engineering Experiment Station's series of bulletins.

Obituary

Henry J. McGregor, superintendent of the Tacoma (Wash.) light and water department, died recently following an operation for appendicitis. Mr. McGregor had charge of the La Grange end of the construction of the Tacoma municipal power plant.

Robert J. Watson, head of the four-year apprenticeship trade course at the Westinghouse Electric & Manufacturing Company, died recently at Wildwood, N. J. Mr. Watson had been in the employ of the Westinghouse company since the fall of 1901, starting as a time clerk.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

TENDENCY NOTICED TO SELL UNDER CURRENT MARKET

Situation Largely Brought About by Advance Price-Increase Announcements, Permitting Heavy Stocking

Even with the volume of trade and the difficulty in supplying it, competitive conditions still prevail in the electrical supply jobbing field. In a number of staples prices considerably under the current market prices are constantly being quoted. Not long ago a prominent jobber in the East sold a large quantity of flexible conduit that he had in stock at considerably less than \$70. At the time it would have cost him to buy it from the manufacturer in carload lots in the neighborhood of \$69. To be sure, he made a profit on the transaction over the cost to him, because he had laid in the stock at a low price, but he had to replace that stock at a cost of a few hundred dollars above what he sold it for.

It is not difficult to see that if such a program is carried out consistently in the end the net result will be a loss. So long as the market is advancing it is possible to show a net profit and still sell under the current market, but when the market settles down or a decline comes, then all of these profits are wiped out and more besides. By selling at a price that shows a profit on the cost to buy at the time of the sale the seller takes the safest course.

Of course, this situation has largely come about through manufacturers announcing price increases far in advance. Jobbers are urged to lay in heavy stocks, and then in order to turn over their stock as rapidly as possible the jobbers are willing to take a price under the current market.

In fact, in some sections of the country it is possible to buy from contractors certain indoor wiring supplies at prices considerably under what the manufacturer is now quoting for carload lots.

JAPAN AS A FACTOR IN WORLD'S LAMP MARKET

Exports of Incandescent Units Amounted to \$335,000 in 1916, with Prospects of Surpassing \$1,250,000 During Current Year

Prior to the outbreak of the war in Europe in the summer of 1914 the largest single factor by far in supplying the foreign trade of the world with incandescent lamps was Germany. American tungsten filament lamps were beginning to compete, but not in a large way. In fact, up to that time the greatest efforts had been made to force the foreign lamps out of the American market on a quality as well as price basis. This was virtually accomplished at the beginning of the war.

Soon after hostilities commenced, however, Germany found it impossible to continue her foreign trade except with her allies and contiguous neutral nations. For that reason a foreign lamp trade of an unusual value of from \$3,000,000 to \$5,000,000 was suddenly thrown upon the market.

American manufacturers soon realized this opportunity, and as a result the exports of incandescent lamps manufactured in the United States have grown from around \$500,000 annually to more than \$2,000,000 annually since the war began. At the same time the Japanese manufacturers began to take steps to cultivate this market, and consequently the Japanese exports of incandescent lamps in

1916 amounted to \$335,000, and in the first four months of the current year to \$420,000, or at the rate of over \$1,250,000 for the current year. These figures are to be compared with no exports and with imports of \$150,000 in the year previous to the war.

The one difficulty the Japanese lamp manufacturers have had was in the supply of filaments; practically all of these used to be imported. Now, however, only a small fraction of the filaments used are imported. Large factories have been constructed, and the Japanese manufacturers are now in a position to supply their own filaments.

As the figures show, the progress made by the Japanese lamp industry has been very great. With the modern factories that have been constructed and with exceedingly cheap labor, it is conceivable that Japanese lamps may dominate the foreign markets in the same way that German lamps did three years ago and previously. It is interesting to note in this connection that American capital is interested in the Japanese lamp industry, and it is reasonable to believe that it is playing no insignificant part in developing this industry.

NEED EXISTS FOR WATCHING DEBTORS' INVENTORY ACCOUNTS

Eastern Banker Urges that Stock Be Carried More on Basis of Normal Cost Rather Than on To-day's High Prices

A warning to distributors was issued recently by one of the prominent bankers of the East to watch the inventory accounts of debtors. Inventory accounts, in the opinion of this man, are being carried too high. Prices are much higher to-day than under normal conditions, and therefore a normal stock would cost considerably more. To carry this stock on the books at the higher figure is the evil to which attention is called. In fact, it is urged that this stock be carried on a normal cost basis.

The reason for this warning is to be found in the uncertainty of future prices. Present-day stocks may depreciate over night in value should the market take a sudden slump and consequently any borrowing done on the basis of an inventory using present prices would place both the creditor and the debtor in an unfortunate position should a sudden decline occur.

SWEDISH ELECTRICAL TRADE SHOWS A RAPID GROWTH

Consular Report States that Scandinavian Manufacturers Are Diligently Engaged in Seeking New Markets

In the Swedish electrical industry, represented by several important concerns, there have been consolidation, increase of capital, rapid growth, and the diligent seeking of new markets, it is stated in a recent report to the Bureau of Foreign and Domestic Commerce, by Consul General H. W. Harris.

One of the principal companies, now increasing its capital stock from \$7,236,000 to \$8,040,000, ranks as the largest of its kind in northern Europe. Its products include generators, motors, transformers, and equipment for light, power and electric railways. It has built generators up to 25,000 hp. Its net earnings in 1916 were \$3,343,000, as compared with \$1,238,000 in 1915 and \$589,000 in 1914.

CHARGING INTEREST

ON OVERDUE ACCOUNTS

Credit Men Not Yet Ready to Adopt Practice, Fearing Boomerang of Possibility of Having to Act as Banker to Trade

While but few electrical concerns make a practice of charging interest on overdue accounts, considerable attention is being given to this practice by the industry. The feeling exists very strongly that something ought to be done to bring the delinquent debtors up to scratch. Credit men, however, are on the whole distrustful of the interest-charging practice. By charging interest on overdue accounts the distributor lays himself open to becoming a banker for his trade. Of course, the jobber is practically acting as banker already for many of the smaller customers, and much of the material sold to this class is paid for after it is sold, or, what amounts to the same thing, on a consignment basis.

Those who are charging interest on overdue accounts, as far as can be learned, are satisfied with the results. It is found, however, that the creditor must be firm and impress upon the debtor that prompt settlements are expected and that interest is charged merely as a penalty.

This matter was discussed at some length by members of the National Electrical Credit Men's Association at the Boston convention, but the members declined to adopt a resolution that it was the sense of the meeting that the interest-charging practice should be followed.

For the manufacturer, particularly under existing conditions, it would probably not be difficult to institute the interest-charging plan. For the jobber, however, it would be more difficult because of the class of customers.

METAL MARKETS CONDITIONS

Trading Is Still Dull Waiting for Announcement of Government Prices

There was little trading done in the various metals last week. Buyers and sellers alike are awaiting the government decision on steel and copper prices.

There has been a large amount of copper buying held back and it is believed that as soon as prices are fixed a brisk demand will develop. It is expected that the government price will be announced in the course of a week or ten days, and that a price between 20 cents and 25 cents, probably 2.5 cents, will be fixed.

Refineries are now obliged to draw on surplus stock owing to previous mining curtailment. Should buying pick up on a large scale soon, it is not impossible that a shortage of copper might develop.

Quotations fell off again on electrolytic copper, and on Tuesday nominal prices were as follows: September, 25.62½ cents; October, 25.25 cents; November, 24.75 cents; fourth quarter, 24.5 cents.

NEW YORK METAL MARKET PRICES

	Aug. 27			Sept. 4		
	£	s	d	£	s	d
Copper:						
London, standard spot	120	0	0	120	0	0
Prime Lake	27.00		to 28.00*	27.00		to 28.00
Electrolytic	26.00		to 26.50*	25.50		to 25.75
Casting	25.50		to 26.00*	25.00		to 26.00
Wire base	32.00		to 33.00*	32.00		to 33.00*
Lead, trust price		11.00			10.50	
Silver, ingot		50.00			50.00	
Sheet zinc, f.o.b. smelter		19.00			19.00	
Nickel, spot	7.92½		to 8.30		8.05	
Aluminum, Straits		61.50			61.25	
Aluminum, 98 to 99 per cent.	44.00		to 46.00*	43.00		to 45.00*

OLD METALS

Heavy copper and wire	24.00	to 25.50	23.00	to 24.00
Cass, heavy	15.00	to 15.50	15.00	to 16.00
Cass, light	12.50	to 13.00	12.00	to 12.25
Lead, heavy	9.00	to 9.25	9.00	to 9.25
Iron, old scrap	5.50	to 6.00	5.50	to 6.00

*Nominal.

THE WEEK IN TRADE

DEMAND for supplies from normal quarters is slowly dropping off, with the exception of the South, where a building revival has started. Utility purchasing is at a low point and under present prices and financial conditions will probably continue to be small. With the exception of some line construction materials, prices are remaining firm and steady. Deliveries are becoming better. Collections appear to be holding up well, but the optimism on this point is not so strong as it was a few weeks ago.

NEW YORK

Government contracts continue to hold the prominent place in the market for electrical goods. Outside of cantonment construction building is at a minimum. There is a movement on foot, however, to stimulate building, and a generally optimistic feeling exists. It is expected that in spite of high prices a number of apartment houses and office buildings will be begun shortly. Utility buying is growing smaller, and all repairs and maintenance work are being kept at a minimum. In fact, practically the entire normal market for electrical goods has fallen considerably below its recent level. There is, however, no indication of a break in prices. Prices are very firm, and in some instances, particularly in the line of equipment, higher prices are noticed.

Deliveries generally are better and consumers' stocks are as a result diminishing. Purchasing is being made more as necessity arises.

Export demand continues, but it is now very difficult to supply this market because of shipping conditions.

CROSS-ARMS.—Deliveries are very poor on both Pacific Coast and Mississippi points shipments. Labor disturbances, particularly those connected with the I. W. W., have hurt production on the coast. Shipbuilding and government orders have held back deliveries to the regular trade. Prices advanced on Aug. 25 about 5 per cent.

INSULATORS.—Glass insulators have advanced on the average about 5 per cent. Some sizes did not change at all, while others increased more.

TRANSMISSION POLES.—There is a strong tendency toward an advance for chestnut poles. Farmers and small local interests are disposed to hold out for higher prices, with the result that the jobbers are paying more to-day than they did three weeks ago.

POLE AND LINE EQUIPMENT.—There is little business except for government work. Central stations and railways are making their ordinary requirements for maintenance and improvements as small as possible. Nor are there any large extensions in this territory. Cantonment work, however, is going along briskly. Deliveries are somewhat better than they were. Hardware can now be had in three to four weeks where a short time ago three months or more were required for a shipment. Other items, particularly cross-arms, are still on very long and uncertain deliveries. Deliveries have not improved sufficiently, however, to warrant local jobbers in cutting down on stocks.

WIRE.—Prices are unchanged for current deliveries, although buyers who are anticipating their requirements for January and later deliveries are receiving the advantage of the lower price on copper. Business in small sizes is practically at a standstill, while in the larger and circular-mill sizes a nice demand is experienced. Railroads are buying considerably, but the light and power and railway utilities are cutting their purchases down. Telephone and telegraph requirements are nil. There is quite a bit of pick-up work in the local market, such as repairs, work done over and replacement. This work, which is largely industrial, has resulted in a big volume of small orders.

INCANDESCENT LAMPS.—Industrial consumers are reducing the volume of stocks on hand and buying more

from hand to mouth. For a time, when the lamp delivery situation was critical, these buyers laid in a three months' stock. Now that the manufacturers have increased production beyond the consumption power of the market, local agents have bettered their stocks and buyers are depending on these local stocks and those of the manufacturers. There is a considerable demand from the government for cantonment purposes. The requirements of each are from 15,000 to 20,000 lamps. Practically 40,000 lamps will be required in the New York territory to equip the cantonments at Syracuse and Yaphank.

TOYS AND HOLIDAY SPECIALTIES.—There is already a big volume of orders being placed for the Christmas trade. Indications are that Christmas-tree battery outfits are selling best at present. These will be used with toy transformers on house-lighting circuits. The difficulty in obtaining ornamental glass bulbs has led to the development of celluloid ornamental cases to go over plain glass bulbs.

COLLECTIONS.—There was little difference noted in the amount of collections during the month of August, the total holding up as well in the jobbing line as in previous months.

ELECTRIC RANGES.—Many inquiries are being received from Scandinavian countries, but little business is developing from this direction owing to the transportation problem. For this reason it is doubtful if any trade will come from these neutrals for some time to come.

MOTORS.—Great Britain has added electric motors up to ½ hp. to the list of prohibited imports. This is not applicable, however, to motors imported under license.

SPLICING SLEEVES.—Several large orders for seamless copper splicing sleeves have recently been filled for the Colorado Power Company, Lehigh Navigation Electric Company and the Harwood Electric Company by Edwin G. Hatch, New York.

SOOT CLEANERS.—The Vulcan Soot Cleaner Company, through its New York representatives, has recently closed a contract for soot cleaners for ninety-eight boilers for a group of electric light, power and railway companies controlled by the H. L. Doherty Company. Besides the efficiency of mechanical soot cleaners as compared with hand blowing, the continually rising price of coal is also accountable for the present volume of business.

CHICAGO

In the Middle West business is steady. The price-fixing program at Washington is perhaps the topic of greatest interest in business circles. If this question is settled soon in a satisfactory manner, better business is expected. Regardless of the character of the decision, however, normal fall purchasing is expected to prevail.

The month of August was ahead of July for some of Chicago's prominent jobbers. With the manufacturer, however, it is reported that, especially in supply lines, the volume in August was a little less than in July. The fact that all industrial plants are busy and expect to continue so is looked upon as a good omen. Normal stocks of industrial lighting goods were laid in to anticipate demands from this source. There has been no change in prices. Credits and collections are still satisfactory.

MOTORS AND TRANSFORMERS.—It is reported that one prominent company was overstocked and is turning some of its stock of material into money for extensions.

APPLIANCES.—Owing to campaigns conducted for central stations by one manufacturer sales of appliances have increased. None of the campaigns was extraordinarily successful but all were satisfactory.

LABOR.—The strike which has involved the Springfield (Ill.) central station assumed threatening proportions again on Labor Day, when 2000 strike sympathizers wrecked a number of street cars and attacked the gas and electric company's office.

COAL.—The State Council of Defense of Illinois is continuing to urge industries and individuals to purchase and

store coal now rather than take chances on not being able to get it in midwinter.

SMALL LIGHTING SETS.—The Universal Motor Company of Oshkosh, Wis., reports that its business in small engine-driven lighting sets has increased 200 per cent over 1916 and a 100 per cent plant extension is being made to take care of orders. Some of the increase is government business.

QUANTITY PRICES.—W. N. Matthews & Brother, Inc., has adopted a unique plan for granting quantity prices in connection with the sale of its new "Matthews holdfast adjustable" and its line of lamp guards which have been on the market for some time. The holdfast adjustable will sell for from 60 to 45 cents, depending upon the quantity ordered. As it is a companion article to the Matthews holdfast lamp guard, it has been decided to give the customer the benefit of quantity prices if a quantity of lamp guards and adjustables are purchased and shipped at the same time. For example, the best price on adjustables is obtained when lots of 1000 are ordered; the best price on lamp guards is obtained when 1000 are ordered. If a customer has use for 750 lamp guards and 250 adjustables, the order can be combined and the minimum price will be obtained on each article. A higher price exists on each of these articles in 100 lots than in 1000 lots, but this price is better than the price in lots of ten. By combining sixty lamp guards and forty adjustables, the price on 100 lots can be obtained.

BOSTON

Business in the jobbing trade continues fair, but with a tendency to fall off in lines affected by the slackness of the building industry. On the whole, business is better than jobbers anticipated a few months ago. Prices are about the same, though it is rumored that advances are likely to take place in the domestic appliance field about Sept. 15. Reports on collections vary, some jobbers stating that these are poor and others that credits are good. A strong tone of optimism as to the prospects for fall business is voiced by a representative Boston jobber, who expects, however, some reduction in the rate of business increase along with an excellent total volume of trade. In few lines are there signs of improved deliveries. For the present there is not much chance of factories accumulating stocks of staple material. Government demands continue to be brisk in many classes of electrical material. The central station appliance business is exceedingly good and an early acceleration of pre-holiday trade is expected. Electrical manufacturers are working at night in some departments. Draft and enlistment have unquestionably affected the production situation, but in the jobbing, contracting and retail fields the labor shortage is less marked. That part of the electrical contracting business associated most closely with the wiring and furnishing of fixtures for speculative building for both residence and apartment-house work has been gradually decreasing in the past six months, as those from whom the builders secured their loans have gradually been tightening up in this respect, making it very difficult for the speculative builder to obtain funds. The industrial side of the contracting business continues excellent and the prospects are good for the next six or eight months.

MOTORS.—Since the middle of August a decrease in the heavy influx of motor orders is apparent. Deliveries and prospects for a reduction in prices do not appear to be in evidence, and on some lines prices tend to stiffen somewhat. Government business is very properly taking the precedence and a much larger volume of this class of trade is anticipated for the near future.

DRY BATTERIES.—The volume of business is increasing, largely owing to demands for high-quality product rather than to the requirements of the war. Deliveries are rather slow. It is not believed that the government is a large buyer of dry cells, although some equipment of this class is used in Coast Guard signaling service with low voltage incandescent lamps and special reflectors.

ELECTRIC RANGES.—The volume of trade is at present rather spotty, with a general opinion among central stations that the range business is likely to pick up considerably this fall. Deliveries are at present improving

and in Boston a good stock of ranges is on hand. Prices have not changed lately, nor are any further price movements anticipated. The high cost of coal is being featured in sales arguments and will undoubtedly stimulate range sales.

LUMINOUS RADIATORS.—Prospects for fall trade are unusually good in view of the high cost of coal that prevails everywhere.

WASHING MACHINES.—A considerable trade in these units is noted, influenced by the scarcity of immigrant labor and the high cost of living. Central station trade in these equipments appears very promising in connection with the fall campaign.

ELECTRIC SIGNS AND BILLBOARD LIGHTING.—As yet the war has had little or no depressing effect on the business of representative dealers. Considerable loss in outdoor advertising space has been noted in connection with the national prohibition legislation, but the gap has been filled with other good business. The supply of materials and equipment has been a serious problem, even at very high prices. Sign dealers and equipment men are at present operating on very close margins and as yet no concerted movement has been made to pass the increased cost over to the advertiser.

RUBBER-COVERED WIRE.—Prices tend to sag off somewhat at present.

INCLOSED FUSES.—Prices stiffened somewhat during the past month, but no further increases are in sight. The volume of business is heavy and well maintained. Deliveries are very good and factory stocks are increasing.

SWITCHES AND CABINETS.—Cut-out switches and cabinets are behind on orders.

LAMPS.—Prices are about the same and stocks are being built up. A slightly increased demand is apparent.

LABORATORY AND METER TESTING EQUIPMENT.—Uncompleted orders are on hand which require factory production at maximum capacity to avoid congestion in output. The present year has exceeded all others in point of output, according to an authoritative source. Labor is plentiful and prices remain at the present levels. Prompt deliveries, however, are difficult, on account of the material situation.

ATLANTA

There is no apparent let-up. Business continues excellent and a number of new jobs for industrial and commercial building are being started. Residence building shows a slight improvement over last week, but there is still considerable room for expansion in this field. Reports from cantonnments in the Southeast indicate that all work is progressing rapidly. All material required to complete electrical work is on the ground, with the exception of a few distributing transformers, which deficiency is being taken care of temporarily by the various central stations supplying power to the camps.

On the whole, prices remain firm, with two exceptions, heating devices and cross-arms. Deliveries show no improvement.

WIRING DEVICES.—There is a very heavy demand and stocks are getting low. Deliveries are growing longer.

LAMPS.—Normal fall business is opening up briskly. Stocks are in very good shape and orders for stock are being shipped promptly.

CONDUITS.—Prices hold about the same. Deliveries on ¾-in., 1-in. and 2½-in. sizes are getting worse.

COLLECTIONS.—Jobbers and contractors report collections as being very good, but on the other hand manufacturers state that August receipts were away off compared to the standard of previous months. The public service companies have been pressed for immediate funds to carry on expensive extensions and meet bond interest, which, no doubt, accounts for the poor showing made for collections of large amounts at this time.

INCLOSED LEVER SWITCHES.—An active market prevails and deliveries are very good.

CROSS-ARMS.—The demand remains the same and no especial activity was noted, although the price advanced about 10 per cent Sept. 1.

DRY BATTERIES.—The demand continues strong, and some difficulty is being experienced in securing deliveries. Shipment promises have been advanced from eight days to twenty-one days.

FLASHLIGHTS.—One jobber reports his sales to date as 50 per cent. greater than his entire 1916 sales.

FANS.—There is very little activity in this line at the present time.

ELECTRIC SIGNS.—This business up to within the last few weeks has been on a par with corresponding periods of past years. Atlanta's street sign ordinance has tended to hold up any rapid development of this line, but the past week, however, has shown a substantial improvement in the way of orders placed and the increasing number of inquiries. This activity is due to the local merchants realizing the importance of bringing their names more forcibly before the military trade. Recent orders average about \$600 per sign. Deliveries are good, one manufacturer promising and completing shipments in from fifteen to thirty days.

HEATING DEVICES.—The trade has been notified of an advance of approximately 10 per cent to take effect Sept. 15 on air heaters, chafing dishes and percolators. As far as can be ascertained no other appliances in this line other than those mentioned will be affected at that time.

POLE AND LINE HARDWARE.—A large volume of business is recorded; no price advance recently, and deliveries run from six to eight weeks.

SEATTLE

Northwest electrical dealers report very slight decrease of sales as compared with the week previous, due primarily to the threatened shipyard strike, which would involve more than 12,000 metal trade workers, representing fifteen unions. The strike, which would be to enforce long-pending demands for a wage increase, was ordered postponed Sept. 1 to permit a final attempt by the government to effect an amicable settlement of the controversy. The strike was to begin Sept. 5. Committees from Seattle unions will meet with the adjustment committee of the Federal Shipping Board at Washington, D. C.

Sales of electrical equipment to mills are still light owing to the strike in the mills and camps, which shows no signs of early settlement. Demand from factories is about the same as reported for several weeks past. Building and general construction give no indications of an early improvement.

FIXTURES AND WIRING SUPPLIES.—Demand for buildings is negligible, nor has the anticipated increase in demand for incandescent lamps materialized.

APPLIANCES.—Household appliances and novelties are moving satisfactorily and prices remain about the same. There has been no material increase in stocks, which are low. Buying is light, just enough to meet demands. Shipments are coming through fairly well.

CONDUIT.—The demand is increasing and prices are advancing.

CREDIT AND COLLECTIONS.—It is hard to obtain credit, while collections are satisfactory.

SAN FRANCISCO

Business was practically the same last week as in the previous week, with prices unchanged. Stocks are normal on conduit, insulated wire, sockets and outlets, and deliveries are good, but the demand has fallen off. Lamp stocks are quite fair and the demand is increasing. Bare copper wire is short. Household appliance stocks are in good shape. Sales are large and increasing. Collections for August showed a noticeable improvement, being particularly good during the last week.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List, per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor

No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 solid:	
Less than coil.....	\$54.90 to \$61.00
Coil to 1000 ft.....	48.80 to 59.17
No. 12 solid:	
Less than coil.....	63.90 to 71.00
Coil to 1000 ft.....	56.80 to 68.87

Twin-Conductor

No. 14 solid:	
Less than coil.....	\$78.00 to \$104.00
Coil to 1000 ft.....	75.00 to 80.00
No. 12 solid:	
Less than coil.....	121.50 to 135.00
Coil to 1000 ft.....	108.00 to 130.95

DISCOUNT—CHICAGO

Single-Conductor

Less than coil.....	List plus 10%
Coil to 1000 ft.....	List less 10%

Twin-Conductor

Less than coil.....	List plus 10%
Coil to 1000 ft.....	List less 10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	—10% to 12%
1/5 to std. pkg.....	10% to 20%
Std. pkg.....	34% to 44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	12% to +20%
1/5 to std. pkg.....	Net to 20%
Std. pkg.....	30% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28	.29

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 30.....	.35	.35
50 to barrel.....	.31 to .3175	.32 to .3275
Barrel lots.....	.28 to .2875	.29 to .2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less than Coil	Coil to 1000 Ft.
3/8-in. single strip.....	\$67.50 to \$75.00 \$60.00 to \$69.75
3/8-in. double strip.....	71.75 to 75.00 63.75 to 72.00
1/2-in. single strip.....	90.00 to 100.00 80.00 to 93.00
1/2-in. double strip.....	95.00 to 100.00 85.00 to 96.00

NET PER 1000 FT.—CHICAGO

Less than Coil	Coil to 100 Ft.
3/8-in. single strip.....	\$75.00 \$63.75
3/8-in. double strip.....	78.75 71.25
1/2-in. single strip.....	100.00 85.00
1/2-in. double strip.....	105.00 85.00-95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
5/8.....	.15	2.....	.55
3/4.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$55.00	\$24.50-\$25.50 \$21.50-\$24.75
1/4-in.—	\$40.00-\$60.00	\$27.00-\$30.00 \$23.50-\$27.00

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$55.00	\$27.50 \$23.10-\$24.75
1/4-in.—	\$60.00	\$30.00 \$25.20-\$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 3/4
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List Elbows, List

1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.60
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

1/4 in. to 1/2 in.	6% to 8%	3/4 in. to 3 in.	8% to 10%
Less than 2500 lb.....	9% to 11%	2500 to 5000 lb.....	11% to 13%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

1/4 in. to 1/2 in.	6% to 8%	3/4 in. to 3 in.	8% to 10%
Less than 2500 lb.....	9% to 11%	2500-5000 lb.....	11% to 13%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

Net.....	\$3.50
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CHICAGO

List price.....	\$5.00 to \$6.00
Discount.....	.30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.75 to \$6.30
1/5 to std. pkg.	4.50 to 5.25
Standard package, 500. List, each,	\$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500. List, each,	\$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt-B	100	\$0.27
60-watt-B	100	.36
100-watt-B	24	.65
75-watt-C	50	.65
100-watt-C	24	1.00
200-watt-C	24	2.00
300-watt-C	24	3.00
Round bulbs, 3 1/8 in., frosted:		
15-watt-G	50	.50
25-watt-G	50	.50
40-watt-G	50	.50
Round bulbs, 3 3/4 in., frosted:		
60-watt-G	24	.72
Round bulbs, 4 1/8 in., frosted:		
100-watt-G	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$30.00 to \$34.88
Coil to 1000 ft.	21.00 to 26.52

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$37.20 to \$37.84
Coil to 1000 ft.	27.90 to 28.38

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	\$15.00 to \$29.00
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CHICAGO

Net per 100	\$22.50 to \$38.25
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OUTLET BOXES

Nos.	List, per 100
101—A, A1 1/2, 4 S.C., 6200, 320	\$30.00
102—B.A., 6200 S.E., 300, A.X. 1 1/2,	
4 S.	30.00
103—C.A., 9, 4R. B 1 1/2	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list	List to 33%	List to 27%
\$10.00 to \$50.00 list	List to 42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list	40%	35%
\$10.00 to \$50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$14.00 to \$20.00
1/5 to std. pkg.	13.00 to 15.00
Standard package, 2200. List per 1000,	\$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$18.00 to \$20.54
1/5 to std. pkg.	13.00 to 19.24
Standard package, 2200. List per 1000,	\$20.

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net	Std. Pkg. 3500.	Std. Pkg. 4000
Less than 1/5 std. pkg.			
1/5 to std. pkg.	\$10.50 to \$18.00		\$28.00
1/5 to std. pkg.	9.75 to 11.10		21.50

CHICAGO

	Per 1000 Net	Std. Pkg. 3500.	Std. Pkg. 4000
Less than 1/5 std. pkg.			
1/5 to std. pkg.	\$11.85 to \$26.00		\$20.75 to \$30.75
1/5 to std. pkg.	9.00 to 20.00		16.30 to 24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/2-in. cap key and push sockets	500	\$0.33
1/2-in. cap keyless socket	500	.30
1/2-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No. Fuse

High Grade:	List
30-amp. S. P. S. T.	\$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	List
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

High Grade:	List to	%
Less than \$10 list	—	5%
\$10 to \$25 list	11%	16%
\$25 to \$50 list	14%	24%
Low Grade:	List to	%
Less than \$10.00 list	5%	—
\$10.00 to \$25.00 list	11%	16%
\$25.00 to \$50.00 list	14%	24%

DISCOUNT—CHICAGO

Less than \$10 list	5% to +5%
\$10 to \$25 list	11% to 16%
\$25 to \$50 list	14% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net to +20%
1/5 to std. pkg.	15% to Net
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

	List, Each
Union and Similar	
No. 155	\$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list	List to 23%	18%
\$2.00 to \$10.00 list	20% to 23%	18%
\$10.00 to \$50.00 list	23% to 30%	18%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list	25% to 50%	15% to 40%
\$2.00 to \$10.00 list	50%	40%
\$10.00 to \$50.00 list	35% to 64%	25% to 52%

TOASTERS, UPRIGHT

NEW YORK

Net price	\$3.10 to \$3.50
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CHICAGO

List price	\$5.00
Discount	30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

No. 18, less than full spools.	\$0.52
No. 18, full spools.	0.48

CHICAGO

	Per Lb. Net
No. 18, less than full spools	\$0.065 to \$0.6885
No. 18, full spools.	0.5285 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

NEW YORK			
	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14....	\$15.00-18.00	\$12.00-14.50	\$11.50-12.50
12....	21.06-28.35	18.96-24.30	18.01-20.25
10....	29.60-39.83	26.64-34.14	25.31-28.45
8....	42.40-56.49	38.16-48.42	36.25-40.35
6....	72.19-89.39	64.98-76.62	61.73-63.85

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14....	\$18.00	\$16.00	\$14.00
12....	28.63-29.89	24.54-25.62	21.35-22.50
10....	40.28-41.51	34.44-35.58	29.65-31.57
8....	48.84-60.13	44.77-51.50	42.95-44.77
6....	70.24-82.20	63.85-75.35	57.47-60.50

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$40.25 to \$45.00
25 to 50 lb.	39.25 to 42.00
50 to 100 lb.	38.00 to 38.25

CHICAGO

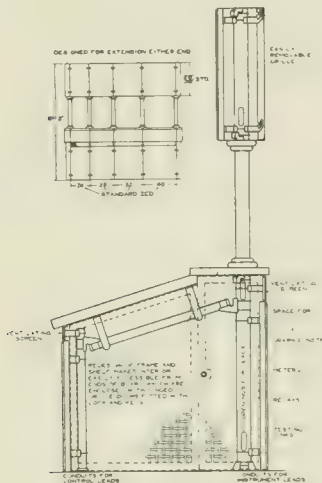
	Per 100 Lb. Net
Less than 25 lb.	\$42.35 to \$45.00
25 to 50 lb.	40.35 to 44.00
50 to 100 lb.	39.00 to 43.00

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Improvements in Benchboard Design

In connection with the manufacture of switchboard equipments by the General Electric Company, Schenectady, N. Y., for some of the large power plants during the last few years, various improvements in benchboards have



DETAILS OF BENCHBOARD IMPROVEMENTS

occurred to the designing engineers or have been suggested by purchasers. Designs have been completed, and the following types of benchboard of new design are standard: (1) Open type of board; (2) closed type of board, with back panels in two or three sections; (3) closed type of board, without back panels, installed near wall; (4) control bench, for installing in front of instrument and meter panels.

All types of board are designed so as to make future extension possible at either end; in fact, with this design a benchboard can be extended just as easily as a vertical switchboard.

The grille panels back of the instrument sections are easily removable without the use of wrench or screwdriver. Instead of grille work back of the bench, panels are used which provide a convenient place for mounting graphic instruments, meters, relays, testing links, etc. This enables the purchaser to test these devices without interfering with the operator in front of the bench. Furthermore, with this arrangement of apparatus, all instrument leads can be brought up from the floor in almost a straight line to the instrument section without passing under the control bench, which is usually crowded. The control leads can then be distributed neatly back of the sub-base, where they leave the conduits, and up to the control apparatus. This improved method not only gives a

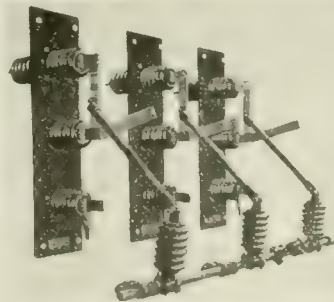
neat arrangement of wiring, but, in case of trouble, the whole system is exposed at once.

Redesign of the bench frame and a slight increase of the dimensions of the bench structure make the interior easily accessible from the ends of the bench, which are inclosed with hinged grille doors equipped with a lock and key.

Ventilating screens are provided on the front and back, running the entire length of the bench, thus preventing excessive heating from lamps and resistances. Further improvements include the use of welded instead of pivoted joints, which makes a better job and also gives a more pleasing appearance to the eye.

Remote-Control Disconnecting Switches

Construction engineers are often confronted with space limitations, making it necessary to install high-tension disconnecting switches in locations where it would be very difficult and dangerous to operate them by means of switch



THREE-PHASE DOUBLE-THROW DISCONNECTING SWITCH

sticks. For such installations it is desirable to employ the interlocked manually operated remote-control type, permitting all phases to be simultaneously opened and closed by means of a common handle, which can be installed at any desired point.

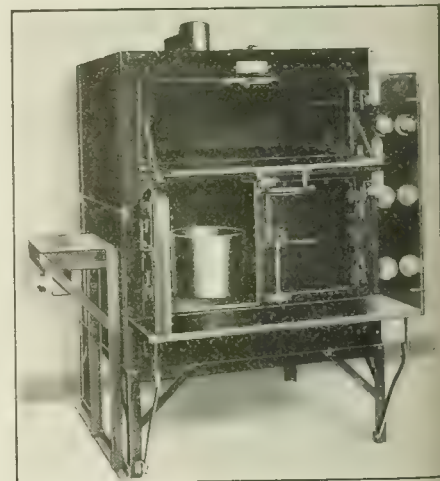
The remote-control switch will often render unnecessary the making of alterations in bus structures or building additions which would be required to secure sufficient space for a safe installation of the ordinary type. A recent development is the "unit type" switch, made in both single and double throw combinations and manufactured by the Delta-Star Electric Company of Chicago. Switches can be assembled in any combination of front and back connections. Provision is made to lock the blades in neutral or open position.

Dining-Room Floor Receptacle and Plug

A receptacle and plug for use in connecting dining-room table appliances with the source of current is being manufactured by the Hart & Hegeman Manufacturing Company of Hartford, Conn. In dining rooms where indirect lighting fixtures are used it is necessary to make the appliance connection through the floor, and this plug is designed to penetrate the rug without damage to the fabric. The plug carries two sharp pointed prongs which are insulated to their tips in order to obviate danger of ground or short circuits. These sharp points, the manufacturer states, can be inserted into the tapered hole beneath the rug very easily. Sliding shutters are used to close the openings of the receptacle the instant the prongs are removed, thus keeping out dust and dirt. This dust-proof feature also makes the receptacle of value as a baseboard setting.

Electric Oven for Army Use

The electric oven illustrated here has been developed by the Hughes Electric Heating Company, Chicago, and submitted to the War Department of the United States for possible adoption for army cooking. This oven is designed to take care of baking, boiling and frying operations necessary in the feeding of about 150 men. It is



OVEN TO COOK FOR 150 SOLDIERS

unique in that it is the first oven to be designed to perform all of these various cooking operations at one time. The hot-plate which is bracketed to the oven will accommodate the standard United States army coffee receptacle. The oven is rated at 15 kw.

Electrically Driven Grinders for Floor Mounting

A line of electrically driven grinders and buffing lathes has recently been brought out by the Webster & Parks Tool Company of Springfield, Ohio. The grinders are provided with high pedestals for floor mounting. The smaller sizes have a shelf on the pedestal for tools, while the larger sizes have a door in the pedestal, and the interior of the pedestal provides a large compartment for tools. Heavy guards provided with connections for dust-exhausting systems cover the grinding wheels.

The motors are fully inclosed and equipped with ball bearings. Outboard bearings are also provided on the large grinders. In the smallest size grinders a 1-hp. motor is used, and a 5-hp. motor is used on the largest grinders. The motors are made by the Robbins & Myers Company, Springfield, Ohio. In addition to the direct-connected electrical outfits, the company makes a complete line of belted outfits for all services.

Amplly Ventilated Floodlighting Projector

For general floodlighting purposes the Electric Service Supplies Company of Philadelphia recommends the type FL-1412 projector shown herewith, used with either "Golden Glow" or "Crystal" mirror reflector, depending on the floodlighting conditions to be met.

The body proper, including ventilator housing and door, is made of sheet steel, and wherever possible electrical spot welding is utilized instead of riveting, this resulting in a strong, rigid and weatherproof construction. The door is swung on heavy pressed steel hinges, is fitted with a rubber gasket to assure its being thoroughly watertight, and is held securely closed by a wing nut latch which will not work open.

The mirror is supported in a steel felt-lined shell and is securely held therein by means of eight segments clamping the edge throughout the en-



PROJECTOR FOR POLE MOUNTING

tire periphery. This steel shell also supports the entire focusing mechanism as well as the incandescent lamp, so relieving the mirror of all strain.

The projector, it is pointed out, is amply ventilated. On the lamp casing proper is mounted a heavy cast quad-

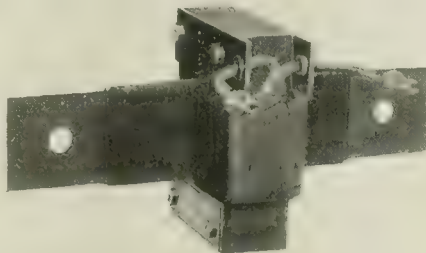
rant, this being supported in a double-jawed swiveling base. By means of this construction the lamp may be rotated in any direction or elevated or depressed at will, thus enabling the operator to train the beam accurately on any object to be illuminated. Means are provided for locking the lamp in any desired position.

Current Transformers for Tripping Breakers

Current transformers designed particularly for tripping oil circuit breakers have been developed recently by the General Electric Company of Schenectady, N. Y. They are known as the type Y-285, form A, and are furnished in ratings from 5 amp. to 800 amp. at 4500 volts or less.

Two styles are available. The first is for use up to 300 amp. and the second from 300 amp. to 800 amp. Either can be used with oil circuit breakers for tripping directly or in connection with relays. In addition to the trip coil or relay an ammeter may also be connected to the transformer, when the trip coil does not require more than 70 volt-amp. at 5 amp.

The 5-amp. to 300-amp. transformers



TRANSFORMER FOR HEAVY CURRENTS

are equipped with a cast-metal base with two bolt holes for mounting on a flat surface, or by means of fittings on pipe supports. The secondary leads are supported by bushings in two small metal plates fastened with flat terminals for bolting to similar terminals on cable leads.

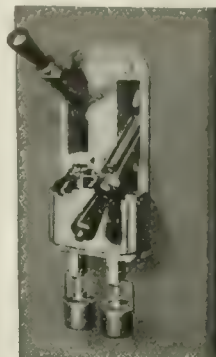
The higher capacity transformers for use from 300 amp. to 800 amp. inclusive are of the bus type and are supported by bolting the primary in the bus or connection bar or to the stud of the oil circuit breaker. No base is required. The secondary leads are supported by bushings in two of the metal plates which help to hold the transformer laminations in place.

Inverse-Time-Limit Attachments

The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., is making an inverse-time-limit attachment for direct mounting on the current-trip magnets of the overload-trip cover plates and electrically operating mechanisms of all its type F and type B automatic breakers.

The attachments for use on cover-plates of manually operated breakers are of the double-disk type and are ad-

justable by varying the area of the moving disk that is directly opposed to the stationary disk. On 100 per cent overload a time element of approximately five seconds is obtainable, and by adjustment this may be varied downward to zero. A longer time element



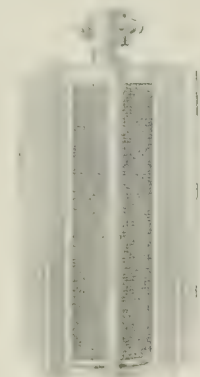
METHOD OF MOUNTING INVERSE-TIME-LIMIT ATTACHMENT

may be obtained up to approximately ten seconds by using a heavier oil than that provided with the attachment.

The attachment for use on electrically operated breakers is of the disk-pot type. Time adjustment on this form is made by varying the opening of the valve disks as on the plunger. The use of the inverse-time-limit attachment does away with the necessity for relays where an inverse-time-limit characteristic on the overload feature is desired.

Grounding Box

A grounding box that consists of a hollow cylindrical cast-iron shell approximately 5 in. (12.7 cm.) in diameter and 12 in. (30.5 cm.) long has been brought out by the Philadelphia Electric Company, Supply Department, 132 South Eleventh Street, Philadelphia. Supported by this shell and forming part of the same casting are a number of longitudinal ribs that extend radially outward from the circumference of the cylindrical surface. The center of the box serves as a re-



HEAVILY GALVANIZED GROUND BOX

ceptacle for holding a special hygroscopic compound of silicates, sodium, carbon and vegetable fiber. Connection to the ground box is made by means of a 1-in. (2.54 cm.) galvanized-iron pipe that is screwed into the top of the casting and securely fastened.

Trade Publications

FUSES.—The Daum refillable cartridge fuses for electric light and power service are illustrated and described in a folder that has been issued by A. F. Daum of Pittsburgh, Pa.

VALVES AND JOINTS.—The Universal Valve Company of Burlington, Wis., has prepared a bulletin descriptive of its non-packing high-pressure valves and joints for steam, air, gas and ammonia.

ELECTRIC HEATERS.—The Hotpoint Electric Heating Company of Ontario, Cal., is distributing a leaflet descriptive of Hotpoint "Hedlite" heaters and is announcing an increase of price after Sept. 15.

SAFETY DISCONNECTING HANGER.—The Thompson Electric Company, 5606 Euclid Avenue, Cleveland, Ohio, has prepared a bulletin supplementary to catalog B-16, descriptive of its safety disconnecting hanger.

PROTECTIVE METER EQUIPMENT.—The Metropolitan Engineering Company, 35 Vestry Street, New York City, is distributing bulletin No. 3600, descriptive of its protective service and meter equipment. This company has also prepared a bulletin descriptive of its service and watt-hour-meter protective devices.

INDUCTION MOTORS.—Bulletin No. 180 has been prepared by the Crocker-Wheeler Company of Ampere, N. J., to describe its form Q induction motor for two-phase and three-phase use, squirrel-cage type, 60-cycle operation. This motor is made in from 1 hp. to 300 hp. and is designed for constant-speed operation.

STOKER EQUIPMENT.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has prepared a bulletin giving a description of complete stoker equipment. The following items are illustrated and described: The Roney stoker, chain-grate stoker, underfeed stoker, stoker engines, forced-draft fan equipment and furnace observation doors.

MOTORS.—The Reliance adjustable speed motors with armature shifting design for direct current are illustrated and described in bulletin No. 1014, now being distributed by the Reliance Electric & Engineering Company, Cleveland, Ohio. This bulletin takes into consideration the mechanical details, quotations from users, starting and reversing equipment, and photographs of actual installations.

WIRE AND CABLE.—The Belden Manufacturing Company of Chicago has issued catalog No. 7, relating to electric wires, cables and cordage. The company's factory and general offices are at Twenty-third Street and Western Avenue. The catalog referred to contains a most useful compilation of information for those in the trade or electric construction. Many tables and convenient data are given.

SHADES AND REFLECTORS.—The Faries Manufacturing Company, Decatur, Ill., has issued its twelve-page, illustrated bulletin No. 25, giving revised prices of metal shades and reflectors. The forty cuts show this company's numerous styles of shades and reflectors, with patent collar lock holders, and in each case is given the watt capacity of lamp to which it is suited. The shades are made of steel and aluminum, usually finished in green enamel on the outside, with an inside finish of frosted aluminum for some styles, and for others of porcelain enamel or aluminum white enamel. The frosted aluminum finish was originated by this company. The reflectors comprise the parabola of different sizes and the half-shade, made of frosted steel, frosted and polished aluminum, brushed brass and oxidized copper.

SUPPLY CATALOG.—The Western Electric Company, which three years ago established a new mark among jobbers by announcing that it would issue its supply catalog every year, once again scores as a pioneer by publishing its 1918 year book in the early fall of 1917. Two reasons are given by the company in connection with this announcement. The first is that because of the popularity which its year book has attained the entire supply of 1917 books is already exhausted. In the second place, from many quarters there arose a demand for a book to be published early in September which could thus be used by buyers in placing their requisitions for fall and winter stocks. The new 1918 year book which is now being distributed to the trade follows the plan of uniform list price and basic discount inaugurated by the Western Electric Company three years ago. In addition, manufacturers' list prices are shown on certain standard lines for the convenience of

any who prefer to buy on the manufacturers' discount or who desire an independent means of checking invoices. Another feature of the book which is unique among all jobbers' electrical supply catalogs is the first section of sixteen pages following the index, devoted to a listing of the company's extensive line of printing plates, window displays, stuffers, lantern slides and other forms of assistance for dealers handling Western Electric appliances. The book consists in all of 1160 pages and contains more than 50,000 items. It is what it purports to be, a real handbook of electrical supplies.

Trade Notes

GEORGE FREDERICK WALT, president Elliott-Fisher Company, Harrisburg, Pa., died on Aug. 19.

THE FRANKLIN ELECTRIC MANUFACTURING COMPANY, Hartford, Conn., has announced that it will institute the plan of giving a quarterly bonus to employees.

THE ELECTRIC WELDING COMPANY, 220 West Forty-second Street, New York, has filed notice of increase in its capitalization from \$24,000 to \$250,000 to provide for extensions.

THE NOVELTY INCANDESCENT LAMP COMPANY, Emporium, N. Y., is building a new addition to its plant at St. Mary's. The structure will be about 85 ft. by 90 ft., and cost \$10,000.

THE STANDARD ELECTRIC TIME COMPANY, Springfield, Mass., has had plans prepared for the construction of a three-story addition to its works on Logan Street, to cost about \$25,000.

JOHN A. STEVENS, engineer, 8 Merri-mack Street, Lowell, Mass., has organized a department to furnish advice and designs of factory buildings and specifications and superintendence of their construction.

THE HARTFORD FAIENCE COMPANY, Hartford, Conn., is planning for the erection of a new addition to its plant, about 45 ft. by 80 ft. The company specializes in the manufacture of electrical porcelain goods.

THE NATIONAL LAMPS WORKS of the General Electric Company, Chicago, Ill., will build a new three-story plant at Harrison and Flourney Streets, to cost about \$60,000. The works will be occupied by the Illinois Miniature Division of the company.

T. M. AVERY, one of the New York City representatives of the Blaw-Knox Company, is leaving for the Pacific Coast to take charge temporarily of the San Francisco office. Edward M. Ornitz, the San Francisco representative, has joined the Engineering Corps as first lieutenant.

THE VULCAN FUEL ECONOMY COMPANY announces that its soot-cleaner business will hereafter be done by the Vulcan Soot Cleaner Sales Company, a new Illinois corporation. The new company includes the officers and directors of the manufacturing company and also Charles DeVed as vice-president and director, and Joseph Kissick, Jr., as director and general sales manager. The Vulcan Fuel Economy Company will continue its business in all other lines heretofore handled by it and certain new lines, announcement with respect to which will be made later.

THE MCCARTHY DRILL & TOOL CORPORATION of Toledo, Ohio, with executive offices at 30 Church Street, New York City, has purchased the Toledo Drill & Tool Company, which has just moved into a new and enlarged fireproof two-story structure where it has arranged to turn out large quantities of high-speed drills in addition to a full line of cutters and reamers. The McCarthy corporation has added new machinery and equipment, and announces that it is now open to take on contracts and make prompt delivery for both millimeter and inch size high-speed twist drills.

W. K. PALMER, who for sixteen years past has been continuously engaged in consulting engineering practice and the head of the firm of the W. K. Palmer Company, engineers, Kansas City, Mo., has accepted a commission as major in the engineer corps of the United States Army. In consequence his practice and the business of the W. K. Palmer Company have been discontinued for the period of the war. Major Palmer organized engineer troops at the beginning of the war and has been actively engaged in military matters for some time past. He is now in Kansas City on a five days' leave from Fort Sill, Okla., for the purpose of closing up business affairs connected with his practice and the business of the W. K. Palmer Company.

New Incorporations

THE EASTERN NEVADA POWER COMPANY, Wilmington, Del., has been incorporated with a capital stock of \$4,000,000 to manufacture and distribute electricity.

THE STANTON COMPANY, Cleveland, Ohio, has been organized by W. J. Mahon, F. G. Mooney, W. T. Redmond and S. T. Powell. The company is capitalized at \$10,000.

THE MILLS ELECTRIC COMPANY, Lafayette, Ind., has been incorporated for \$100,000. The incorporators are B. Mills, Eldon L. Lewis, H. A. Keller and C. J. Mertz.

THE EASTERN LIGHTING COMPANY, INC., New York, has been incorporated by Sidney M. Knopf, Charles H. Sellman and Joseph Daving. The company is capitalized at \$1,000.

THE NEOSHE POWER COMPANY, Miami, Tex., has been incorporated by E. M. Stapleton, Oklahoma City; J. E. Parker, Oklahoma City, and Henry E. Asp, Oklahoma City.

THE KAR ENGINEERING COMPANY, INC., New York, has been organized by M. and S. Karasick and G. P. Robbins, 129 East Eighty-second Street. The company is capitalized at \$125,000.

THE ECONOMY ELECTRIC DEVICES COMPANY, Chicago, has been incorporated with a capital stock of \$20,000. The incorporators are Jacob Bunn, Robert C. Lanphier and Alonzo Hoff.

THE COLUMBIA AUTOMATIC STREET LIGHTING COMPANY, Boston, Mass., has been organized by Eugene S. Sullivan, Boston; William S. McNary, Boston, and Philip C. Stingel, Stoneham.

THE SPRINGDALE LIGHT & POWER COMPANY, Springdale, Ark., has been incorporated with a capital stock of \$50,000. The incorporators are: G. D. Locke, F. L. O'Neal and H. L. Hughes.

THE OLIVE STREET ELECTRIC COMPANY, Los Angeles, Cal., has been organized by Seymore Thompson, Annie H. Thompson and E. Bingham. The company is capitalized at \$10,000.

THE HANDY SUPPLY COMPANY, Lakewood, Wash., has been incorporated with a capital stock of \$10,000 by E. H. Martindale, H. C. Martindale, F. Z. Marty, A. M. Lloyd and H. G. Vile.

THE IDAHO TRANSMISSION COMPANY, Butte, Mont., has been incorporated with a capital stock of \$500,000 by M. E. Buck, A. C. Pratt and S. P. Hogan for the purpose of furnishing light, power and heat.

THE BAKER ECONOMIC TRANSPORT CORPORATION, New York, has been organized to manufacture motors, engines, vehicles, etc., by C. W. Baker, W. A. Hall, 31 Nassau Street, and J. A. Chard, 250 Fulton Street, New York.

THE BOWERS ELECTRIC COMPANY, Reading, Pa., has been organized to furnish heat, light and power. The incorporators are: W. J. Martin, Topton; D. S. Martin, Reading, and S. R. Rothermel, Reading. The capital stock is \$5,000.

THE ELECTRICAL PRODUCTS CORPORATION, Dover, Del., has been incorporated with a capital of \$200,000 by M. L. Gatchell, L. A. Irwin and M. L. Rogers, all of Wilmington. The company proposes to manufacture electrical specialties.

THE NAMETCO PRODUCTS COMPANY, INC., New York, has been incorporated to manufacture metal and electrical supplies. The company is capitalized at \$10,000. The incorporators are: M. Levin, M. Halperin and I. Krainess of 88 Walker Street.

THE LEFIRE COMPANY OF AMERICA, Wilmington, Del., has been organized by C. L. Runlinger, M. M. Clancy and Clement M. Egner, all of Wilmington, for the purpose of manufacturing, selling and dealing in and with power equipment of all kinds. The company is capitalized at \$100,000.

THE DAYTONA ELECTRIC COMPANY, Daytona, Fla., has been organized by Joseph B. Garrison, Ludie B. Garrison, V. Markham and Joseph B. Garrison, with a capital stock of \$5,000. The company proposes to buy, sell, manufacture and deal in electrical fixtures and appliances and merchandise of all kinds.

THE PEARSON-MONNETTE FARM-LIGHTING CORPORATION, Dover, Del., has been incorporated by C. L. Rimlinger and F. Armstrong, Wilmington, and C. M. Egner, Elkton, Md., with a capital of \$350,000. The company proposes to manufacture lighting equipment and fixtures and do business as electrical engineers.

New England States

NASHUA, N. H.—The Manchester Traction, Light & Power Company announces that it has purchased all the franchises, works, system and property of the Nashua Light, Heat & Power Company.

EAST DOUGLAS, MASS.—The W. E. Hayward Company, woolen manufacturer, of East Douglas, is building an electric plant at a cost of about \$15,000. The work will involve the rebuilding of dam.

HOUSATONIC, MASS.—Work has been resumed on the new power plant of the monument mills.

MARLBORO, MASS.—Plans are being considered for the installation of a municipal lighting plant in Marlboro.

NEW BEDFORD, MASS.—Plans have been prepared by the Union Street Railway Company for the construction of a new power station. The new building, 80 ft. by 115 ft., 70 ft. high, with concrete chimney, will be erected on the company's present wharf. It will be equipped with a 30-ton crane. The Harry M. Hope Engineering Company of Boston will have charge of the engineering work.

WORCESTER, MASS.—The Fred T. Ley Company was granted permission to construct a high-tension power line from the Wachusett dam to the town limits. The transmission line is to connect the power house at the Wachusett dam with the power house of the Metropolitan Water Board at Fayville.

BRIDGEPORT, CONN.—Contract has been awarded by the Bullard Machine Tool Company of Bridgeport for the construction of a new plant, to cost about \$1,000,000. The main building will be two stories, 180 ft. by 700 ft.; administration building and storage building, 60 ft. by 165 ft., two stories high; boiler house, 50 ft. by 50 ft.; power house, 30 ft. by 50 ft., and coal storage building, 20 ft. by 50 ft.

HARTFORD, CONN.—Work has begun on the erection of an addition, 40 ft. by 80 ft., to the plant of the Hartford Faience Company, to cost about \$4,500. The company manufactures electrical porcelain specialties.

NEW MILFORD, CONN.—The Southern New England Telephone Company has awarded a contract for the erection of a new telephone exchange, to cost about \$30,000.

Middle Atlantic States

ALBION, N. Y.—Plans have been completed by the Western New York Utilities Company for the construction of a new power dam in the town of Carlton at the location of Clark's Mills, to cost about \$200,000. The proposed dam will be 70 ft. high and 406 ft. long.

ALBION, N. Y.—Plans have been completed by the Western New York Utilities Company of Medina for a new street-lighting system to be installed on Main Street when the new paving is completed. A system of conduits will be installed in the business portion of the city and the county square.

BINGHAMTON, N. Y.—The erection of a new 33,000-volt transmission line from the new power station of the Binghamton Light, Heat & Power Company to a substation on Noyes Island has recently been completed.

ELMIRA, N. Y.—At a meeting of the board of directors of the Corning Light & Power Company it was decided to build an auxiliary electric light and power generating plant in Corning. The new plant will be on Chestnut Street near Tioga Avenue. The plant will have two powerful electric generating units.

LOCKPORT, N. Y.—Plans have been completed by the United Paper Board, Company for the construction of a power plant, to cost about \$200,000. Work, it is understood, will begin at once on the proposed plant.

LYONS, N. Y.—The Niagara, Lockport & Ontario Power Company is contemplating an extension 99 ft. by 151 ft., to its local power house.

MECHANICVILLE, N. Y.—A petition has been presented to the City Council by the taxpayers on North Main Street asking that an ornamental lighting system be installed on that thoroughfare.

MEDINA, N. Y.—L. S. De Graff, E. Carlton Smith and De Lancy Rankine have bought the Tonawanda Power Company from the Niagara Falls Power Company.

NEW YORK, N. Y.—The Fifth Avenue Coach Company it is reported, is contemplating the purchasing of equipment for its new motor truck plant.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

NEW YORK, N. Y.—The contract for the installation of heating, lighting, ventilating, refrigerating apparatus and other power equipment for the Commonwealth Hotel, Times Square, New York City, has been awarded to the General Electric Company.

NEW YORK, N. Y.—The Pennsylvania Railroad Company has awarded the contract for electrical equipment for the new hotel now being erected at Seventh Avenue and Thirty-third Street, New York City, to the Westinghouse Electric & Manufacturing Company of East Pittsburgh.

NEW YORK, N. Y.—The New York Telephone Company is reported to be considering issuing \$25,000,000 in capital stock to provide funds for extensions and improvements and to take up outstanding indebtedness. The company has applied to the Public Service Commission for permission to issue this additional capital stock.

NIAGARA FALLS, N. Y.—Work has begun by the National Electrolytic Company on the construction of a heating plant on the hydraulic canal basin.

OGDENSBURG, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, N. Y., until Sept. 12, for the erection of a new smokestack at the power plant of the St. Lawrence State Hospital, Ogdensburg. E. S. Elwood is secretary.

ROCHESTER, N. Y.—The Rochester Railway & Light Company is building an extension to its distribution system in the Buffalo Road west of the city. It consists of a three-phase line carrying about 4000 volts.

SALAMANCA, N. Y.—The Cattaraugus Union Telephone Company has filed notice of increase in capital stock from \$50,000 to \$75,000, the proceeds to be used for extensions and improvements.

SYRACUSE, N. Y.—Plans have been prepared for the construction of a new shop and car barn, 75 ft. by 150 ft., for the New York State Railways Company, to be erected at Burnett and Fairview Avenues. H. G. Throop is engineer.

TROY, N. Y.—The power house of the Wynantskill Power Company on the Geer estate was recently destroyed.

BAYONNE, N. J.—The Safety Insulated Wire & Cable Company, First Avenue, Bayonne, has been granted a permit for the erection of a one-story extension to its plant.

BORDENTOWN, N. J.—The City Commissioners have awarded the Public Service Electric Company a five-year contract for street-lighting, which provides for extensions to the lighting system on the main streets and the installation of new lamps of the Mazda type to replace the arc and incandescent lamps now in use.

DOVER, N. J.—The Wharton Furnace Company has contracted with the New Jersey Power & Light Company for energy to operate compressors, pumps, hoists and other equipment at its mines. The power company will extend its 11,000-volt transmission line to the mines of the company, a distance of about 1 mile.

NEWARK, N. J.—Bids will be received by the committee on public buildings of the Board of Freeholders until Sept. 12 for improvements in the penitentiary at Caldwell, including the installation of a heating and ventilating system in the women's section, new piping for power house, tunnel piping and improvements in the steam fittings in the main building. August L. Lacombe is chairman of board.

PERTH AMBOY, N. J.—Plans have been prepared by the Lehigh Valley Railroad Company for the construction of a power house, 50 ft. by 100 ft., one story, at its local shops, to cost about \$40,000.

ROCKAWAY, N. J.—The Empire Steel & Iron Company is making extensions and improvements to the electric power plant at its Mount Hope mines.

TRENTON, N. J.—Plans are being considered by the Public Service Corporation for improvements and extensions to its local plant on Brunswick Avenue, involving an expenditure of about \$200,000. A site has been purchased adjoining the station for the proposed extension.

TRENTON, N. J.—Plans are being considered by the City Commission for the in-

installation of ornamental lamps in Broad, Market, Warren, State and Willow Streets and Clinton Avenue. At the present time there are 88 lamps in this district. The new plans provide for a total of about 306 lamps in the same territory.

WESTWOOD, N. J.—The Board of Public Utility Commissioners has granted the New York Telephone Company permission to extend its lines and system in Westwood, in accordance with an ordinance passed by the borough officials.

BELLEVILLE, PA.—The Union Light, Heat & Power Company has made application to the Public Service Commission for permission to operate in a section of Union Township.

EDWARDSVILLE, PA.—The Delaware, Lackawanna & Western Railroad Company is planning to install a coal breaker at its local plant, to be equipped for electrical operation. Energy will be supplied by the Woodward Power Company.

HARRISBURG, PA.—Plans have been completed by the Harrisburg Railways Company for the construction of a new substation.

HARRISBURG, PA.—The City Council is considering plans for extensions to the street-lighting system, which provide for the erection of new arc lamps of 2000 cp. in a number of city streets and also for new 60-cp. incandescent lamps in various parts of the city.

LANCASTER, PA.—Work has begun on the construction of the new plant of the Fidelity Electric Company of Lancaster to cost about \$30,000. L. V. Wright has the contract.

LEBANON, PA.—The Lebanon Valley Iron & Steel Company has completed the installation of a new 500-kw. converter, Westinghouse type, to provide for increased capacity. The Edison Electric Illuminating Company, Lebanon, will furnish the service.

PHILADELPHIA, PA.—Plans have been prepared by the Philadelphia Drying Machine Company for the construction of a new power house at its plant on Stokely Street.

PHILADELPHIA, PA.—The Department of Public Health and Charities is taking estimates on the construction of a power house to be erected at Thirty-fourth and Pine Streets.

PHILADELPHIA, PA.—William R. Dougherty is estimating on plans for the erection of a power house at Thirty-fourth and Pine Streets for the Philadelphia General Hospital.

PHILADELPHIA, PA.—The Pennsylvania Railroad Company has awarded a contract to the John N. Gill Company, 1215 Filbert Street, Philadelphia, for the construction of a one-story shop building, 56 ft. by 100 ft. and power house, 50 ft. by 50 ft., at its Girard Point plant, to cost about \$42,000. The company is also asking for bids for the construction of a two-story addition to its Harrisburg shops.

PITTSBURGH, PA.—The Public Service Commission has granted the Duquesne Light Company of Pittsburgh permission to issue \$3,271,250 in securities to provide for existing obligations, extensions, etc.

POTTSTOWN, PA.—Christman & Quillman of Norristown have been awarded the contract for wiring the County Home.

READING, PA.—Excavations have been finished and all materials have been received for the construction of the new hydroelectric plant at Klappertal, on the Schuylkill River, a few miles below Reading. Construction work is now under way, and it is expected that the plant will be ready for operation soon.

READING, PA.—The Metropolitan Electric Company has completed plans for the erection of another substation of 13,000 volts capacity in the vicinity of Sixth and Bern Streets, in the northern section of Reading. The new substation will be the fourth in the vicinity of the city to be erected within a very short time.

ST. MARYS, PA.—Work has begun on the erection of an addition, 85 ft. by 90 ft., to the local plant of the Novelty Incandescent Lamp Company of Emporium, to cost about \$10,000.

SOUTH WAVERLY, PA.—The Borough Council has awarded a five-year street-lighting contract to the Sayre Electric Company, covering 80-cp. lamps. The company has heretofore been furnishing service to the town.

TREXLETTOWN, PA.—The Trexleltown & Fogelsville Electric Light Company is erecting an electric transmission line between Fogelsville and Trexleltown and Breiningsville. Energy will be secured from Reading.

WAYNESBORO, PA.—The Waynesboro Electric Light & Power Company has completed a new electric transmission line from Pan Mar to Highfield.

BALTIMORE, MD.—Plans have been prepared for the erection of a new power plant at the proposed new factory of the Maryland Chemical Company, to cost about \$30,000.

BALTIMORE, MD.—The Homewood Amusement Company is planning to build an ice skating rink with 22 bowling alleys underneath; about 170 ft. by 65 ft., skating surface. An ice plant, heating and electrical machinery will be installed. E. C. Sandell, 3901 Brookline Avenue, is manager. Blanke & Zink, 835 Equitable Building, Baltimore, are architects.

CHARLESTON, W. VA.—A petition has been presented to the City Council by the citizens of the West Side requesting that an arc light be installed at Charleston Street and Delaware Avenue.

MORGANTOWN, W. VA.—The West Virginia Traction & Electric Company is considering erecting a new 13,000-volt transmission line (11 miles long) to furnish energy in the Morgantown coal districts.

ASHLAND, VA.—The City Council is planning to install an ornamental lighting system, consisting of 38 standards. The amount available for the work is \$15,324.

NEWPORT NEWS, VA.—The Newport News & Hampton Railway, Gas & Electric Company has filed a notice of increase in its capitalization from \$2,375,000 to \$4,000,000 to provide for extensions and improvements. J. N. Shannahan, general manager.

SPRINGWOOD, VA.—Plans are being considered by Jasper Miller of Charlotte, N. C., for a water power development to furnish electricity for a proposed cotton mill.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Portsmouth, N. H., Schedule 1454—200 ft. leaded and armored conductor cable, 4150 ft. buoy marker 4-conductor cable, 800 ft. 3-conductor portable cable, miscellaneous leaded and armored interior communication cable, 8150 ft. lighting and power portable, double conductor wire, miscellaneous leaded and armored twin lighting and power wire, 1500 ft. plain single lighting and power wire, miscellaneous single, leaded and armored lighting and power wire. Brooklyn, N. Y., Schedule 1454—18,500 ft. 14-22-26 conductor, interior communication cable, 39,700 ft. leaded and armored telephone cable, 1,600,000 ft. plain flexible double conductor wire, 18,000 ft. plain single conductor wire; Schedule 1453—15,000 ft. new code twin lamp cord, 16,000 ft. rubber covered wire for 600 volts and less, 8000 lb. weatherproof wire on reels. Application for proposal blanks should designate the schedule desired by number.

North Central States

ALMA, MICH.—The Central Michigan Light & Power Company is erecting a new power plant on the Pine River at Alma. The building is to be 60 ft. by 80 ft. Two turbines will be installed. The cost of the plant is estimated at \$250,000.

LAKEVIEW, MICH.—Electricity generated at the hydroelectric plant at Morley will soon be distributed in Lakeview by the Universal Power Company.

ROGERS, MICH.—A new water system is being planned for the power plant of the Rogers City Light & Power Company. H. M. Stark of Detroit is engineer.

UBLY, MICH.—The contract for the construction of the new water power and lighting plant has been awarded to Joseph Donaldson. The building will be 34 ft. by 40 ft.

VASSAR, MICH.—A 75-hp. engine is being installed in the municipal electric-light and water-works plant.

WOODLAND, MICH.—At an election to be held Sept. 11 the proposal to grant the Thornapple Gas & Electric Company of Hastings a franchise to supply electricity in Woodland will be submitted to the voters. Gas is now used.

CINCINNATI, OHIO.—The Union Gas & Electric Company has secured the contract for installing boulevard lamps on Central Avenue and Third Street. The specifications call for 87 lamps on Central Avenue and 12 on Third Street.

CLEVELAND, OHIO.—The Cleveland Switchboard Company is planning to erect a new factory, 80 ft. by 140 ft., at 2925 East Seventy-ninth Street.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until Sept. 14 for switchboard, oil switches and reactors for the division of light and heat. Specifications may be obtained at the office of the division of light and heat.

MASSILLON, OHIO.—Work will commence shortly on the installation of the new lighting system in the residential section of the city, according to reports.

FLEMING, KY.—The Cornettsville Coal Company is contemplating the construction of a new power plant. J. W. Montgomery is president.

PADUCAH, KY.—The City Commissioners have instructed John K. Hendrick to prepare an ordinance submitting to the voters a bond issue for the enlargement of the municipal electric light plant. The commissioners propose to enlarge and equip the plant so that electricity can be supplied for all purposes.

WHITESBURG, KY.—W. C. Daniels of Monica is contemplating building a new power plant in East End, Whitesburg, to cost about \$25,000.

ELWOOD, IND.—The Indiana General Service Electric Company, which furnishes electrical service in Elwood, Muncie, Marion, Alexandria and Hartford City, has filed a petition with the Public Service Commission asking permission to purchase the property of the Marion (Ind.) Heat & Light Company and the Muncie (Ind.) Heat & Light Company and to consolidate them with the Elwood Company.

INDIANAPOLIS, IND.—Contracts have been awarded by the Pennsylvania Railroad Company for the construction of new reinforced concrete shops at its Irvington works, near Indianapolis. The buildings will include a 30-stall roundhouse, machine and repair shops and power plant.

MONGO, IND.—The Farmers & Merchants' Light & Power Company, recently incorporated with a capital stock of \$500,000, contemplates the installation of electric power plants in Northern Indiana and Southern Michigan. It is proposed to erect the largest plant on the St. Joe River, near Colon, Mich. J. L. Hawk is president and Eli Z. Hawk secretary and treasurer, both of Mongo.

DE KALB, ILL.—An investigation of De Kalb's street lighting is being made. The old lamps now in use here will be sold, and it is probable that a new system will be put in at a later date.

KOHLER, WIS.—Contract has been let to the Kelly Construction Company, Eau Claire, for the installation of an ornamental lighting system to cost \$5,886.

MADISON, WIS.—The City Council has authorized the Wisconsin Telephone Company to lay underground conduits on University Avenue and Brook Street.

MILWAUKEE, WIS.—The bond issue of \$750,000 for electric light bonds has been approved by Charles B. Wood, Chicago, for additions to the Blue Mound sanitarium.

SHERBOYGAN, WIS.—The Eastern Wisconsin Electric Company has awarded the contract for the construction of a new power station, 60 ft. by 90 ft., to the Northwestern Bridge & Iron Company of Milwaukee. The proposed plant will have a generating capacity of 6000 kw. The Fargo Engineering Company of Jackson, Mich., is consulting engineer.

NEW ULM, MINN.—Bids will be received at the office of the city clerk, New Ulm, until Sept. 27, for furnishing and installing a deep-well pump-head starting apparatus, including electrical equipment, and laying approximately 440 ft. of water mains. Specifications may be obtained upon application to A. J. Mueller, superintendent of electric light and water works department.

ST. CLOUD, MINN.—At a special election held in the village of Albany it was voted to sell the municipal electric light and power plant to the Union Light & Power Company of St. Cloud for \$12,000.

WALKER, MINN.—The Village Council has passed an ordinance granting a franchise to M. D. Stoner and T. H. Crosswell to erect and maintain an electric-light and power plant in the village of Walker for a period of 15 years, subject to the approval of the voters.

WORTHINGTON, MINN.—Orders have been placed for two new high-pressure boilers for the municipal electric power plant. Work on the new plant will begin in the fall.

DUBUQUE, IOWA.—The Eastern Iowa Electric Company has petitioned the Board of Supervisors for a franchise to build

transmission lines from Dubuque to Dyersville, New Wine, Luxemburg and Holy Cross.

READLYN, IOWA.—A franchise has been granted to Tegtmeyer Brothers for an electric light and power plant.

WEST UNION, IOWA.—A meeting of the Board of Supervisors will be held Sept. 11 to consider granting a franchise to C. Miller & Sons for an electric lighting plant. Theo. Miehe, chairman.

PARKVILLE, MO.—Bids are being asked (date of closing not decided) by the president of Park College, Parkville, for the construction of a new power house. Smith, Rea & Lovitt, Finance Building, Kansas City, are architects.

STANLEY, N. D.—Plans are being prepared by the Stanley Electric Lighting Company for the construction of a new power house. R. F. Wherland is manager.

UNDERWOOD, N. D.—Preparations are being made by the Central Power Company for the construction of a new power plant at Bitumina and the erection of an electric transmission line from Underwood to Turtle Lake. The company will supply electricity to a number of towns in McLean and adjoining counties.

DUNBAR, NEB.—The city is to vote on a bond issue of \$7,500 for an electric lighting plant.

OMAHA, NEB.—The power plant of the Ideal Pleating Company in the Brown block, at Sixteenth and Douglas Streets, was destroyed by fire. The loss is estimated to be \$1,500.

YORK, NEB.—The contract for electric wiring of the new high school has been awarded to the Public Service Company of York, at \$3,450.

CONCORDIA, KAN.—Bids will be received by the Board of Education until Sept. 11 (extension of date) for the construction of a high school, to cost from \$55,000 to \$60,000. Separate bids to be submitted for electric wiring, heating and plumbing. W. E. Hulse & Company, First National Bank Building, Hutchinson, are architects.

LEEDS, KAN.—Preparations are being made for the installation of an engine and generator, directly connected, at the municipal farm, for which bids have been received.

Southern States

HARLEM, GA.—J. J. Zachry is contemplating rebuilding lumber mill and electric-light plant recently destroyed by fire.

JACKSONVILLE, FLA.—Preparations are being made by the City Commission to extend the municipal electric-lighting service to South Jacksonville for use of the government shipyards. It is proposed to erect a 6600-volt cable from the substation to the Hillver-Snerring-Dunn Company's plant on South Side, now under government control.

ALBANY, ALA.—Improvements to cost \$10,000 are being made here on the power house of the Alabama Power Company. A new Corliss engine is being installed and a new generator. The capacity will be increased 40 per cent.

GADSDEN, ALA.—The Alabama Power Company will furnish the power for operating Gadsden's municipal plant.

GADSDEN, ALA.—Arrangements are being made by the city of Gadsden to equip the pumping station of the water-works system for electrical operation. The equipment will include a 2100-gal. per minute pump; two 1750-gal. per minute pumps for filling reservoir; also 200-hp., 150-hp., two 40-hp. and 10-hp. motors. Bids have been asked for installing machinery. The city will maintain an auxiliary steam plant. Ernest Smith is city engineer.

MOBILE, ALA.—The Mobile Electric Company, it is reported, is contemplating extension to its electric transmission system, to cost about \$20,000, in the Pinto and Blakely Islands district.

GREENWOOD, MISS.—The Yazoo & Mississippi Valley Railroad Company, it is reported, is planning to build a new power house, 26 ft. by 54 ft.

DE RIDDER, LA.—T. S. Reed of Beaumont and others are considering rebuilding the local electric-light plant, recently destroyed by fire, causing a loss of about \$15,000.

SENTINEL, OKLA.—At an election held recently the proposal to issue \$5,000 in bonds for the installation of an electric-light plant was carried.

BIG LAKE, TEX.—Henry Japson has purchased the Big Lake Townsite, and it is reported will construct a water-works system, electric-light plant and make other municipal improvements to the town.

DALLAS, TEX.—The Western Union Telegraph Company and the Mackay Telegraph Cable Company are planning to place their wires in underground conduits in the business district.

DALLAS, TEX.—The City Commission has under consideration a plan for an entirely new system for lighting the streets of the city which provides for the erection of hundreds of electric lamps in different sections of the city now without street-lighting service. The street-lighting system, it is said, will be operated under a meter system when the new franchises are accepted.

SINTON, TEX.—The municipal electric-light plant, which was recently destroyed by fire, will be rebuilt. New equipment, including a new engine, generator and other equipment, will be installed.

Pacific and Mountain States

EVERETT, WASH.—The City Commissioners have closed a deal for 100 acres at the Horseshoe Bend in the Sultan River, which includes about 1 mile of river bank, for a power site.

GOLDENDALE, WASH.—The Pacific Power & Light Company has filed a petition with the Board of County Commissioners of Klickitat County asking for a franchise to construct, reconstruct, maintain and operate transmission and distributing lines for transmitting electricity for light, power and other purposes for a period of fifty years on certain county roads, streets and public highways in Klickitat. Roy E. Crooks, County Auditor.

INDEX, WASH.—Preliminary work has been started on the construction of a municipal light plant for the city of Index, Wash. Bids will be received shortly for furnishing pipe for the system. G. N. Miller, engineer.

PASCO, WASH.—The Pacific Power & Light Company at Pasco will build a new central switching station for a 66,000-volt system which will be installed in Pasco. The building and equipment will be erected about two blocks east of the municipal docks at an estimated cost of \$100,000.

SEATTLE, WASH.—The Electric Sales Corporation has recently closed a contract for the installation of the Apfel electric heating system in the new Paul (Idaho) High School.

SEATTLE, WASH.—Bids will be received by C. B. Bagley, secretary of board of public works, Seattle, until Sept. 28 for furnishing air brakes, including safety control and electrical equipment, for single-truck, double and safety motor cars for division "A" of the Seattle municipal street railway.

SEATTLE, WASH.—The City Council has granted an extension of time for submitting proposals for the proposed hydroelectric plant until Oct. 5. This action was taken owing to the present uncertain bond market condition. Bids are to be submitted to C. B. Bagley, chairman of board of public works.

SEATTLE, WASH.—Plans are being considered by the Puget Sound Traction, Light & Power Company for changes in its steam heating plant at Western Avenue and Union Street and in its steam-driven power plant at Georgetown, involving an expenditure of between \$400,000 and \$500,000. At the Georgetown plant it is proposed to install automatic starters, at a cost of between \$200,000 and \$250,000, to provide for burning coal instead of oil. Improvements similar to those proposed for the Georgetown plant will be made to the Western Avenue power station. Plans have been started, it is reported, for the construction of a five-story addition to the Western Avenue power plant, which will house a coal pulverizing plant to cost about \$50,000. These changes are due to the shortage in fuel oil.

SEDRO WOOLLEY, WASH.—Contract for the construction of a power house at the state insane asylum was awarded to the Warrack Construction Company, Seattle, at \$24,200. The improvement will include the construction of a 140-ft. concrete smoke-stack. George W. Lawton prepared the plans.

SPOKANE, WASH.—The contract for electrical work for the new theater to be erected by Alexander Pantogios at a cost of \$150,000 has been awarded to Ne Page McKinney Company of Seattle.

SUNNYSIDE, WASH.—The City Council has passed an ordinance granting to the City Telephone Company a franchise to do general telephone business in the town of Sunnyside.

TACOMA, WASH.—The County Commissioners have granted the Puget Sound Traction, Light & Power Company a 25-year franchise to operate electric transmission lines between Tacoma and Tapps.

TACOMA, WASH.—The city of Tacoma has filed a claim for 600 cu. ft. of water per second on the Nisqually River and on Mineral Creek, and also a claim for the use of Mineral Lake for storage purposes. The claim was filed with the ultimate purpose of constructing an auxiliary electric generating station to duplicate the present plant at La Grande at a selected site on the upper Nisqually River, about 5 miles above Elbe. The City Council will be asked to appropriate a sum sufficient to divert the water from Mineral Lake into the Nisqually River in order that the plant at La Grande may handle a peak load during low water periods. The Council also has another plan under consideration for diverting sufficient water from the Nisqually River to establish a reservoir at another point and provide for the construction of an additional power plant having a capacity equal to the present municipal plant.

BEND, ORE.—The Bend Water, Light & Power Company is installing new equipment, which will increase the output of its plant by 500 kw.

FRESNO, CAL.—A. G. Wishon, general manager of the San Joaquin Light & Power Company, reports that two new hydroelectric plants on the Kern River will be placed in operation within the next thirty days.

FRESNO, CAL.—The San Joaquin Light & Power Company is planning to erect 15 miles of new lines in the Chowchilla district this fall. The company will furnish power for the Swift property and on the land of the Howard Cattle Company.

FRESNO, CAL.—The San Joaquin Light & Power Corporation has filed an application with the Railroad Commission for authority to issue \$750,000 first and refunding 6 per cent bonds. The proceeds from the sale of the bonds are to be used for additions and improvements to its system.

GRASS VALLEY, CAL.—Walter W. Bryne has completed arrangements for work at the Franklin and Ford properties, adjoining the Allison Ranch. Orders have been placed for an electric pump, a 75-hp. hoist and a ten-drill compressor.

LOS ANGELES, CAL.—The Hill Street Improvement Association is considering installing an ornamental lighting system on that thoroughfare similar to the one which will be constructed on Broadway.

REDWOOD CITY, CAL.—The Pacific Gas & Electric Co. has just been awarded the contract for furnishing Camp Fremont with electricity. The contract calls for the installation of nearly 20,000 lamps. The company has already started work at the camp, and substations are being built, rights-of-way established and the poles erected.

SAUSALITO, CAL.—An ordinance was passed granting the Pacific Telephone & Telegraph Company the right to place, erect and maintain poles, wires and other appliances and conductors for wires for transmission of electricity for telephone and telegraph purposes in and under streets, alleys, avenues, thoroughfares and public highways in Sausalito, Cal.

VALLEJO, CAL.—The Pacific Gas & Electric Company will soon file bond for \$15,000 for the privilege of operating within the city of Vallejo.

BOISE, IDAHO.—The Idaho Power Company contemplates the installation of six new units at the Swan Falls plant on the Snake River, near Cuffey. The proposed extensions will develop about 8000 hp. and will cost about \$500,000.

OGDEN, UTAH.—Lightning struck the Utah Power & Light Company's plant on Twelfth Street. One of the large generators was so badly burned that it will have to be replaced, according to reports.

BIG TIMBER, MONT.—The City Council has passed a resolution providing for the establishment of a lighting district that embraces the entire town, for the installation of a new street-lighting system subject to the approval of the taxpayers. The plans provide for the installation of 32 single post lamps of 250 cp., and for 41 lamps of 250 cp., to be erected in the residential district. The cost of the system is estimated at \$5,300.

HARLOWTON, MONT.—Arrangements are being made for the installation of an ornamental lighting system in Harlowton, for which bids have been received.

MALTA, MONT.—The Town Council has passed an ordinance creating three special improvement districts for the installation of a street-lighting system. The cost is estimated at about \$15,000.

TROY, MONT.—Electrically operated machinery, it is reported, will be installed in the mines of the Big 8 line on Callahan Creek near Troy. Energy will be secured from the plant of the Snowstorm Consolidated Company. Harry L. Day of Wallace, Idaho, has charge of the development work on the Big 8 line.

LUSK, WYO.—Bids will be received until Sept. 10 for machinery, materials, etc., for improvements to the municipal electric-light plant as follows: One 100-hp. oil engine, with piping, water-cooling apparatus and starting equipment; one 60-kva., three-phase, 60-cycle, 2300-volt generator, directly connected to engine; one 20-hp., three-phase, 60-cycle, 2300-volt alternating-current motor with compensator. For details see Searchlight Section.

DENVER, COL.—Plans are being considered for installing an ornamental lighting system on Lake Place from the Fourteenth Street viaduct to Federal Boulevard and West Thirty-third Avenue and from the Twentieth Street viaduct to the boulevard.

ROCHESTER, NEV.—It is reported that the Nevada Valleys Power Company is constructing a power line through Humboldt and Lander Counties to connect with the line at Rochester. A line is to be extended to Golconda and from there to Winnemucca and into Grass Valley.

Canada

NELSON, B. C.—The Granite-Poorman Mining Company is planning to install a new compressor plant with a capacity of 1500 cu. ft., and a 300-hp. electric motor. The present plant has an output of 100 hp. Energy is secured from the municipal electric power plant of Nelson.

VANCOUVER, B. C.—The Whalen Pulp & Paper Company is preparing to construct a shipbuilding plant. The plans for the proposed power plant provide for a 7000-kw. and a 750-kw. generating unit.

LONDON, ONT.—John A. Moody of London is reported to be in the market for a 50-in. water wheel and a Fitzgibbon marine boiler.

SMITH'S FALLS, ONT.—The by-law authorizing an appropriation of \$135,000 to purchase the plants of the Smith's Falls Electric Power Company and the Citizens' Electric Power Company and also a by-law authorizing the purchase of electricity from the Hydro-Electric Power Commission of Ontario were approved by the ratepayers at a recent election.

TORONTO, ONT.—The plant of the Polson Iron Works was damaged by an electric storm recently, causing a loss of about \$10,000. Two large electric cranes were destroyed, one falling against a 125-ft. steel stack, demolishing it completely. Considerable damage was also done to the machine shop.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Washington, D. C., until Sept. 10 for furnishing steel cable, phosphor-bronze rope, sheet copper, cable clips, insulating paper, etc. Blanks and further information relating to this circular (No. 1162) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York City; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

PANAMA.—Bids will be received at the office of the general purchasing agent, the Panama Canal, Washington, D. C., until Sept. 17 for furnishing steel wrought-iron or steel pipe, chain, pumps, jacks, wire, electric cable and wire, conduit, condulets and covers, gaskets, electrical fittings, trunking and capping, etc. Blanks and information relating to this circular (No. 1165) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York City; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

MADURA, INDIA.—Plans are under consideration for the erection of an electric lighting plant capable of providing 5000 private lamps, 700 public lamps and 1000 fans in Madura, India.

1,238,124. **ELECTRIC HEATING UNIT**; Royal E. Frickey, Redding, Cal. App. filed Feb. 26, 1916. Low-temperature gradient between the heating element and the fluid to be heated, and also to provide a heating element which is protected from oxidation.

1,238,145. **ELECTRICAL REGULATING DEVICE**; Gottlob Honold and Heinrich Conzelmann, Stuttgart, Germany. App. filed Sept. 24, 1914. Excitation of the dynamo is decreased to abnormally low value before the voltage of the dynamo can increase to such a value as may burn out the circuits or the lamps in the power system.

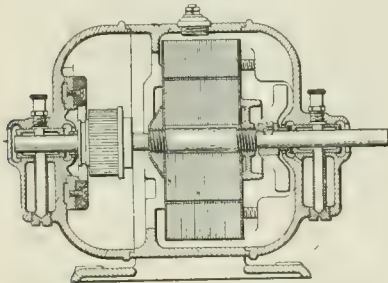
1,238,155. **DIMMING SWITCH FOR PROJECTION LAMPS**; Karl Kleinert, Stuttgart, Germany. App. filed Aug. 2, 1915. Improvements.

1,238,206. **WELDING APPARATUS**; Edward A. Shuler, Chicago, Ill. App. filed July 13, 1916. Portable apparatus for welding nails or the like to the side sheets of steel cars for securing insulation in place.

1,238,213. **ELECTRIC GENERATOR AND MOTOR**; Harve R. Stuart, Springfield, Ohio. App. filed April 22, 1914. Production of an electric generator or motor in which the magnetic lines of the field magnets are increased in the outside portions of the pole pieces and decreased in the central portion of the pole pieces so as to hold the magnetic center stationary or uniform and prevent the shifting of the axle of commutation.

1,238,243. **FIELD-COIL SUPPORT**; John L. McK. Yardley, Pittsburgh, Pa. App. filed Oct. 17, 1912. Supporting structure for field coils of machines of the interpole type.

1,238,250. **ELECTRICAL APPLIANCE**; Carl H. Bissell, Syracuse, N. Y. App. filed May 28, 1914. Arranged in an electric circuit for supporting and establishing electrical contact with an incandescent lamp.



1,238,290—Universal Motor

1,238,251. **ELECTRICAL PROTECTIVE DEVICE**; Harold W. Brown, Ithaca, N. Y. App. filed Dec. 19, 1913. Provides a relay which will operate at a predetermined volt-ampere load.

1,238,261. **SWITCH**; John F. Cavanagh, Meriden, Conn. App. filed Dec. 1, 1916. For controlling the circuits of an automobile, such as the signal and lighting circuits.

1,238,277. **ARC LAMP**; John L. Dinsmoor, Brooklyn, N. Y. App. filed April 24, 1913. For substantially eliminating or neutralizing the disturbing magnetic fields in the vicinity of the arcs.

1,238,280. **COIL SUPPORT**; Allan B. Field, Pittsburgh, Pa. App. filed Aug. 2, 1913. Provides a supporting and spacing member adapted for disposal intermediate to the layers of coils and having a plurality of projecting ribs oppositely inclined on opposite sides of the said member for engaging and spacing the several coils in the said layers.

1,238,290. **UNIVERSAL MOTOR**; Allen McR. Harrelson, St. Louis, Mo. App. filed July 8, 1915. Constitutes a motor which will be universal in the sense used in this specification at the lower and more practicable speeds of 100 to 1800 r.p.m.

1,238,292. **VENTILATING CONSTRUCTION FOR DYNAMO-ELECTRIC MACHINES**; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Aug. 6, 1915. Improves the efficiency of ventilating devices and prevents the entrance of water or other foreign substances through the ventilating openings.

1,238,304. **DYNAMO-ELECTRIC MACHINE**; Jan A. Kuyser, Edgewood, Pa. App. filed March 3, 1914. Provides a single short-circuited damping grid, co-operating both with the rotor core proper, with the usual damper bars and with the coil-retaining end rings.

1,238,311. **CONTACT**; Alexander J. Loguin, Norwood, Ohio. App. filed Nov. 29, 1911. Contacts may be so located and arranged that they may be readily inspected and removed without the use of tools.

Record of Electrical Patents

Notes on United States Patents issued on August 28, 1917

1,238,313. **POLYPHASE ELECTROMAGNET BRAKE CONTROL**; Benjamin McInnerney, Council Bluffs, Iowa. App. filed April 21, 1917. Provides an alternating-current magnet having an armature that is positively pivoted and is firmly seated in the same position relatively to the pole pieces in successive operations.

1,238,321. **ROTOR WINDING FOR ASYNCHRONOUS MACHINES**; Stanley G. Nottage, Wilkesburg, Pa. App. filed July 14, 1915. Special reference to rotor windings for phase converters such as are employed for converting single-phase alternating-current energy into polyphase energy for the purpose of supplying polyphase electric motors.

1,238,323. **SIGNAL MECHANISM**; Paul E. Oswald, Los Angeles, Cal. App. filed Aug. 4, 1913. Warnings at railway crossings or other dangerous places.

1,238,336. **SWITCHING APPARATUS**; Clarence Renshaw, Edgewood Park, Pa. App. filed Oct. 31, 1913. Relates to switching apparatus of the group switch type, and it has special reference to the supporting structure thereof.

1,238,339. **ART OF PRODUCING AND TREATING HYDROCARBON VAPORS DURING THE DISTILLATION OF THE SAME**; James H. Robertson, New York, N. Y. App. filed April 25, 1916. Causes electricity to pass through the confined volumes of such gases, thereby obtaining results which have been found impossible in the practice of well-known methods or processes.

1,238,345. **MAGNETIC LATCH DEVICE**; Frank A. Schoenle, Buffalo, N. Y. App. filed Nov. 25, 1916. Improvements.

1,238,382. **ELECTRIC SWITCH**; Graham Bidle, Oakland, Cal. App. filed Jan. 10, 1916. Provides an electric switch of the make-and-break operating type, wherein the same may be worked by the ordinary push-button, without the snap or noise that is characteristic of the snap switches now used.

1,238,383. **CONDUIT-JOINT WRAPPER**; Maurice Blumenthal, Brooklyn, N. Y. App. filed Dec. 14, 1915. Absolutely waterproof and acid-proof.

1,238,406. **ARC WELDER**; Albert H. Homrighaus, Detroit, Mich. App. filed Feb. 26, 1915. Relates to mechanism for economically controlling power consumption in the use of electric current.

1,238,443. **RECTIFIER**; Henry K. Sandell, Chicago, Ill. App. filed May 1, 1914. Improvement.

1,238,459. **ATTACHMENT PLUG**; William C. Tregoning, Cleveland, Ohio. App. filed Oct. 2, 1914. Comprises a limited number of elements which have certain original features of construction and together constitute a new and useful article of manufacture for making an electrical connection.

1,238,460. **ATTACHMENT PLUG FOR ELECTRIC WIRES**; William C. Tregoning, Cleveland, Ohio. App. filed Oct. 10, 1914. Provides a plug having means to relieve the terminals for the electric wires of pull and strain, said means being mounted on the base of the plug and located within its interior in a concealed and protected position behind the screw shell.

1,238,477. **SWITCH-CONTAINING ELECTRIC-LAMP SOCKET**; Ernst G. K. Anderson, Chicago, Ill. App. filed Oct. 17, 1912. Improvements.

1,238,482. **THIEF-PROOF LAMP-HOLDING DEVICE**; Reuben B. Benjamin, Chicago, Ill. App. filed Aug. 22, 1912. Improvements.

1,238,516. **MOTOR CONTROLLER**; Clark T. Henderson and Herbert J. Harris, Milwaukee, Wis. App. filed Nov. 2, 1914. For shunt motors.

1,238,529. **BATTERY**; Nicolas Kribs, Dundee, Ill. App. filed July 28, 1916. Dry-cell type.

1,238,532. **PORTABLE BURGLAR ALARM**; Leon Lemberg, Brooklyn, N. Y. App. filed July 22, 1916. Improved.

1,238,540. **THREE-WAY PULL-CHAIN SOCKET**; John F. McCarthy, New York, N. Y. App. filed Dec. 29, 1916. Improved.

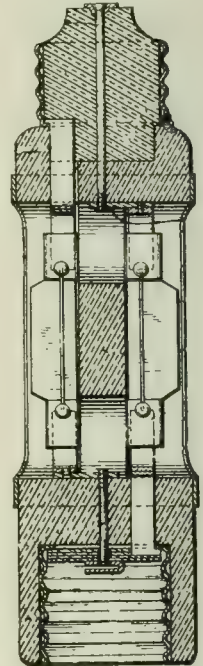
1,238,573. **ELECTRICAL SYSTEM**; Norman F. Rutherford, East Falmouth, Mass. App. filed April 11, 1916. Wherein a group or groups of elements may be changed from one circuit arrangement to another, each arrangement having any desired number of elements in series and parallel respectively, and preferably wherein each combination is rectangular, that is, so connected as to have the same number of elements in each series sub-group.

1,238,597. **ELECTRIC SWITCH**; John M. Terzich, Amador City, Cal. App. filed May 26, 1916. Provides a switch having an effective means for establishing good connection between blade and mounting.

1,238,600. **PROCESS OF PRODUCING ALKALIS FROM KELP**; Harlan L. Trumbull, Seattle, Wash. App. filed March 22, 1917. Furnishes compounds of potassium more valuable than those commonly derived from kelp.

1,238,628. **STOP MOTION FOR LOOMS**; George N. Bertrand, Stafford Springs, Conn. App. filed Oct. 12, 1914. Provides a simply constructed device adapted to close automatically an electric circuit and stop the loom, should breakage of one or more of the heddle frames or horizontal supports occur.

1,238,638. **DIRECTION INDICATOR**; Melvin Colby, Springdale, Wis. App. filed July 7, 1916. Automobile.



1,238,690—Fuse Plug

1,238,660. **ELECTRIC DISCHARGE APPARATUS**; Crosby Field-Frank, New York, N. Y. App. filed Jan. 27, 1916. Provides a simple and durable electric discharge device which will permit a very free discharge of electricity as long as the difference of potential between the terminals of the device is excessive, but will interrupt the discharge the instant the difference of potential becomes normal.

1,238,667. **ELECTRIC-CIRCUIT CONTROLLER**; Edward A. Halbleib and Thomas L. Lee, Rochester, N. Y. App. filed June 26, 1915. Improvements.

1,238,671. **ELECTRICALLY HEATED SOLDERING TOOL**; Lafayette Holcomb, Las Vegas, Nev. App. filed May 2, 1917. Provides a metallic soldering brush by which solder is applied as desired, and which may be detachably mounted in communication with the soldering receptacle.

1,238,684. **ELECTRICAL LAMP LOCK**; William C. Kerch, Mill Valley, Cal. App. filed July 24, 1916. Improvement.

1,238,690. **FUSE PLUG**; Edward D. Knott, New Orleans, La. App. filed Dec. 9, 1916. Improvements.

1,238,719. **ELECTROMAGNETIC SWITCH**; Burton W. Sweet and Franklin Schneider, Cleveland, Ohio. App. filed Aug. 30, 1911. Improvements.

1,238,727. **ELECTRIC HEATER**; Frank W. Hewitt, Arlington, Mass. App. filed May 27, 1916. Element is practically surrounded closely on all sides by heat-conducting material.

1,238,728. **COMBINED LIGHTNING ARRESTER AND THERMAL PROTECTOR**; Frederick R. Parker, Chicago, Ill. App. filed Jan. 19, 1917. Improved.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN

Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, SEPTEMBER 15, 1917

No. 11

Street-Lighting Poles and Fixtures

THE article by James R. Cravath printed this week concerns a subject where common sense and an appreciation of the fitness of things are peculiarly valuable. It takes up the very practical question of the poles and fixtures for street lighting in small places. As a rule sins against good taste are more common in such communities than in large cities, where, if the equipment is not artistic, it is at least in the main inoffensive. The prevailing vice of small and growing municipalities is a cheap attempt at distinguished magnificence. There are plenty of places where a bronze standard of highly decorative design bearing a group of graceful fixtures is both appropriate and artistically desirable. An imitation of the same thing in painted concrete, installed on a boulevard where razor-back hogs may still be seen running in the gutters, is humorous instead of impressive. To those who have a keen appreciation of the fitness of things Mr. Cravath's good advice will be singularly welcome. The mere statement that when street lamps are supplied with energy from overhead circuits it is useless to make the lamp-supporting poles more expensive and ornamental than the line poles on the same street covers the esthetic principles of the situation.

Wood, steel and concrete all have their places in carrying poles for electric lamps. All of these can be made neat and comparatively inexpensive, and if properly designed a certain ornamental value can be given to them. For most situations, in fact, inconspicuousness is the chief merit, whether for poles carrying lamps or those carrying wires only. In places suitable for decorative effects by day as well as by night the ornamental forms of lamp support may be desirable and justified by the conditions. The center suspended lamp or, more broadly, a lamp placed far out in the street is always a puzzle from the artistic viewpoint. Short brackets, up to 6 feet or 8 feet (1.8 m. or 2.4 m.), if the lamps are carried rather high, can be made of graceful design. When, however, it comes to reaching the center of a 40-foot (12.2-m.) street the trouble begins. Mr. Cravath's suggestion of steel poles set in concrete with a slight rake and pulled up true by the span wire is an extremely good one, particularly in these days of big gas-filled units of which the hanging weight is not considerable. About the only other refuge in such cases is the long mast arm, always ugly in itself, but sometimes comparatively inoffensive when carried well up so as to show only against the foliage of the trees which compel its use, and painted so as to be inconspicuous. The common sense of Mr. Cravath's advice should appeal to every one who has to deal with the problem.

Effect of the War on Industrial Research

IT IS curious to notice the profound but varied influences which the war exerts upon industrial researches in different places. Industrial laboratories which have regularly conducted researches have been sadly depleted by the demand for armies and for army munition makers of all kinds. Consequently many industrial researches have had to be postponed on account of the war. However, interference with normal trade relations and the interruption of certain necessary supplies have served to stimulate industrial research in all the allied countries. The war has demonstrated to a vast number of industries that had previously remained content to distribute merely and to let some one else do the investigating the necessity of maintaining researches. It is likely that this salutary lesson will make an indelible impression on many industries, so that in future those affected will be likely to keep up with the front ranks of progress by independent pioneer efforts. Consequently, the war has developed, or at least initiated, a number of new lines of industrial research.

Moreover, the conduct of the war itself is demanding an abnormally and incredibly large amount of technical investigation and research. Military men say that the mode of fighting which was correct three years ago is now as extinct as the dodo in the military schools. A large amount of the change is the result of experience under the guidance of military industrial research.

It is interesting to note that, according to our information, the American Institute of Electrical Engineers intends to devote a meeting before long to the subject of industrial research. The discussion at that meeting should elicit more than usual interest at this stage of the world struggle between autocracy and democracy, because the issue in the struggle largely depends upon the relative effectiveness of co-operative effort, including industrial research, which the two opposing systems of conducting community life can maintain.

Coal Conservation

THE time has come when all electric supply stations must take counsel with themselves as to ways and means of keeping down the increasing cost of coal. Just how serious the situation may become cannot now be told, particularly since the government is not yet in position to act with full knowledge on matters of mining costs and transportation. Very much, however, in the way of remedial measures lies within the reach of the stations themselves. We are confronted not only with a shortage of transportation that means, aside from all other factors, increase of cost, but also with

important changes in the nature of the commercial demand for fuel. The navy, and vessels in government service generally, will demand exceptionally large quantities of high-grade fuel. At whatever cost the fighting ships must be kept tuned up to the highest point of efficiency, particularly in view of the possible raids more than hinted at by Admiral Jellicoe. On high-grade steam coal, therefore, the government has the call, morally and legally. Moreover, for oil-burning craft there will be required a great extra quantity of oil which will inevitably disturb the economic balance existing between coal and oil. Putting it broadly, there will be a shortage of high-grade fuel which will necessarily work some hardship and is already doing so. As for means of relief, they must be sought in each individual case, in general by endeavoring to work out a change in fuel so that the demand for fuel of various grades may be more nearly equalized.

From time to time for some years past we have hammered away at the specialization of boiler-room equipment for dealing with low-grade coals. It is a well-known fact that the utilization of the poorer fuels requires a special study of furnace design and operation in order to make the best of them. Sometimes it is a matter of radical change of equipment, which may be well worth while if we must look forward to a long period of disturbed conditions, sometimes only minor rearrangements, or in hand-fired furnaces special instruction of the fireman. But it is evidently necessary that preparations should be made for economy's sake, so that all things burnable may be efficiently utilized. The long and short of it is that we cannot count on getting the customary grades of steam coal in adequate amounts, and must perforce turn attention to burning what can be had. Whether the government will pursue the British plan of saving in transportation by deflecting the output of certain coal areas into specific regions cannot now be told. If it should do so, the limitations of fuel would become at once apparent, and it would be much easier to take account of them. It would be the part of wisdom as things now are to assume that the equivalent of such a step is the natural outcome of the situation. The main point is that it is up to all operating engineers to get busy and see what they can do with somewhat unwonted fuels which offer the chance of economy.

It is an unpleasant situation, yet it may yield large results in the future and will tend greatly to conserve the general fuel supply when the stress is relieved. During the great coal strike some years ago householders learned that heating apparatus could be run successfully on fuels that it had never before entered their minds to use, and one of the technical outcomes was a study of the smokeless combustion of soft coals which ultimately was of considerable use. Just such a sort of evolution has got to take place in the central station's method of making steam, and the sooner all hands get at it the less trouble will be caused. Further, whatever the fuel, it is going to be relatively high in price, and every coal-saving economy known to the art should be played for all it is worth, with a rigor never before so absolutely necessary. Special efforts should be made to keep ma-

chines running at their maximum efficiency and boilers worked at their most economical point. While this is supposed to be generally done, there are many plants in which a little extra care and tact in load distribution would make a material daily saving in fuel. Particular discretion, too, should be used in taking on load so as to keep the load factor at the highest possible point. Finally, there should be persistent efforts made to get everything possible out of the hydraulic resources of the country, using transmitted power as skillfully as possible to keep down coal consumption and to steady the load required from the steam units. It is not safe to indulge in any optimistic dreams of troubles soon over. They may last a long time, and even if they do not the lessons in economy learned under the pressure of present needs will in the long run prove profitable.

Repulsion Between Strap Conductors

IT HAS been known ever since the original experiments of Ampère that active electric conductors exerted mutual attractions or repulsions. Two parallel wires which carry currents in the same direction appear to feel a mutual bond of sympathy and pull together with a tendency to coalesce into a single wire. On the other hand, when two such wires carry oppositely directed currents, like the going and returning conductors of one and the same circuit, they act as though they loathed each other and they try to escape from each other's vicinity. Ordinarily, these forces between active parallel conductors are insignificantly small. Thus, if a pair of parallel going and returning conductors are separated by an interaxial distance of 2 centimeters, and the current in them is 10 amperes, their mutual repulsion will amount to only 1 dyne per linear centimeter, or about 30 milligrams weight per linear foot. In electric signaling, or in weak-current electrical work generally, the men engaged in it might never be led to suspect the existence of such forces. On the other hand, however, these ever-lurking forces increase as the square of the current strength; so that if the two wires just considered carried 10 kiloamperes, or 1000 times as much current as before, the force would be magnified a million times, and the mutual repulsion would be 1 megadyne per centimeter, or 30 kilograms per linear foot, a very respectable push, which might readily deform the structural supports if these were not adequately designed.

With the growth of central stations delivering powerful currents and subject to possible short circuits, these electrodynamic forces become increasingly important to engineers. Unless busbars are well braced, they may at the instant of some unexpected short circuit rise up in their might and move in a rapid and indignant way.

In the case of round copper rods, the magnitude of these electrodynamic forces is relatively easy to compute. Large copper busbars are, however, rarely constructed in the form of round rods, partly on account of the relatively small surface and consequent large heating with the circular cross-section. The more usual form is that of a strap or group of straps, and

then the computation is more difficult. This case is dealt with very neatly in an article by H. B. Dwight on another page. The formula arrived at is lengthy, but the curves supplied enable a solution to be quickly obtained for any given geometrical relation between parallel rectangular straps. It is interesting to observe that, except when the straps lie in one plane, the force is less and sometimes much less than when the conductors are rods of the same cross-section.

If we consider a loop of conductor carrying constant current, the electromagnetic energy of the loop depends upon the product of the flux linked with the loop and the current carried. The loop always tries to increase this energy, by spreading itself, so as to embrace more flux. In spreading itself half the increment of energy goes into the mechanical work of the spread, and half into extra kinetic energy of current. Consequently, if we can compute the increase of inductance in the loop due to a small displacement, and so the change in electrokinetic energy, we know that an equal amount of energy has been expended in mechanical displacement, and we can find the magnitude of the force involved. With rectangular cross-sections, or strap conductors, the change of linear inductance with displacement is a somewhat difficult problem, and Mr. Dwight's presentation of the result in graphical form will be very acceptable to designing engineers.

"Hunting" and Its Remedy

THE phenomenon of "hunting" is less common now than formerly, owing to the better design of prime movers and governors and in part to the more general use of large machines with heavy rotating parts which render them immune from certain varieties of periodic disturbances. William Knight's brief paper on this subject in another column is a particularly neat and finished discussion of the broad facts in the case. The substance of it should find its way into textbooks of engineering, in which the subject is too often now dismissed with a brief note. There are two contending factors which must be considered, the moment of inertia of the rotating parts and the dynamical restoring moment tending to resist displacement of the rotating member from its position of rest or steady motion. With a uniform torque applied and uniform load on the electrical side stability is automatic. If either torque or load is irregular, the rotating part must take up a new position of equilibrium. If the irregularity is aperiodic, no permanent disturbance will be created; if periodic,

the disturbance will be reflected only in small periodic shifts of equilibrium, unless the periods of the two opposing moments bear such a periodic relation to each other that the reactions are additive. When this occurs there will be trouble from hunting unless damping forces are applied. Mr. Knight in his article shows how the situation works out in practice and how the respective periods due to moment of inertia and disturbing forces are numerically related, giving a very finished synopsis of the fundamental facts. Although directly aimed at the parallel running of alternators, the explanation and formulas apply with very slight change to all cases of periodic disturbances in an electric system containing synchronous machines and should find their way into the notebook of every engineer interested in alternating-current practice.

Changing Grade of Conduits

IN A growing community it frequently happens that the grade of streets is changed, to the considerable inconvenience of utilities installed therein. Electric companies are less frequently inconvenienced than others in this way, because as a rule grading takes on a fairly permanent form before the electrical development reaches the underground stage. Sometimes, however, trouble occurs, and F. L. Rohrbach's description of how the situation was met in Spokane, Wash., will doubtless be of service to others. The Spokane situation involved both possible phases of the trouble, dropping a conduit line for lowered grade and building up another above the street surface to meet a subsequent rise in grade. In each case the system had to be kept in service while the change was made. In the former instance the lines were of fiber duct laid in concrete and the operation after cutting through the ducts to allow for the slight change of length in the rigid body was simple. The whole length was blocked up and then very cautiously lowered by jacks to its new position, after which the necessary cuts in the structure were repaired, when the lines settled down to duty at their new level without interruption.

The second task involved the building of about 1000 feet (304 m.) of temporary duct line above grade and the demolition of the old duct line. Here the cables had to be cut around temporarily, and then the temporary conduit of wooden troughs containing the cables packed in coarse sand was built and connected in. The illustrations in Mr. Rohrbach's article give a good idea of the nature of the work and its execution.

THE fourth article on street lighting for small cities and towns by James R. Cravath will be devoted to residential districts. The subject will be treated from three viewpoints: (1) Streets that are closely settled and paved, (2) streets that are outlying or sparsely settled in very small towns, and (3) extra-fine residence streets, where special lighting treatment is desired. Practical limits of efficiency have been about reached for modern dynamos, and the big problem now is to cheapen further the

The Coming Issues

cost of production and increase the size of units. The largest obstacle to this problem is the rate at which heat can be dissipated. This subject will be described in the next issue and some definite data, arrived at from painstaking research, will be given. The second installment of the article on the rehabilitation of the Ashley Street station of the Union Electric Light & Power Company, started in the Aug. 4 issue, will be printed in the Sept. 29 issue.

Street-Lighting Poles and Lamp Supports

An Outline of Equipment That Has Been Found Adaptable to Small Cities and Towns for Residential and Business Sections with Overhead and Underground Construction

BY JAMES R. CRAVATH

In this article, the third in the series on street lighting for small cities and towns, there are described the available poles and lamp supports for the different conditions attendant upon residential and business section lighting, underground and overhead construction, with attention given to whether street or alley distribution is employed in the latter. Wood, iron, steel and concrete posts are considered.

IN CITIES of less than 50,000 population, such as we are considering here, there is seldom enough willingness to pay the extra cost of street lighting from underground wires to make it possible for anything but an overhead system to be used in residence

Ordinary wood-pole construction is so common that not much need be said, except to remind the central station company that neatness and good maintenance, whereby poles are kept plumb, cross-arms square and secure, wires reasonably tight and guys taken up, are conducive not only to safety and reliable service but to favorable public sentiment.

An example of what can be done with neat wood-pole construction where the main pole lines could not be put in alleys is shown in Fig. 1. Here the wood poles, which had to be on the street anyway to support commercial service, are so neat in appearance as to make suitable



FIG. 1—NEAT OVERHEAD LINE BETTER THAN UNSIGHTLY MIXTURE OF OVERHEAD AND UNDERGROUND



FIG. 2—LIGHT STEEL POLES ARE DESIRABLE FOR CARRYING OVERHEAD STREET CIRCUITS

districts generally. There are some exceptions to this which will be taken up more fully in a later article. Generally speaking, the underground construction for street lighting in such cities must be confined to ornamental posts in the business district and a few residence streets.

OVERHEAD CONSTRUCTION

For streets where the supply is from overhead lines it is obviously useless to spend money on lamp-supporting poles that are more expensive and ornamental than the line poles on the same street. The lamp and line poles should be consistent and uniform. The usual construction is plain unpainted wood poles. A better appearance at a higher cost is had with the use of painted wood poles carefully selected for appearance. Next comes tubular steel pole construction, and finally concrete.

supports for the ornamental lighting brackets. Such treatment is more consistent than ornamental iron lamp poles interspersed with wooden poles of inferior quality.

When the possibility of using steel or concrete line poles for overhead street-lighting lines is considered, the difference in local conditions must be recognized between a city or district where nearly all the light and power distribution lines, except those supplying street lamps, are in the alleys and a city where all lines, both street-lighting and commercial, must be kept in the streets. In the towns and districts with alley construction the only lines in the streets are the branches or loops from the main alley lines to street lamps, and it is more feasible to use steel or concrete poles for the street lines than if the main distribution lines were in the streets. Poles to support one or two street circuit wires can be light and inexpensive, because it is not so

necessary to work upon live street-lighting circuits as on commercial circuits. Steel or steel-concrete poles are objectionable from a safety standpoint for commercial 2200-volt circuits which must be worked upon when alive. Furthermore, they are difficult to climb, unless provided with steps.

Assuming alley construction for main lines, tubular



FIG. 3—TYPICAL CLUSTER POST INSTALLATION IN SMALL CITY

steel poles can be used on streets without prohibitive expense, but of course it must be at an increased yearly rate. An example of steel-pole construction for street-lighting circuits from Champaign, Ill., is shown in Fig. 2. The majority of these poles are 3-in. (7.62-cm.) bottom and 2.5-in. (6.35-cm.) top by 25 ft. (7.62 m.) long. Their cost set in concrete is roughly double that for 6-in. (15.24-cm.), 25-ft. (7.62-m.) wood poles set in dirt. The peculiar form of lantern bracket used in this case on the standard steel pole was designed by the writer to make possible an unobtrusive but safe entrance of the heavily insulated series circuit wires to the bracket pipe, either from overhead or underground, thus permitting a uniform bracket for both overhead and underground (Fig. 7) and making future change to underground possible.

Concrete poles for overhead lines are almost beyond a reasonable expense limit for small towns. The least that can be expected is three or four times wood-pole costs for the same lengths. Fig. 4 shows the Toronto concrete pole construction and lantern used.

For the numerous locations where center-suspended lamps are advisable it is worth while to study plans for making the construction as neat as possible. It is seldom that poles less than 30 ft. (9.14 m.) long should be used and often they should be 35 ft. (10.66 m.) high. Common practice with wood poles is to guy both poles to counteract the pull of the lamp suspension. These guy wires are not particularly ornamental, but with wood poles they are perhaps better than the attempts to do away with the guy wire by giving the poles a rake to counteract span wire pull. With steel poles set in concrete and a span-wire pull calculated to pull the poles to plumb, the guy wire may be omitted without detriment to heat appearances. Considerable gain in neat appearance can be made by doing away with the swinging leads from the lamp to the line and drawing the leads tight. The rope or chain for lowering is then used for the other half of the span. The swinging leads being troublesome on account of breakage, as well as unsightly, this change is of twofold advantage.

UNDERGROUND CONSTRUCTION

Underground distribution for downtown ornamental street lamps and for a few choice residence streets is now fairly common and well within the financial reach of small cities and towns. When "white-way" lighting was first introduced the common forms of posts were of cast iron or pressed steel with a cluster of three, four or five lamps. Fig. 3, from Grinnell, Iowa, is typical of this construction in the enterprising smaller towns. In the last few years, however, these cluster lamps have been on the wane as regards popularity for new installations, and one-light posts chiefly have been installed. Fig. 9 shows a one-light post with ball globe at the top. Although the one-light post with ball globe has always had considerable popularity, and on account of its simplicity and neatness probably always will, the majority of new work has been done with the post-head type of fixture of which Figs. 5, 6 and 8 are examples.

Concrete, as shown in Figs. 6, 8 and 9, is now an active competitor of cast iron in the present field for ornamental lamp standards. Its use is rapidly on the increase on account of its durability, low maintenance cost and substantial appearance.

In Fig. 6 is shown a simple type of concrete post as made for the city of Milwaukee. The post head, however, is not the one used at Milwaukee, as a special harp design is there used. This type of post is made by the centrifugal whirling-mold process, so there is a considerable hollow space in the pole and an economical use of material. The steel reinforcement is placed near the outside.

Fig. 8 shows another type of concrete post as used at



FIG. 4—CONCRETE POSTS FOR OVERHEAD LINES

Wheaton, Ill. This type of post is of solid concrete with a pipe through the middle, lightness in this case being secured by placing the reinforcements in the rib and making them resemble a cross in cross-section.

By using an acid etching process on the exterior some

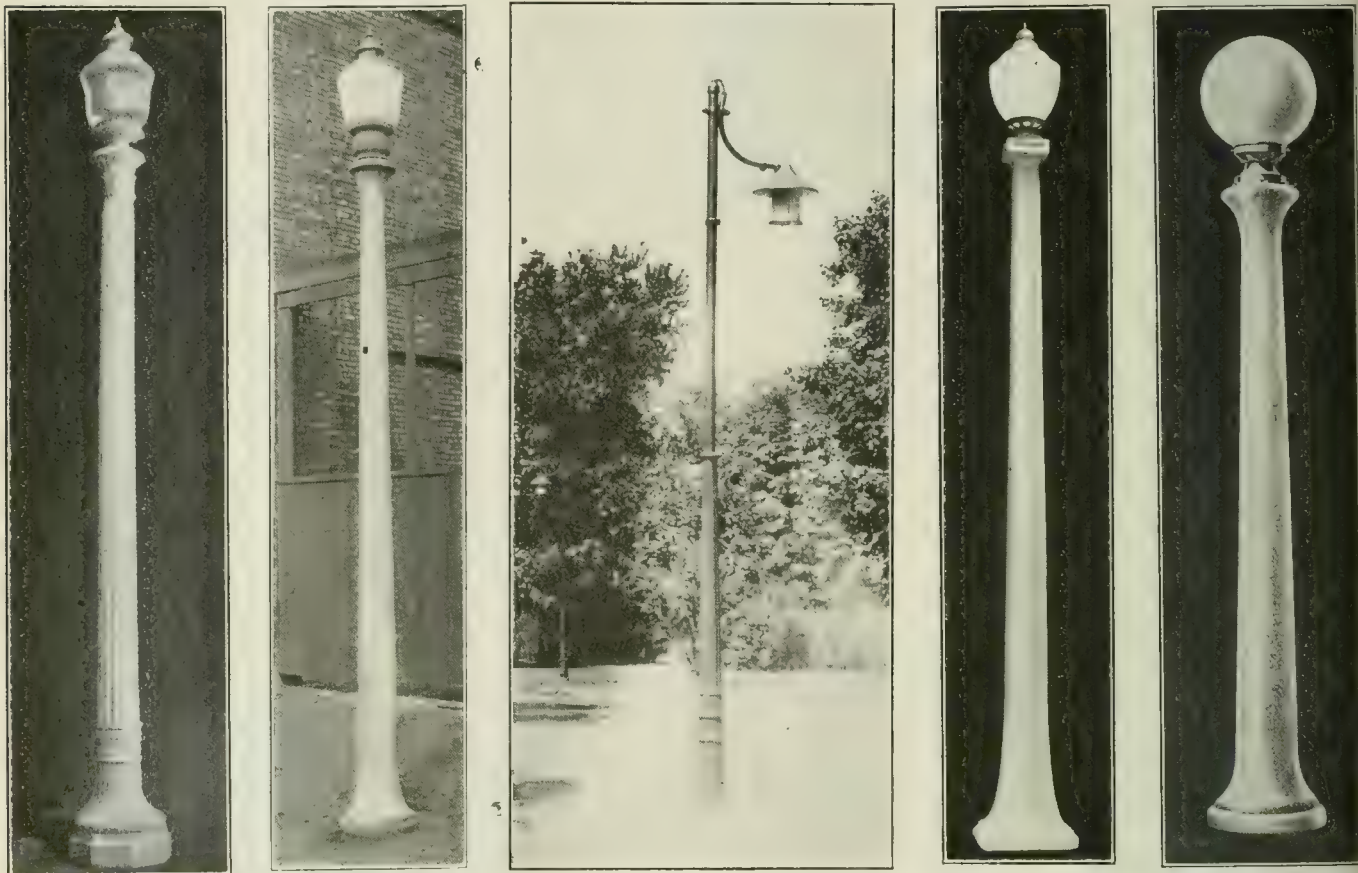
very handsome concrete finishes are obtained. Another process used to some extent is that of turning the post or column in a lathe after the concrete has partly set. By this means a variety of designs can be made up without special molds for each design.

A word of caution is in order to the small purchaser who is thinking of trying inexperienced local concrete-block makers for such posts. Concrete-post manufacture is an art in which experience is not very widespread, and while no concern has any monopoly of the brains and skill in this line, some experience and skill in post manufacture are necessary if good results as to appearances are to be looked for. Practically all concrete and metal lamp standards for under-

ple, at the present time two of the best known makes of concrete posts can be obtained for about \$20 at factory, not including any fixture or foundation, for a post 13 ft. (3.9 m.) long above the ground. For a 15-ft. (4.5-m.) post the cost is \$23; for a 16-ft. (4.8-m.) post, \$24; for a 22-ft. (6.7-m.) post about \$32, and for a 30-ft. (9.1-m.) post about \$45.

Circuit-Protecting Device

James G. Zimmerman of Milwaukee Wis., has designed a circuit-protecting device (patent No. 1,223,549) which is based upon the idea of the "pinch effect." In the secondary of an induction motor circuit is ar-



FIGS. 5 TO 9—TYPICAL METAL POST WITH MODERN HEAD; CONCRETE HOLLOW POST; CONVERTIBLE OVERHEAD TO UNDERGROUND DESIGN, SHOWING UNDERGROUND USE (SEE FIG. 2 FOR OVERHEAD USE); CONCRETE POLE, RIBBED CONSTRUCTION; CONCRETE POST WITH BALL GLOBE

ground construction are designed to be set into or upon a concrete base of some kind.

It is desirable in order to avoid glare, as explained in a previous article, and also to produce a dignified architectural effect, that lamps be mounted higher than has been the common practice in some of the smaller towns and a few of the large cities. Mounting lamps only 9 ft. or 10 ft. (2.7 m. or 3 m.) high is common, largely to save post cost. An actual lamp height of 14 ft. to 16 ft. (4.2 m. to 4.8 m.) is the minimum that should be used, and it is better to maintain this height even if fewer posts are installed than could be afforded if shorter posts were used. This matter will be discussed more fully in a later article, where the various elements which influence the spacing distance will be taken up.

Post costs increase rapidly with height. For exam-

plained a circuit breaker the operation of which is controlled by the "pinching" of a liquid resistance by an excess of current due to overload. The coil of the circuit-breaker magnet being in parallel with the liquid conducting body has the same voltage across its terminals. Current passing through the coil under normal operating conditions would not be sufficiently strong to attract the armature and overcome the action spring to complete the circuit. However, when the voltage across terminals of the liquid conducting body has increased a predetermined amount, owing to the "pinch effect" caused by the current passing through the liquid the coil will be energized to such an extent that the armature will be attracted into the closed position, whereby the coil will be energized by current. This causes the circuit breaker to open and cut off the induction motor from its source of supply.

Parallel Operation of Alternators

Discussion Regarding the Interactions Between Prime Movers and the Corresponding Alternators When Two or More of Them, All Designed for the Same Frequency and Equal Terminal Voltage, Are Operated in Parallel

BY WILLIAM KNIGHT

Assistant Mechanical Engineer Crocker-Wheeler Company

WHEN a synchronous machine is moving ahead of its mean position with regard to another one connected in parallel with it and rotating at a uniform speed, there is a force directly proportional to their relative displacement (ordinarily not more than ± 2.5 electrical degrees are allowed by electrical designers) tending to slow it down to the same speed as the uniformly rotating one. Similarly, when the rotor drops behind its mean position a force will tend to pull it ahead. This is accompanied by current surges between the machine under consideration and other machines operating in parallel with it.

If, for some reason, the resisting torque of the prime mover decreases, the rotor accelerates and its momentum increases accordingly. This causes the field system to overshoot the synchronous position by a small angle. As a result of these conditions the torque exerted by the synchronizing current will pull the rotor back. During its backward course the momentum acquired by the rotor in that direction will be large enough to make it pass the synchronous position again.

Thus there is a tendency for the rotor to oscillate back and forth from its mean position when disturbed by a temporary change of conditions; as, for instance, when switched into parallel with other machines before exact synchronism is obtained, or when the load on the machine is suddenly altered. This action is called "free oscillation." If no other oscillations should take place in synchronism (or approximately) with them, these oscillations are not likely to cause trouble with machines of normal design operating in parallel. In addition, however, the rotor is subject to a number of "forced oscillations"* impressed by the prime mover. If the period of these is the same, or approximately the same; as that of the free oscillations,* parallel operation becomes impossible and "hunting" occurs, unless the free oscillations are damped somehow.

In steam engines variation of steam pressure on the piston, or variation in pressure having its origin in the action of reciprocating parts, will cause impulses having a cycle of half a revolution. Impulses having a cycle of a full revolution are due to (a) unequal steam distribution on the two ends of the cylinder, (b) weight of reciprocating parts, and (c) difference in pressure of reciprocating parts not being alike in phase for the forward and return stroke. These statements hold true for all steam and two-stroke-cycle gas engines, no matter how many cranks or pistons are connected to the same shaft. In four-stroke-cycle gas

engines the impulses complete a cycle in two revolutions, as it is very improbable that equal work is done in all cylinder ends.

EFFECT OF RELATION OF FORCED AND FREE OSCILLATIONS ON PHASE SWINGING

With a single-crank, double-acting steam engine steam is admitted to the cylinder twice every revolution. The variation of speed produced by this irregular turning moment may be considered as a periodic oscillation impressed upon the rotor, and the duration of it in seconds is $t = 60/(N \times 2)$, where N is the number of revolutions per minute. A two-crank engine having cranks at 90 deg. with each other will produce four oscillations per revolution, and the duration of an oscillation is $t = 60/(N \times 4)$. For a three-crank engine with cranks at 120 deg. $t = 60/(N \times 6)$. If t for any engine is equal, or nearly equal, to the time of a free oscillation of the rotor, resonance results, and phase swinging will keep on increasing until the alternator falls out of step.

The relative positions of the cranks of two or more sets supplying energy to the same line has also some influence in determining oscillations. Suppose that two single-crank, double-acting engines are driving two alternators working in parallel, and assume that when the crank of one of them is in the position corresponding to the maximum turning moment, the other engine is exerting the least turning moment on the other alternator. This will evidently start phase swinging between the two alternators. With very low-speed machines a convenient adjustment of the steam valves such as to secure equal work in all cylinders and synchronism of the crank positions must be resorted to in order to avoid hunting troubles. With higher-speed machines, although it is always very desirable to have a good mechanical synchronism as well as electrical, synchronism of the cranks is not easily obtained in practice.

Another source of trouble in the parallel operation of alternators is found sometimes in the performance of the engine governor. With a very sensitive governor the fluctuation in the angular velocity of the steam engine is likely to set up periodic oscillations of the controlling springs of the governor balls. This will magnify the variation in speed of the prime mover, and hunting will occur. Such an outcome may be avoided by sufficiently damping the governor so that it will not be responsive to the variation in speed produced by the varying turning moment of the crank shaft.

Governor drop, or regulation, which is the difference between the speeds corresponding to minimum and maximum steam pressure (no load and full load), varies from 3 to 6 per cent of the no-load speed, according to the type of governor used. A large governor drop is desirable in so far as parallel running is con-

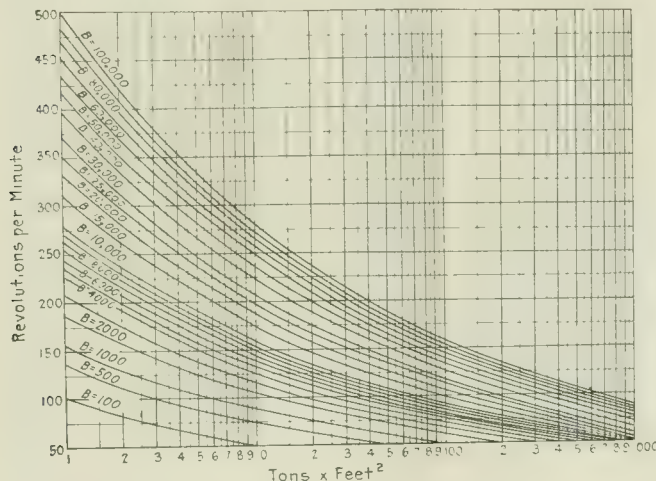
*The number of free oscillations (or natural frequency) of a vibrating body is the number of oscillations per second that its mass will make if subjected to a force increasing as the distance through which it is rotated. For instance, a weight suspended by a string will, if moved out of the position vertically under its point of suspension, swing to and fro by the action of gravity. The irregular turning moment of an engine consists of a number of superimposed harmonic waves. For the various impulses the number of waves per revolution may be any integral number. The number of waves per second is called forced frequency, or number of forced oscillations per second.

cerned, but this will also produce a large variation of frequency between no load and full load. Hence the governor drop must be chosen large enough to permit good parallel operation, but not more than is necessary. Machines with inferior regulating properties are therefore better suited for parallel working than similar machines with a very close regulation. However, the most satisfactory result in parallel operation is secured with turbo-alternators, owing to the uniform driving torque of the turbine.

From what was said before it is evident that in order to secure good results in parallel operation of alternators it is necessary to provide a flywheel large enough to fulfill two conditions: It must limit the periodic variation in angular velocity so that the resulting displacement will not exceed ± 2.5 electrical degrees and at the same time must give a natural frequency at least 25 per cent either above or below the frequency of any of the engine impulses.

METHOD OF CALCULATING PERIOD OF FREE OSCILLATION

The free oscillations of an alternator could be compared to the oscillations of a ring connected to a central shaft by means of springs. If a force is tem-



SPEEDS AT WHICH RESONANCE OCCURS WITH DIFFERENT FLYWHEEL EFFECTS (SEE FORMULAS 10 AND 11)

porarily applied to the ring, tending to produce rotation in one direction, and then relieved, the springs will start the ring vibrating back and forth from its position of rest. If the disturbing force is periodically applied and the period of the disturbance coincides with the natural period of vibration of the springs, we have resonance, and the amplitude of the oscillation keeps on increasing according to an exponential law unless otherwise damped by some viscous forces. The motion of any point of the ring will be a simple harmonic function of the time, and this can be computed by using the same formula as for a pendulum.

$$t = 2\pi \sqrt{\frac{\Sigma mr^2}{m}} \quad (1)$$

Where

t = periodic time of a complete free oscillation in seconds.

Σmr^2 = mass moment of inertia of rotor and flywheel.

m = restoring moment which would act on the rotor if this were rotated from its position of rest through a unit angle.

It could be proved that the above formula, after

making the necessary substitutions, can be expressed in the ft.-lb.-sec. system as:

$$t = 0.001705N \sqrt{\frac{PR^2}{kw.f I_o/I}} \quad (2)$$

and, with the meter-kg.-sec. system, as:

$$t = 0.0083N \sqrt{\frac{kg.m^2}{kw.f I_o/I}} \quad (3)$$

Where

N = revolutions per minute.

PR^2 and $kg.m^2$ = flywheel effect.

$kw.$ = output of alternator.

f = frequency in cycles per second.

I_o/I = ratio of short circuit to full-load current.

Calling w the number of waves or impulses for every revolution of the prime mover, n (forced) the number of waves or impulses per second, and n (free) the number of free oscillations per second:

$$n \text{ (free)} = 1/t = \frac{588}{N} \sqrt{\frac{kw.f I_o/I}{PR^2}} \quad (4)$$

$$n \text{ (forced)} = wN/60. \quad (5)$$

Parallel operation becomes impossible when n (free) = n (forced), or:

$$\frac{588}{N} \sqrt{\frac{kw.f I_o/I}{PR^2}} = \frac{wN}{60}$$

In this case N is the critical number of revolutions per minute. Solving for N

$$N \text{ (critical)} = 187.7 \sqrt{\frac{kw.f I_o/I}{w^2 PR^2}} \text{ r.p.m.} \quad (6)$$

or, solving for the critical value of PR^2 ,

$$PR^2 \text{ (critical)} = 12.4 \times 10^8 \frac{kw.f I_o/I}{N^4 w^2}. \quad (7)$$

The following values of w will give the number of impulses impressed by the prime mover on the rotor:

	Values of w
Four-stroke-cycle single-acting gas engine, one cylinder.....	0.5
Four-stroke-cycle single-acting gas engine, two cylinders.....	1
Four-stroke-cycle single-acting gas engine, four cylinders.....	2
Four-stroke-cycle single-acting gas engine, six cylinders.....	3
Four-stroke-cycle double-acting, and two-stroke-cycle, one cylinder.....	1
Four-stroke-cycle double-acting, and two-stroke-cycle, two cylinders.....	2
Four-stroke-cycle double-acting, and two-stroke-cycle, four-cylinders.....	4
Double-acting steam engine, one crank.....	2
Double-acting steam engine, two cranks.....	4
Double-acting steam engine, three cranks.....	6

Above values of w are for normal operating conditions. For special conditions, such as when one cylinder in a gas engine is missing, the value of w given for one cylinder should be used in all cases. For the case of incorrect valve setting of steam engine, use $w = 1$. For steam turbines in general use $w = 1$.

In every case the operating speed must not be closer than 25 per cent above or below the critical.

An extremely simple formula for finding the period of oscillation of m paralleled alternators running either at the same speed or at different speeds is given by Franklin Punga. The formula, because of its simplicity, is of use both to designers and engineers.

As shown before,

$$t = 2\pi \sqrt{\frac{\Sigma mr^2}{m}}$$

The corresponding number of free oscillations per second is given by

$$n \text{ (free)} = 1/t = \frac{1}{2\pi} \sqrt{\frac{m}{\Sigma mr^2}} \quad (8)$$

If $1/m = Y$ and $1/\Sigma mr^2 = J$, the natural period of

oscillation of m paralleled alternators is

$$n \text{ (critical)} = 1/2\pi \sqrt{\frac{J_1 + J_2 + \dots + J_m}{Y_1 + Y_2 + \dots + Y_m}} \quad (9)$$

The values of J and Y must be based on the same speed. For instance, if alternator No. 1 has the values Σmr_1^2 and m_1 and is rotating at a speed N_1 , and it is desired to use N as the normal speed, Σmr_1^2 and m_1 must be multiplied by $(N_1/N)^2$ before putting their reciprocal values in formula (9).

Mr. Punga's investigation led him to the conclusion that if the actual PR^2 of an alternator lies below the PR^2 (critical), resonance is reached by lowering the voltage. If the actual PR^2 lies above the PR^2 (critical), resonance is reached by lowering the speed.

The exact value of resonance is best found by chang-

ing the voltage at reduced speed. It must be noted that the vibration at resonance is in general too great; it can be helped, however, by approaching the critical voltage from both sides and noting the voltage at about 5 per cent above and below the critical, at which point the vibrations are quite great. In this way the PR^2 (critical) for a given alternator can be obtained experimentally.

If we make $B = \text{kw.} \times f \times I_p I \times 1/w^2$ and express PR^2 in tons-ft.,² then formulas 6 and 7 become:

$$\text{R.p.m. (critical)} = 28.1 \sqrt[4]{B/\text{tons-ft.}^2} \quad (10)$$

$$\text{Tons-ft.}^2 \text{ (critical)} = 624,000 B/N^4 \quad (11)$$

The last two formulas are represented graphically by the accompanying set of curves.

Changing Elevation of Underground Duct Lines

Methods of Handling Two Extremes of Construction, One Imposed by Lowering Grade of Street and the Other by Elevating the Street to Accommodate Viaduct Beneath

BY F. L. ROHRBACH

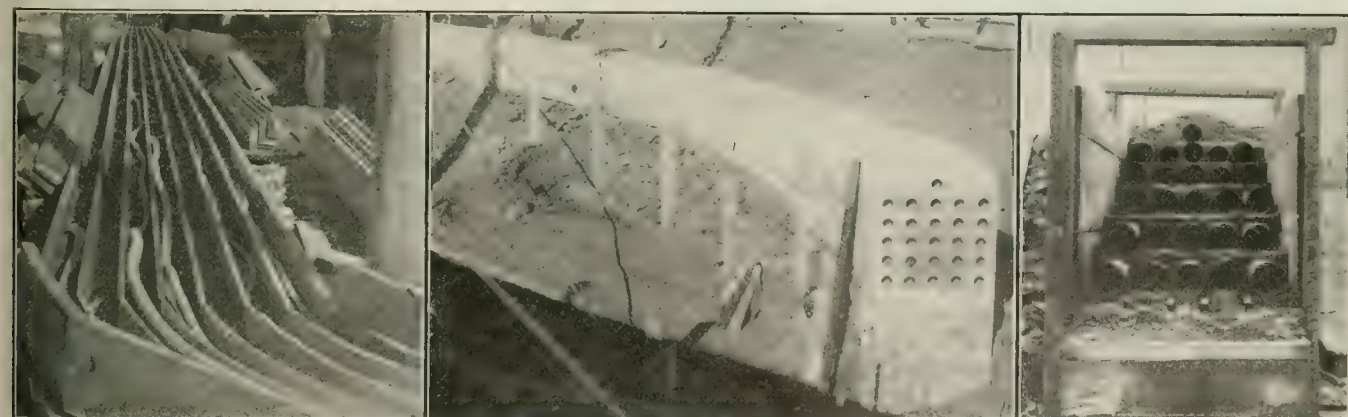
Washington Water Power Company

THE Washington Water Power Company of Spokane has recently been confronted with what might be considered the two extremes in underground conduit construction, viz., the lowering of several conduit lines without interruption to service and the building of a conduit line above the surface of the street.

The lowering of the several conduit lines was made necessary by the regrading of the streets. Three lines were affected; Howard Street, length 310 ft. (94.5 m.), maximum depth to be lowered 4 ft. (1.2 m.); Post Street, length of line 225 ft. (68.5 m.), maximum depth to be lowered 3½ ft. (1.06 m.), and Monroe Street, length of line 220 ft. (61.6 m.), maximum depth to be

measured 3½ in. (8.9 cm.) inside diameter, had been laid in two rows of three each, the clearance between ducts being ¾ in. (1.9 cm.). The protection of concrete on the top and bottom of the duct line was 3 in. (7.6 cm.) and on the sides was 2 in. (5.1 cm.). This gave a weight of 200 lb. to 230 lb. per linear foot (297 kg. to 342 kg. per. m.) of duct line, including cables.

In regrading the streets a hump of from 3 ft. to 4 ft. (0.9 m. to 1.2 m.) was removed. This meant that the duct line had to be lowered at one point as much as 4 ft. (1.2 m.), while the ends were to stay at their original elevation. The piece of duct line to be lowered was cut through at three points, at the hump and at each end, wedges being placed in the openings to over-



FIGS. 1, 2 AND 3—METHOD OF SPACING TEMPORARY CABLES; SECTION OF ELEVATED DUCT, AND PARTLY COMPLETED DUCT LINE

lowered 3 ft. (0.91 m.). Each of the three lines contained three Edison mains (500,000 circ. mil), and in addition the Post Street line included two tie lines (each 4/0 three-conductor, 13,000-volt) and an Edison feeder (1,000,000 circ. mil concentric). Each of the three lines consisted of six fiber ducts laid in concrete. The duct, which was in 5-ft. (1.5-m.) lengths and

come any end motion. The cuts were afterward repaired, as described later.

After all gas and water pipes had been lowered, excavations were made on each side and under the duct line to be lowered, the concrete being held in its old position by blocking placed about 10 ft. (3 m.) apart. Bents made out of 8-in. by 8-in. (20.3-cm. by 20.3-cm.)

timber and spaced 8 ft. (2.4 m.) apart were then set straddle of the duct line. On top of each bent was placed a jack and sufficient blocking to allow proper clearance at that particular point. Pieces of timber, 8 in. by 8 in. by 18 ft. (20.3 cm. by 20.3 cm. by 5.5 m.) were rested on top of the jacks, there being three jacks under each timber. The duct line itself was supported by loops of $\frac{1}{2}$ -in. (1.27-cm.) messenger wire placed about $4\frac{1}{2}$ ft. (1.36 m.) apart. Each loop of wire was drawn as tight as possible by hand and then fastened by three clamps. When everything was ready to start the actually lowering of the duct line, the jacks were screwed up slightly in order to take up any slack in the wire loops and to remove some blocking from beneath the duct line.

Owing to the fact that the duct line was not lowered the same vertical distance over its whole length, great care was necessary in handling the jacks. It was not thought necessary to use an instrument to check each jack as it was lowered, but a careful watch was kept on each wire loop so as to keep the load evenly divided. After the jacks were run down their full length, the duct line was supported from below, while blocks were

were carefully inspected and found to be practically as good as new.

The temporary line contained fourteen ducts (two rows of seven each) and was constructed out of 1-in. (2.54-cm.) lumber except for the sides and bottom, which were 2-in. (5.08-cm.) material. The wooden



FIG. 5—METHOD OF LOWERING DUCT LINE

trough was about 800 ft. (262.4 m.) in length and contained three right-angle turns. Cables were first placed in the bottom row of ducts and the space around the cables—each duct was about 5 in. (12.7 cm.) square—then filled with coarse sand, after which the second or top row of cables was installed. No trouble was found in placing the cables in these ducts. A cable-pulling machine was placed near one end of the line and the cable fed from a reel in the usual manner, a series of large wooden spools being used to guide it around the turns of the duct line. The following cables were used in this temporary duct line: two tie lines, each 13,200 volts, three-conductor, 2/0; six railway feeders, each 1,000,000-circ. mil, four alternating-current light and power cables, each six-conductor, 1/0, and one alternating-current arc cable, seven-conductor, No. 8. Records were kept of the exact location of all joints so that in case of trouble they could easily be found. This duct line was used for a period of eight months until the viaduct was completed and duct lines were installed in the re-

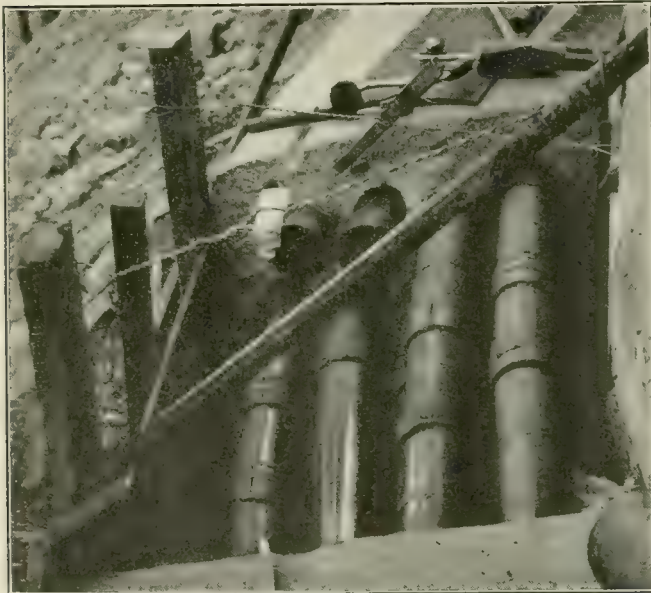


FIG. 4—FIBER DUCT LINE WHICH WAS SPLICED AFTER BEING DAMAGED BY LANDSLIDE

removed from under the jacks to give another setting.

Owing to the construction of a viaduct to accommodate a railroad it was necessary to raise a street level about 10 ft. (3 m.) and, at the same time, to give proper clearance, cut about 8 ft. (2.4 m.) below the old street level. This change affected a length of about 1000 ft. (304.8 m.) of duct line, which contained cables that had to be kept in service. Accordingly, a twenty-six-duct conduit line about 215 ft. (65.5 m.) long was built above the street level. A curve in the line was necessary in order to get from the street to a position under the sidewalk where a manhole was to be placed. Later the end of the duct line was utilized as one side of the manhole. The ducts were separated 4 in. (10.2 cm.) where they entered the manhole. At other places the separation was $\frac{3}{4}$ in. (1.9 cm.). The old duct line was torn out after the cables had been "cut around" temporarily. The pieces of fiber duct taken from this demolished line, which had been in service five years,



FIG. 6—REPAIRING SECTION OF DUCT LINE

graded streets. The cables were then removed and placed in their permanent positions.

About a year ago one of the duct lines was badly damaged by a slide which occurred at one end of a railroad bridge abutment. The rock and gravel were cleared away as soon as possible and the duct line was

examined. It was found to be cracked in five or six places and seriously damaged at the point where it was fastened to the abutment, but none of the cables was injured. All were important cables, being tie lines between two stations. The concrete at the damaged point was cut away from around the cables and repairs were made to the duct line without any interruptions to service. Short pieces of fiber duct were first sawed lengthwise on one side only and then soaked in hot water to make them pliable. It was then a simple matter to slip the fiber over the cable, very little force being necessary to separate the duct where it had been sawed.

EFFECT OF THE WAR ON
ENGINEERING COLLEGES

These Institutions Have the Largest Freshman Class in History, but Total Attendance Is Reduced—
Adjustments in Curriculum

That students and faculties of the universities of the country responded nobly to the national call when war was declared is now well known. The extent to which the engineering colleges have been affected has been the subject of an investigation by the ELECTRICAL WORLD. Reports were received from sixty-two engineering

TABLE SHOWING THE EFFECT OF THE WAR ON AMERICAN ENGINEERING SCHOOLS AND UNIVERSITY DEPARTMENTS

Name	Location	Opening Date	Percentage of Attendance Expected	Number of Faculty Absent	Rearrangement of Courses, Etc.
Alabama Polytechnic Institute	Auburn, Ala.	Sept. 12	90	8	Laboratory and shop time reduced.
University of Arkansas	Fayetteville, Ark.	Sept. 20	Upper, 20; freshman, full	2	Extra extension courses.
Armour Institute of Technology	Chicago, Ill.	Sept. 10	100	4	None.
University of Arizona	Tucson, Ariz.	Sept. 18	Fresh., 150; soph., 125; junior, 50; senior, 10	None	Military training required of all students; also courses in military engineering and geology.
Bucknell University	Lewisburg, Pa.	Sept. 20	75	6	Very little.
Carnegie Institute of Technology	Pittsburgh, Pa.	Sept. 20	Upper classes, 65; entering classes, 75	100	Introduction.
Clarkson College of Technology	Potsdam, N. Y.	Sept. 11	60	None	None.
Clemson Agricultural College	Clemson, S. C.	Sept. 19	100	None, some new men	None so far.
Cornell University	Ithaca, N. Y.	Sept. 25	75	6	Slight.
University of Colorado	Boulder, Col.	Sept. 10	100	3	None.
Colorado College	Colorado Springs, Col.	Sept. 12	55	5	Not settled.
University of Southern California	Los Angeles, Cal.	Sept. 10	80	None	None.
De Paul University	Chicago, Ill.	Sept. 24	75	3	
Drexel Institute	Philadelphia, Pa.	Sept. 24, day; Oct. 1, night	Day, 50; night, 100	2 day; 5 night	Modification in evening courses.
Georgia School of Technology	Atlanta, Ga.	Sept. 19	100	5	Additional military drill, also government school of aeronautics.
Haverford College	Haverford, Pa.	Sept. 27	75	1	None.
Johns Hopkins University	Baltimore, Md.	Oct. 2	70	1	None.
University of Illinois	Urbana, Ill.	Sept. 17	80	18	None.
Iowa State College	Ames, Iowa	Sept. 10	Fresh., 100; decrease in upper classes.	4, places filled	Additional short war courses and military drill.
State University of Iowa	Iowa City, Iowa	Sept. 17	Upper, 80; fresh., 100	3	None.
Kansas State Agricultural College	Manhattan, Kan.	Sept. 10	Nearly full	4 teachers, 3 fellows	None.
Lafayette College	Easton, Pa.	Sept. 20	80		
Lehigh University	Bethlehem, Pa.	Sept. 19	Larger fresh. class; upper diminished	4	None.
Lewis Institute	Chicago, Ill.	Sept. 24, day; Oct. 8, night	80	5	In progress.
Massachusetts Institute of Technology	Cambridge, Mass.	Sept. 24	90	50	
Michigan Agricultural College	East Lansing, Mich.	Oct. 10	75	Not yet known	None.
University of Michigan	Ann Arbor, Mich.	Oct. 1	85	12 6 replaced	Additional military course
University of Mississippi	University P. O., Miss.	Sept. 19		35	
University of Missouri	Columbia, Mo.	Sept. 17	90	2	None.
University of Nebraska	Lincoln, Neb.	Sept. 12	Upper classes materially depleted	2	None.
New Hampshire State College	Durham, N. H.	Oct. 3	70-85	3	Somewhat.
New Mexico College of A. & M.	State College, N. M.	Sept. 26	80	1-2	Added practical engineering course, using four-quarter plan.
North Carolina State Col. of Agric. & Eng.	W. Raleigh, N. C.	Sept. 6	90	None	Slight.
Northwestern University	Evanston, Ill.	Sept. 24	85	None	None.
Norwich University	Northfield, Vt.	Sept. 18	75	3	
Ohio Northern University	Ada, Ohio	Sept. 11	90	1	Yes.
Oklahoma A. & M. College	Stillwater, Okla.	Sept. 6	80	None	Probably to a small extent.
Oregon Agricultural College	Corvallis, Ore.	Oct. 8	90	2	None.
Pennsylvania State College	State College, Pa.	Sept. 12	Upper, 75; largest fresh. class on record	7 in military service	Not important
University of Pittsburgh	Pittsburgh, Pa.	Oct. 1	65; large fresh. class	6	
Polytechnic Institute	Brooklyn, N. Y.	Sept. 17	80	3	Yes.
Pratt Institute	Brooklyn, N. Y.	Sept. 19	90	None	Will give instruction to 500 men in U. S. Navy which will double usual enrollment.
University of Princeton	Princeton, N. J.	Sept. 25	65		
Rensselaer Polytechnic Institute	Troy, N. Y.	Sept. 12	100		None.
Rhode Island State College	Kingston, R. I.	Sept. 18	60 (uncertain)	1	Adjustment in special cases to allow for harvest.
University of Rochester	Rochester, N. Y.	Sept. 27		1, place filled	No.
Ross Polytechnic Institute	Terre Haute, Ind.	Sept. 19	90	1	Seniors graduate in January.
University of South Carolina	Columbia, S. C.	Sept. 19	75	4, places supplied	
Leland Stanford, Jr., University	Palo Alto, Cal.	Oct. 1	75-80	1-2	None.
Stevens Institute of Technology	Hoboken, N. J.	Sept. 24	90		None.
Syracuse University	Syracuse, N. Y.	Sept. 18	80		None.
A. & M. College of Texas	College Station, Tex.	Sept. 19	90	10	Negligible.
Throop College of Technology	Pasadena, Cal.	Sept. 3	75	4	Yes.
Tufts College	Tufts College, Mass.	Oct. 4	90		None.
Tulane University of Louisiana	New Orleans, La.	Sept. 24			
Union College	Schenectady, N. Y.	Sept. 17	50-75	4, places supplied	Adjustments.
University of Utah	Salt Lake City	Sept. 13	90		Some new courses added.
University of Vermont	Burlington, Vt.	Oct. 10	80	2	Yes.
Virginia Polytechnic Institute	Blacksburg, Va.	Sept. 20	Fresh. and soph., 110; junior, 60; senior, 30	3	Slight
George Washington University	Washington, D. C.	Sept. 26	100		Courses in late afternoon.
University of Washington	Seattle, Wash.	Oct. 1		5	Quarter system.
University of Wyoming	Laramie, Wyo.	Sept. 25	50	None	None.

schools or engineering departments of universities as to the opening date, percentage of attendance expected, number of faculty absent and curriculum adjustments necessitated. It was found that the opening date extended anywhere from Sept. 3 to Oct. 10, the most popular time being the week ending Sept. 22.

The reports show conclusively that the enrollment in engineering studies this fall will be considerably reduced. Out of fifty-one replies giving figures only seven expect a 100 per cent attendance, while two expect one as low as 50 per cent. The others were divided as follows: thirteen, 90 per cent; ten, 80 per cent; nine, 75 per cent; four, 85 per cent; three, 60 per cent, and three, 70 per cent. It is safe, therefore, to say that the attendance will on the whole be from 10 to 25 per cent diminished. That these figures are not larger is owing to what seems to be the largest freshman engineering class in history. The upper classes have been severely depleted in numbers. One university expects but a 10 per cent senior attendance; others expect as low as a 20 and 30 per cent attendance in

the upper classes; few report a full senior enrollment.

There is also a depletion in the ranks of the faculty. Only fifteen colleges out of the sixty-four reporting have no members of the faculty absent. The others reported 206 faculty members absent, fourteen of whom have been replaced.

In the matter of curriculum adjustments twenty-four reported none and twenty-six reported adjustments of some nature. Four have instituted military drill and courses. One is requiring of all students in engineering a course in military engineering, and one a course in military geology. One is adding a course in practical engineering, while another is reducing laboratory and shop time. An Eastern college is making adjustments to allow for the harvest. While but two reported as making a change to the quarter system, others are known to have done so. One college has decided to graduate seniors in January.

The accompanying table shows in detail the report of each college. The figures are for engineering colleges and departments only.

Repulsion Between Strap Conductors

Method of Calculation Which May Be Used in Connection with Wide, Closely Spaced Busbars or Where the Round-Wire Formula for Widely Separated Conductors Will Not Apply

BY H. B. DWIGHT

Engineer Canadian Westinghouse Company.

WITH the increased importance now attached to the study of short-circuit conditions in large power houses, and with the growing use of electric furnaces, the calculation of the mechanical repulsion between strap conductors is a problem of practical interest and value. When the straps are separated a considerable distance, it is possible to use with fair accuracy the usual formula for repulsion of round wires or cables, which is very simple (see equation 3). But with comparatively close spacing, as with wide busbars or in low-voltage electric furnace circuits, the round-wire formula will not apply at all closely and a different method of calculation is necessary.

In this article there is derived a formula for the repulsion of equal long parallel straight conductors of rectangular section, which applies to all relative positions, whether edgewise or in parallel planes, and whether far apart or so close as to be touching, except for insulation that may be between the conductors. This formula is not very short or convenient, and so Fig. 1 has been drawn, which gives the results of the formula with practically no calculation for the solution of engineering problems. For large spacings not indicated on this curve sheet the round-wire formula is correct within less than 5 per cent.

There are two methods of deriving the formula for the repulsion between two small wires, first, by calculating the strength of field in which one conductor lies, and, second, by calculating the differential of the mutual inductance.

In the first method the magnetic field at a distance s (expressed in centimeters) from a wire carrying a current i_1 (expressed in absolute units) is $H = 2i_1/s$. This value is obtained by integrating the effect of the

current i_1 on a unit magnetic pole at distance s . Let the return wire, which lies in the magnetic field of density H , be moved a small distance ds away from the first wire. Let it be subject to a mechanical force of F' dynes per centimeter of conductor. Then the mechanical work during the above motion will be $F'ds$. The electrical work during the same motion is i_2Hds . By equating this expression to the mechanical work the following equation¹ is obtained:

$$F' = i_2H = 2i_1i_2/s \text{ dynes per centimeter of conductor. (1)}$$

This expression gives the repulsion in the case of a return circuit where the currents in the two conductors are in opposite directions.

The other method,² which is essentially the same as the preceding one, uses the value of the mutual inductance of the two wires and involves using the formula

$$M \text{ (per cm. of one wire)} = 2 \log_e 2l - 2 \log_e s - 2 + 2s/l, \quad (2)$$

where l is the length of one wire. If one of the wires moves a distance ds in time dt , it cuts magnetic lines of force at the rate $i_1 dM/dt$ and thus generates a voltage $e = i_1 dM/dt$.

The rate of electrical working is therefore $-ei_2 = -i_1i_2 dM/dt$, since e and i_2 are in opposite directions. The rate of mechanical working is $F'ds/dt$, where F' is in the direction in which s is measured. Therefore, equating the above quantities, $F' = -i_1i_2 dM/ds = (2i_1i_2/s) - (2i_1i_2/l)$, which may be taken equal to $2i_1i_2/s$, since l is supposed very long compared with s .

The preceding formula for the repulsion of small

¹J. J. Thomson, "Elements of the Mathematical Theory of Electricity and Magnetism," fourth edition, page 361.

²Bulletin of the Bureau of Standards, Washington, D. C., Vol. 8 No. 1, equation 99.

wires is true also for large round wires close together, since the expression for force is the differential of the expression for mutual inductance, and the latter is true for large round wires as well as small ones. Therefore $F' = 2i_1 i_2 / s$ dynes per centimeter of conductor, where i_1 and i_2 are in absolute units and s is in centimeters. Therefore,

$$F = \frac{2I_1 I_2}{100s \times 2.54} \times \frac{2.54 \times 12}{981 \times 453.6} = (5.40 I_1 I_2 / s) 10^{-7} \quad (3)$$

pounds per foot of circuit, where I_1 and I_2 are measured in amperes and s is the axial spacing in inches.

In the case of alternating currents this formula gives the average force on a conductor. It rises to double this value at the peak of the current cycle and becomes zero when the instantaneous current is zero when the currents are in phase.

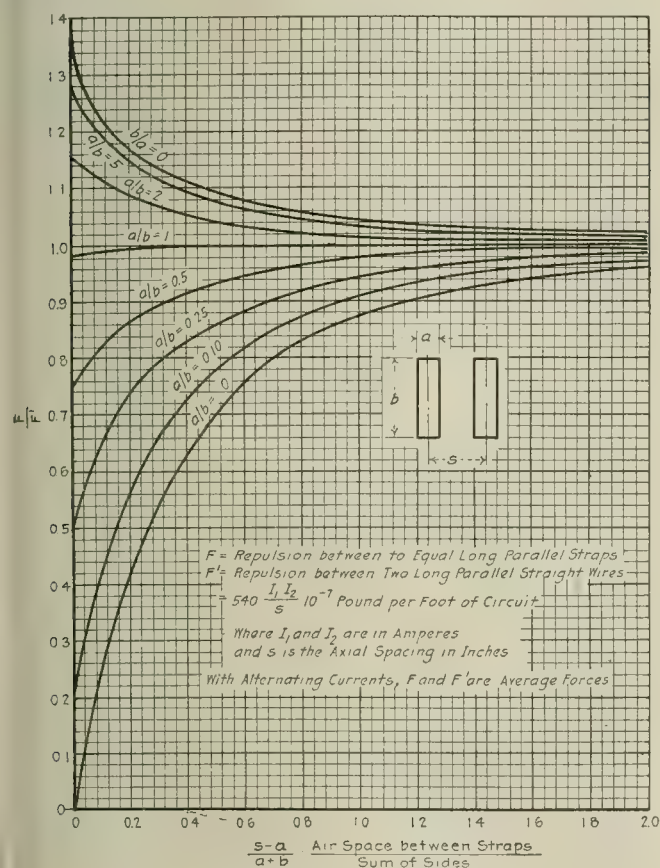


FIG. 1—REPUSSION BETWEEN STRAP CONDUCTORS

In finding the formula for the repulsion between two straight conductors of rectangular section, the repulsion between two equal thin sheets in parallel planes is first calculated. (See Fig. 2.) The horizontal repulsion on the long narrow strip dx caused by the similar strip dy is

$$\frac{2i_1 i_2 s dy dx}{b^2 [s^2 + (x - y)^2]} \text{ dynes per centimeter,}$$

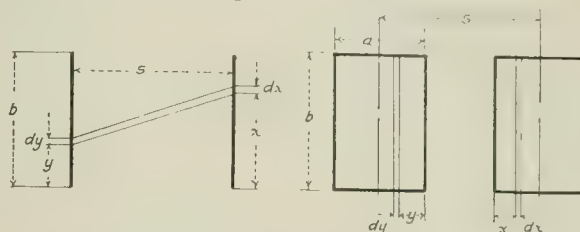
where the dimensions are in centimeters and i_1 and i_2 are the currents in the two sheets, in absolute units.

By integrating first over one sheet and then over the other the repulsion on a sheet is found to be

$4i_1 i_2 / b \tan^{-1} (b/s) - 2 (i_1 i_2 s / b^2) \log_e (1 + b^2/s^2)$ (4) dynes per centimeter of sheet. The angle $\tan^{-1} b/s$ is to be expressed in radian measure. The curve for this expression, plotted on a base $(s - a)/(a + b)$, is the lowest curve of Fig. 1.

The repulsion between two solid straps is obtained by

integrating expression (4) over the two sections shown in Fig. 3. It should be noted particularly that s is the distance between the centers of the straps and not the air space between the straps. If i_1 and i_2 are the currents in the straps, in absolute units, the force in dynes per centimeter of strap is



FIGS. 2 AND 3—REPUSSION BETWEEN TWO THIN SHEETS, AND BETWEEN TWO RECTANGULAR CONDUCTORS

$$F = \frac{i_1 i_2}{a^2 b^2} \left\{ 2b \left[(s + a)^2 - (b^2/3) \right] \tan^{-1} \frac{b}{s + a} + 2b \left[(s - a)^2 - b^2/3 \right] \tan^{-1} \frac{b}{s - a} - 4b (s^2 - b^2/3) \tan^{-1} \frac{b}{s} \right. \\ \left. + (s + a) \left[b^2 - \frac{(s + a)^2}{3} \right] \log_e \left[\frac{(s + a)^2 + b^2}{s^2} \right] \right. \\ \left. + (s - a) \left[b^2 - \frac{(s - a)^2}{3} \right] \log_e \left[\frac{(s - a)^2 + b^2}{s^2} \right] \right. \\ \left. - 2s (b^2 - s^2/3) \log_e \left(\frac{s^2 + b^2}{s^2} \right) + \frac{2}{3} (s + a)^3 \log_e \left(\frac{s + a}{s} \right) \right. \\ \left. + \frac{2}{3} (s - a)^3 \log_e \left(\frac{s - a}{s} \right) \right\} \quad (5)$$

dynes per centimeter of one strap, where the dimensions are in centimeters and the angles are in radian measure.

As mentioned before, this formula is rather long, but if an approximation within a few per cent is all that is desired there does not seem to be any need to work

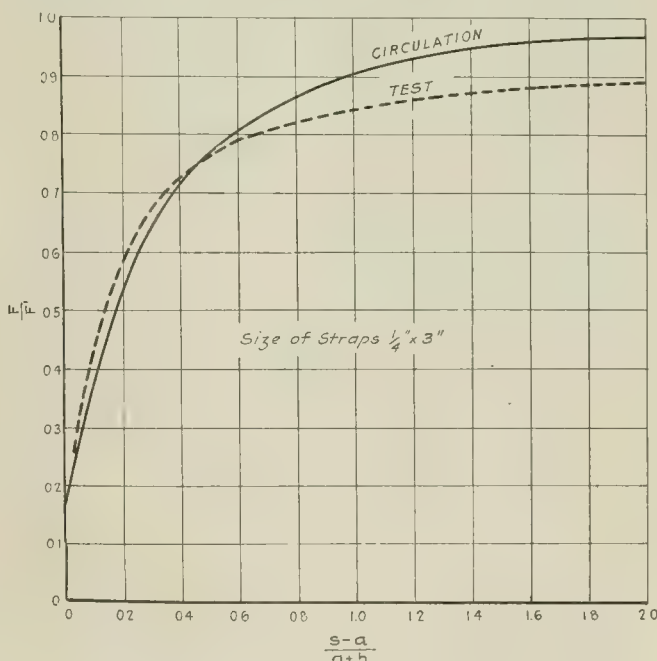


FIG. 4—COMPARISON OF CALCULATED RESULTS WITH TEST DATA

out formula (5), because Fig. 1 and formula (3) can be used instead for any case of equal long parallel rectangular conductors, and the only calculation needed will be simple slide-rule work. Fig. 1 can also be used for the repulsion between ventilated busbars consisting

of several straps with air spaces between them. For approximate results the complete busbar can be assumed to be the same as a solid conductor of the same outside dimensions. For theoretical exactness the repulsion of each strap in one busbar on each strap of the neighboring busbar can be calculated according to Fig. 1 or formula (3). Fig. 1 may prove useful in calculating the repulsion between coils in transformers.

The formula for the repulsion of two thin sheets in the same plane—that is, edge to edge—is

$$\frac{2i_1 i_2}{a^2} \left[(s+a) \log_e \left(\frac{s+a}{s} \right) + (s-a) \log_e \left(\frac{s-a}{s} \right) \right] \quad (6)$$

This expression is used to calculate the upper curve of Fig. 1. The only approximation used in obtaining the formulas of this article is that skin effect is neglected and thus uniform current density is assumed over the section of the conductors.

The calculations in this article can be compared with a test curve which has been published in the *Transactions* of the American Institute of Electrical Engineers.³ This test is a comparatively difficult one to make, currents up to 8000 amp. having been used. The results for one size of strap are shown in Fig. 4, together with the corresponding calculated curve.

Examples will now be given to show the use of Fig. 1 and formula (3). In three-phase work the forces due to the products of the instantaneous values of two alternating currents which are 120 deg. out of phase are treated the same as in calculating the alternating-current power, i.e., by multiplying the instantaneous values of the alternating current and the alternating voltage.

Example I.—Find the repulsion of two straps measuring $\frac{1}{4}$ in. by 6 in. (6.4 mm. by 15.2 cm.), in parallel planes, with the distance between centers $1\frac{1}{4}$ in. (3.2 cm.) and with the current in each strap 5000 amp.

$$F' = \frac{5.40 \times 5000 \times 5000 \times 10^{-7}}{1.25} = 10.8 \text{ lb. per foot, by formula (3).}$$

From Fig. 1, $F/F' = 0.42$ approximately, since

$$\frac{a}{b} = \frac{1}{24} \text{ and } \frac{s-a}{a+b} = \frac{1.25-0.25}{0.25+6} = \frac{1.0}{6.25} = 0.16.$$

Therefore, $F = 10.8 \times 0.42 = 4.5$ lb. per foot, average.

Example II.—Find the average force exerted between two straps measuring $\frac{1}{4}$ in. x 3 in. (6.4 mm. by 7.6 cm.), in parallel planes, with the distance between centers 6 in. (15.2 cm.) and with 10,000 amp. in each strap.

$$F' = \frac{5.40 \times 10,000 \times 10,000 \times 10^{-7}}{6} = 9 \text{ lb. per foot, by formula (3).}$$

$$\frac{s-a}{a+b} = \frac{6-0.25}{0.25+3} = \frac{5.75}{3.25} = 1.77$$

and

$$\frac{a}{b} = \frac{1}{12}.$$

Therefore, from Fig. 1, $F/F' = 0.96$; or $F = 9 \times 0.96 = 8.6$ lb. per foot, average.

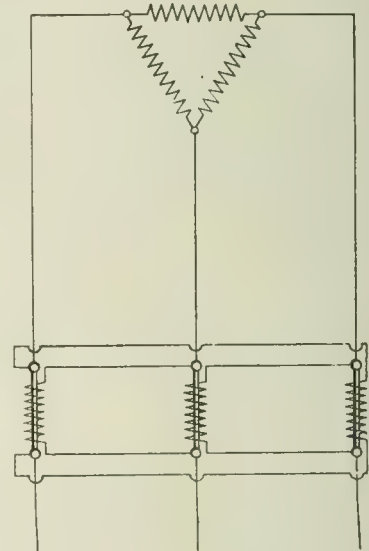
Example III.—Find the average mechanical force on three-phase busbars measuring $\frac{1}{4}$ in. x 3 in. (6.4 mm. by 7.6 cm.), in parallel planes, with an axial spacing of 6 in. (15.2 cm.) and with 10,000 amp. per phase.

Let the three busbars in a row be called *A*, *B* and *C*. The currents in them are 120 deg. apart in phase. The force on *A* caused by $I_B = 9 \times 0.96 \times \cos 120 \text{ deg.} = 4.3$ lb. per foot, average repulsion.

In calculating the repulsion on *A* caused by I_C $(s-a)/(a+b) = 3.61$ and F/F' may be assumed to be 1. Then $F = 4.5 \times \cos 120 \text{ deg.} = 2.2$ lb. per foot. The total average force on *A* = $4.3 + 2.2 = 6.5$ lb. per foot. The force on *C* is also 6.5 lb. per foot, which is approximately 75 per cent of the force in the similar single-phase circuit in Example II. The middle strap *B* is under repulsion from both *C* and *A*, and although it has a momentary force first in one direction and then in the other, the average force is zero.

Overload Circuit Opener

In patent No. 1,214,718 E. O. Schweitzer of Chicago proposes a system of fuses arranged so that if, for example, an overload current in one conductor of a three-phase circuit should operate or blow a fuse the other



WIRING ARRANGEMENT FOR OVERLOAD CIRCUIT OPENER

conductors of the system would not be receiving sufficient overload current to blow the fuses provided for their protection. The overload current in the first conductor, being permitted to persist to some extent, notwithstanding the blowing of the fuse, would in fact operate the fuses of the other conductors and thereby cut out the load on the line.

In each of the three conductors of the three-phase circuit are placed fuses which may be the ordinary type and adapted to operate or blow in the usual way upon an overload in the circuit conductors in which the fuses are respectively installed. Heating coils of resistance wire are wound about the several fuses. These heating coils are of sufficiently fine and high-resistance wire to generate heat that will melt or operate the fuses upon a predetermined overload current flowing in the coils. The heating coils are connected so as to receive currents from the circuits or conductors containing the fuses which the coils respectively include. If, then, an overload takes place in one conductor, the very drop across the fuse of the overloaded conductor provides the energy of the heating coil to melt the fuse of the neighboring conductor.

³See discussion by C. J. Barrow on "Mechanical Forces in Magnetic Fields," by C. P. Steinmetz, *Trans. A. I. E. E.*, Feb. 15, 1911, page 392.

War Surcharge on Indianapolis Power Rates

Careful Analysis of Costs Made by the Indiana Public Service Commission to Support Its Important Action in Allowing Increase in Rates to Large Customers

IN THE important decision of the Indiana Public Service Commission giving authority to the Indianapolis central station companies to increase power rates, because of higher cost of coal and other materials and labor, many facts are revealed which sustain the judgment that larger revenue was necessary.

"The evidence reveals that both petitions rest primarily, but not solely," says the commission, "on failure to get coal on contracts and on resultant advances in the cost of coal, which constitutes at present prices, according to the Merchants' Heat & Light Company, 66 2/3 per cent, and of the Indianapolis Light & Heat Company, 70 per cent of the cost of kilowatt-hours at the switchboard."

Analyzing coal costs of the companies, the commission says in part:

Testimony by the Merchants' Heat & Light Company is that when the present schedules were authorized the prices of coal used by the petitioner were: Screenings, \$0.75 per ton; mine run, \$1.10 per ton. An audit by accountants on the staff of the commission reveals that this petitioner entered into a coal contract with the Jackson Hill Coal & Coke Company on Aug. 1, 1916, for two years for its entire requirements at the following prices, f.o.b. cars at mines: Screenings, \$0.85 per net ton; mine run, \$1.10 per net ton. The petitioner, notwithstanding this contract, has had to buy great quantities on the open market, at prices ranging from \$2.95 to \$4.25 per ton, f.o.b. mines, to fill deficits in its supply and to maintain services uninterrupted.

Testimony presented by the Merchants' Heat & Light Company is that, notwithstanding its contract, many times it has been compelled to go on the open market where "price for present and future delivery is what the traffic will bear"; that, notwithstanding the coal contract during the last year, it was billed coal at prices aggregating \$123,000 in excess of the contract price; that even during the last two months, while working conditions were favorable, it unsuccessfully has tried to get the coal company to ship coal for storage purposes for use next winter, and that it faces winter without proper accumulations of coal.

This petitioner testified that it would have to estimate average cost of coal for the year ending June 30, 1918, at least at \$2.50 per ton delivered at its plant. The consumption estimated for the year ending June 30, 1918, is 251,000 tons. The contract cost would be approximately \$250,000 f.o.b. mines, or approximately \$388,000 (on the basis of present freight rates) delivered at the petitioner's plant. Estimates for the year ending June 30, 1918, place the cost at \$627,500 delivered at plant.

For the Merchants' Heat & Light Company the difference between the estimated cost for the year ending June 30, 1918, and the original contract price is \$240,000. The original contract, however, was changed in April, 1917, 25 cents a ton being added to cover increase in mining wages.

The Indianapolis Light & Heat Company showed that on July 19, 1916, it had entered into a contract for its entire supply with the Queen Coal & Mining Company, Jasonville, Ind., for a period ending April 1, 1918, at the following prices f.o.b. mines: No. 5 screenings, \$0.90 a ton; No. 5 mine run, \$1.10 a ton; No. 4 screenings, \$1 a ton; No. 4 mine run, \$1.16 a ton. The contractor met all of the requirements until during December, January, February and March, when this petitioner was forced to buy 9033 tons on the open market at an average of \$3.71 per ton f.o.b. its plant, and as high as \$5.50, delivered at the plant, was paid. The petitioner showed that the coal has become inferior as to quality; that the petitioner granted, in April of this year, an addition of 25 cents a ton to the

contract price to reimburse the mining company for advances to miners. The petitioner refused to grant another 25 cents asked by the company.

Testimony of the Indianapolis Light & Heat Company indicates that it does not anticipate that it will be able to get all of its coal requirements for the year ending June 30, 1918, on this contract; also that during the winter months it will be necessary for it to have an average of over ten carloads of coal a day; that at least coal in excess of ten carloads a day will have to be bought in the open market. The estimate presented in testimony by the petitioner for the year ending June 30, 1918, is as follows:

		F.O.B. Plant
100,000 tons on revised contract, with existing 55-cent freight rate, at \$1.85.....		\$185,000
19,000 tons during winter months to make up deficit beyond contract and also deficit caused by failure to ship ten cars a day, at \$4.....		76,000
35,000 tons additional to cover period between expiration of coal contract March 31, 1918, and end of fiscal year on June 30, 1918, at \$3.....		105,000
Amount added by petitioner, estimate of 15 cents a ton additional freight rate on hypothesis that prayer of railroads for such addition will be granted by the commission of Indiana, to make intrastate rates conform with increase in interstate rates granted by Interstate Commission (154,000 tons at 15 cents)		22,950
		\$388,950

LABOR

Testimony by the Merchants' Heat & Light Company is that common labor could be had when present rates and schedules were put into effect at 20 cents per hour; it cannot now be had at less than 27½ cents, and much of it is commanding 30 cents to 35 cents. Skilled labor could be had three years ago at 30 cents; it cannot now be had at less than 35 cents, and most of it commands 40 cents. All salaried men are receiving 10 per cent to 15 per cent more than three years ago. In the estimated operating expenses for the year ending June 30, 1918, common labor is at 37.3 per cent advance over the fiscal year ending June 30, 1915; skilled labor, 16.6 per cent; electricians, 5 per cent; salaries, 10 per cent.

The Indianapolis Light & Heat Company showed that increases in labor costs are estimated at 35 per cent for the year ended June 30, 1917, and 42 per cent for the year ending June 30, 1918, as compared, in both instances, with 1914-15. The following table presented by the petitioner shows a comparison made from its records for 1914 and 1917:

Kind of Labor	Per Cent Increase	Kind of Labor	Per Cent Increase
Switchboard operators	18.6	Coal and ash men.....	60.0
Water tenders	15.4	Steam fitters, pipe coverers, etc.	75.0
Electric repair men.....	14.3	Miscellaneous station labor.....	47.0
Firemen	25.0	Linemen	19.0
Oilers	18.0	Teams	25.0
Enginemen	18.0	Trouble men	52.0
Blacksmiths, machinists, carpenters, etc.....	37.0	Common labor	33.3

TAXES

The Merchants' Heat & Light Company showed that the local tax rate when the present rate schedule was filed three years ago was \$2.38; to-day it is \$2.69, and under circumstances existing Aug. 8 \$2.90 was estimated for the next year. The assessed valuation of the property for taxation was increased recently from \$2,625,000 to \$3,564,914, or to approximately 70 per cent of its alleged true cash value. If the assessment valuation stands and the tax rate be \$2.90, the increase in local taxes would be from \$32,723, when present rates were authorized, to \$103,382. In addition, the city franchise tax and income tax will aggregate

\$48,850, making \$152,232 for taxes. The petitioner is apprehensive that there will be additional federal taxation.

The Indianapolis Light & Heat Company showed taxes: Year ended June 30, 1914, \$88,083; June 30, 1915, \$92,661; June 30, 1916, \$84,682; June 30, 1917, \$100,470; June 30, 1918 (estimated), \$150,703. If anticipated war taxes were added the estimated total increase for 1918 over 1917 would be advanced to \$59,530.

OTHER MATERIALS

These two petitions rest primarily on increases in coal, labor and taxes. Testimony, however, showing increases in practically all other materials was presented.

The Indianapolis Light & Heat Company presented the following list of increases over prices prevailing in 1914:

	Per Cent Increase		Per Cent Increase
Boiler and Stoker Parts		Boiler and Stoker Parts	
Boiler tubes	87.0	Galvanized guy wire	95.0
Stoker parts	71.0	Cross-arms	7.0
Firebrick	15.5	Cross-arm braces (galv.)	81.0
Fireclay	77.0	Solder and tape	68.0
Brick for settings	14.0	Bolts and lags	55.0
Lubricants	46.0	Lightning arresters	36.7
Packing	11.0	Fuses	59.0
Wipers	60.0	Transformers	11.0
Steel and iron	154.0	Meters	11.0
Poles, chestnut	11.0	Cast-steel valves	70.0
Poles, cedar	13.0	Miscellaneous pipe and fittings	118.0
Insulators	23.0	Stationery and printing	25.0
Copper wire	125.0		

The Merchants' Heat & Light Company places the increased cost of copper at 188.8 per cent; of boiler tubes, 100.5 per cent to 100.8 per cent; stoker castings, 25 per cent; arc lamp globes, 147 per cent; gasoline, 1.09 per cent, as compared with the time present schedules were authorized.

Estimates submitted by the Merchants' Heat & Light Company for the fiscal year ending June 30, 1918, in which coal costs are based on \$2.50 a ton delivered at the plant, show a deficit of \$218,045 without allowance for depreciation or dividend.

Testimony and records show that the net income of the Indianapolis Light & Heat Company decreased so that during the six-month period ended June 30, 1917, there was a deficit of \$224, and that it faces much heavier losses this winter and for the fiscal year ending June 30, 1918. For the fiscal year ending June 30, 1918, it estimates a deficit of \$178,705, with no allowance for dividends.

CONSIDERATION OF PLEAS

There must be due allowance for possible redress on coal contracts with solvent, responsible mining companies, said contracts themselves being secured by bonds. There must, in light of the President's proclamation setting prices, issued since the hearing, be allowance on certain estimates, such, for example, as the estimate of \$4 a ton on 19,000 tons of coal which the Indianapolis Light & Heat Company expected to buy on the open market during the winter, and possibly on the three-dollar estimate made on 35,000 tons of coal to complete the fiscal year. There must be allowance also in considering increased local taxes as applied to a specific period ending June 30, 1918, as only a part of such increases will have accrued by June 30, 1918.

On the other hand, coal supply may become so scant as to require curtailment of operation or service, which, while possibly working a saving in fuel costs, would not relieve the companies of fixed and heavy capital charges.

The commission is impressed with the weight of testimony, evidence and investigation bearing on cost of production. On the other hand, the petitioners have not shown material increases in cost of distribution.

The average cost per kilowatt-hour generated by the Merchants' Heat & Light Company was, for the year ended June 30, 1915, 5.74 mills; year ended June 30, 1916, 5.25 mills; year ended June 30, 1917, 6.80 mills; by the Indianapolis Light & Heat Company, for the year ended June 30, 1915, 5.91 mills; year ended June 30, 1916, 4.61 mills, and year ended June 30, 1917, 5.88 mills. The summary of kilowatt-hour production cost for the Indianapolis Light & Heat Company must be submitted to analysis. The 1915 figure of 5.91 mills is high and abnormal because of readjustments, while 5.88 mills average for the year ended June

30, 1917, is lower than costs now, because of the inclusion of normal production costs of July, August, September and October last year, when the average cost was approximately 4.50 mills, which may be taken as closely approximating normal production costs.

The commission has made investigation of electric light and power rates and it reveals that the Indianapolis rates provided for power users and for large consumers of electricity for light are very low. Testimony indicates that some existing lower power rates now are "absolutely lower than the cost of coal alone to-day."

The commission does not propose to shift from public utility companies all the burden incident to the war. It does not intend to be placed in the position of levying on patrons a tax to absolve coal companies or other contractors of their obligations, and the relief granted in no wise shall be taken as making good any losses that might be recoverable from contractors.

The Merchants' Heat & Light Company has instituted legal procedure against its coal contractor to recover \$100,000 on excess price over contract prices, and an additional \$23,000 of accumulated excess prices is to be settled on the basis of the final adjudication of the original suit.

Correspondence by the commission with operators of public utilities in England since the filing of the dissolved 30 per cent surcharge petition by the Indiana Electric Light Association indicates that the petitioners are not correctly advised as to war-time policies in England as affecting public utilities. This commission is informed that public utilities are not there regulated by prescribed "governmental agencies." Public utilities get their grants from Parliament, and most private company grants contain coal clauses under which changes are automatic as coal goes up or down in price and, generally, dividend rates are also affected. Under such coal clauses many or most rates have advanced, but, this commission is informed, not uniformly or as a determined war policy of governmental agencies.

The surcharge granted on electric services figures out a very small percentage advance on consumers who are on the higher schedule of rates. For those who have a 5-cent rate the increase is 10 per cent. For a 2½-cent rate the increase is 20 per cent, but on the large users of power for industrial purposes who are obtaining such power at very low rates the percentage increase will be heavier. These larger users, however, as a rule, are enjoying war-time profits or opportunities to "pass along such extra costs of manufacture." It is difficult to impose an unfair rate upon such patrons. They differ from the small users of electricity paying the higher rates in that whenever they see that the cost of power from the central power station is higher than what they consider reasonable they adopt other means of obtaining power. In this field the public utility is always in a competitive position.

ORDER OF THE COMMISSION

It is therefore ordered that the prayer that a surcharge be authorized to be added to each bill be denied.

It is further ordered that as a measure of substantial justice between the company and its electric patrons there should be added a surcharge of 5 mills per kilowatt-hour to all bills rendered for power and for large lighting uses under rates or schedules printed or designated as standard rate "B," optional light rate "B-1," optional power rate "B-2," lighting and power rate "C," lighting and power rate "D," lighting and power rate "E," primary current rate "F," off-peak and power rate "G," commercial rate "H," additional wholesale power rate, flat power rate, and other commercial large light and power rates, and that said surcharge shall also be applied to municipal light and power.

No surcharge shall be added to bills for services rendered under the 7-cent rate carrying the 50-cent monthly minimum charge, or to bills for services rendered under suburban rates carrying higher rates and minimum charges.

The companies are authorized to put said surcharge into effect immediately, as of Sept. 1, 1917, to continue in effect on services rendered during the fiscal year ending June 30, 1918, unless modified or canceled by the commission.

The companies shall not consider this a change or modification of existing rates and schedules, but said surcharge shall be added as a separate item, so designated, to the total of bills rendered, under existing rates and schedules.

STATION AND OPERATING PRACTICE

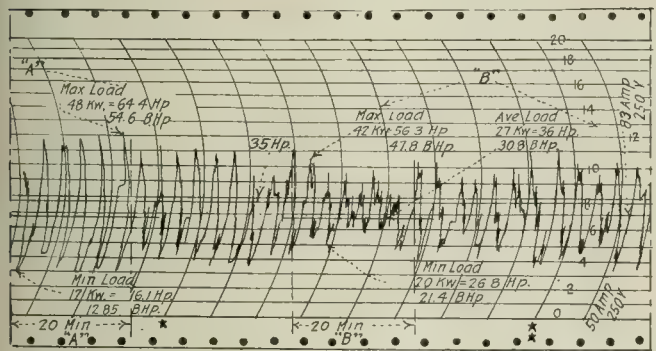
A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

MINIMIZING LOAD WITH GROUP GRINDER DRIVE

Adjusting Work Cycles so that They Overlap and Starting Grinders in Succession to Take Advantage of Flywheel Effect

BY SYDNEY FISHER

When selecting a motor to drive groups of grinding machines, care must be taken to see that the maximum capacity of the motor selected on an average power basis is greater than the sum of the loads imposed by all of the machines. The load imposed can be minimized by adjusting the work cycles so they overlap and by starting the grinders in succession to take advantage



LOAD CURVE WITH GRINDERS OPERATING UNDER DIFFERENT CONDITIONS

of their flywheel effects. The writer recently made an investigation along this line, the results being given here.

The drive consisted of twelve Hemming grinders, each machine having a cup-shaped emery wheel 16 in. (40.6 cm.) in diameter with a radial thickness of 1.25 in. (3.2 cm.) and operating at a speed of 625 r.p.m. The work feed is 1 ft. (30.5 cm.) per minute. Originally a 35-hp. motor was installed to drive six machines, but this motor was finally used to drive all twelve machines.

The machines are arranged in groups of six, each of which is operated by one man. The method of operation and the rate of feed is such that the power demand gradually increases to a maximum when all six machines are grinding simultaneously, and then gradually decreases to a minimum when the machines have finished grinding.

The two portions of the accompanying curve marked A and B indicate the variation in power demands under two different conditions of operation. During the period marked A the relative operation of the two groups is such as to cause their work cycles to be exactly in phase, while during period B they overlap. As shown by the curves, there is a marked difference in the power demand for the two conditions.

With loading A the average power is 30.8 hp., which

is less than the rated output of the motor. The peak load is 54.6 hp., which is well within the maximum overload capacity of the motor. The minimum load is 12.85 hp. Evidently there is quite a variation in power demand.

The average power with B operation is 30.8 hp., the same as that for A, the work done in each case being practically the same and the periods equal (twenty minutes). The variation in power demand is considerably less and approaches the ideal condition of a uniform load of 30.8 hp.

With intelligent operation as exemplified in B excessive current variation is obviated and higher operating efficiency is obtained. Most important of all is the lessened possibility of interruption of service due to tripping of the overload relays with excessive overload.

ELIMINATING TROUBLES AFFECTING ARC LAMPS

How Periodic Burn-outs of Lamp Mechanism Coils Were Stopped by Altering Position of Shunt-Coil Stop and Changing Coil Insulation

The cost of maintaining arc lamps on one Southern system has been reduced considerably by making a few changes in the method of repairing the lamps. About fifty coils were formerly burned out each month, and some of the lamps could not be made to work perfectly after every possible adjustment had been tried. These lamps are of the series type, some flaming arcs and some ordinary arcs, and have an operating mechanism such as shown in the accompanying diagram.

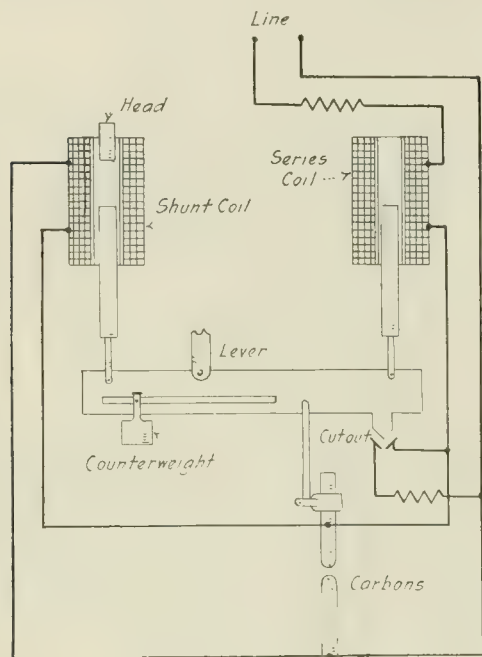
CONSTRUCTION AND CHARACTERISTICS OF ARC LAMP COILS

	FLAMING ARC			ORDINARY ARC	
	Shunt, Bad Coil	Shunt, Good Coil	Series	Shunt	Series
Diameter outside	2.3	2.3	2.5	2	2
Diameter inside	0.625	0.625	0.625	0.5	0.5
Length	5.0	5.0	5	2.5	2.5
Wire	19*	19*	12†	24†	12*
Layers	19	19	10	31	7
Resistance	6.4	6.4	0.395	44	0.21
Length of head inside coil	1.2	0.9	No head	0.25	No head
Length of armature inside coil when drawing 1/8-in. arc	2.5	2.8	2.8	1	2
Volts	70	70	70	70	70
Amp.	1.25	1.13	7.5	0.47	0.75
Ounce pull	13.0	10.4	22.5	5.2	14.2

*Double cotton-covered insulation.
†Single cotton-covered insulation.

To draw the arc to its correct length of 5/16 in. (0.80 cm.) the shunt armature must be lowered 1.3 in. (3.39 cm.). With the head set 1.2 in. (3.05 cm.) inside and the armature 1.3 in. (3.39 cm.) from the head, only 2.5 in. (6.35 cm.) of the armature is left inside of a 5-in. (12.7-cm.) coil. It was found by tests that the

pull exerted on the armature at this point was 13 oz. (0.36 kg.). However, with so great a pull the counterweight is not heavy enough even when placed at the extreme left of the lever. The head was then set only 0.9 in. (2.28 cm.) inside the coil and the armature



OPERATING MECHANISM FOR LAMPS WHICH WAS MODIFIED

extended 2.8 in. (7.11 cm.) inside when the arc was 5/16 in. (0.80 cm.) long. The pull was reduced then to 10.4 oz. (0.29 kg.) and the counterweight found sufficiently heavy to draw a 5/16-in. (0.80-cm.) arc. Besides, the current in the shunt coil was reduced from 1.25 amp. to 1.13 amp., thus reducing the heating.

After raising the coil heads a few of the lamps still operated imperfectly. It was found that this was due in some cases to having the wrong number of layers or using the wrong size of wire for the coils or the wrong thickness of insulation on the wire. Even though the number of layers in two coils is the same, if one has single cotton insulation and the other double cotton, then the current pull and resistance will be different. In the table are given the number of layers and the thickness of insulation that have been found most satisfactory. On account of giving better service the double cotton insulation is used where there is sufficient space on the spools to hold the necessary number of turns. If the space is too small the single cotton insulation is used. The size of wire on the coils and the kind of insulation are determined by inspection. To ascertain whether or not the coils have the proper number of layers, the resistance was measured, which is a fairly accurate check. After the heads were set properly and the right number of layers were put on, using wire of the right size and with the proper thickness of insulation, the lamps all operated perfectly.

When rewinding the coils two turns of 1/16-in. (16-mm.) asbestos paper were used for insulating the spindle in place of the mica sleeve used in the original winding. Formerly, after winding, the coils were painted with air-drying varnish, but this did not penetrate thoroughly and allowed the insulation to become charred, finally resulting in short-circuits between turns. This practice has therefore been changed and now the

coils are dipped in liquid bakelite and then baked for five hours at a temperature of 70 deg. C. The bakelite penetrates to the bottom of the layers and gives very good protection against disintegration of the insulation caused by the action of heat.

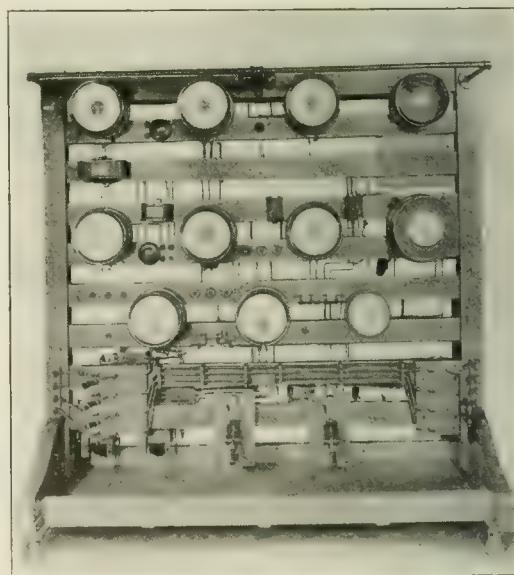
PORTABLE SWITCHBOARD USED IN UNIVERSITY LABORATORY

Designed to Help Students Study Central Station Problems—Eliminates Necessity of Assembling Portable Instruments

An experimental switchboard which has proved of great help to students at the University of Minnesota in studying central station problems, in addition to providing means for making experiments in connection with single-phase, two-phase and three-phase tests of motors, generators, transformers, controllers, etc., is shown herewith.

The switchboard is made of a skeleton wood frame mounted on 3-in. (7.6-cm.) rubber-tire, roller-bearing casters. The material is oiled red oak, which has been sandpapered and then given two coats of shellac. The equipment on the board includes a complete set of damped Westinghouse central station switchboard instruments and accessories, as follows: four current transformers, three potential transformers, one static ground detector, one alternating-current voltmeter, one frequency meter, one ammeter, one power-factor meter, one synchroscope, one polyphase wattless-factor meter, one indicating wattmeter, one direct-current voltmeter, one direct-current ammeter and two circuit breakers.

Switches are provided for the following purposes: Two for short-circuiting the secondaries of the current transformers, three for changing potential primaries, one for changing potential primaries from three-wire three-phase to four-wire two-phase, and an-



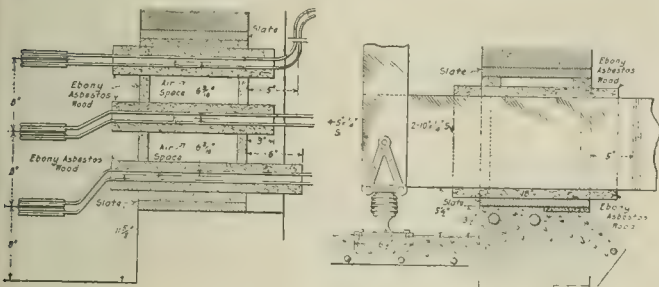
EXPERIMENTAL SWITCHBOARD FOR CLASS USE

other for short-circuiting the shunt terminals to the direct-current ammeter. A push-button is provided for the direct-current voltmeter, so that it remains ordinarily open-circuited. The board was designed by F. W. Spring, professor of electrical engineering at the University of Minnesota.

WALL ENTRANCE FOR USE WITH FLAT BUSBARS

Constructed to Prevent Admittance of Birds and Cold Air, but so that Bars May Be Well Insulated and Ventilated

To prevent birds and cold air entering its transformer room in the winter and yet give proper ventilation and insulation for outgoing busbars the arrangement shown herewith was used by a large cotton mill in



DETAILS OF BUS ENTRANCE TO TRANSFORMER ROOM

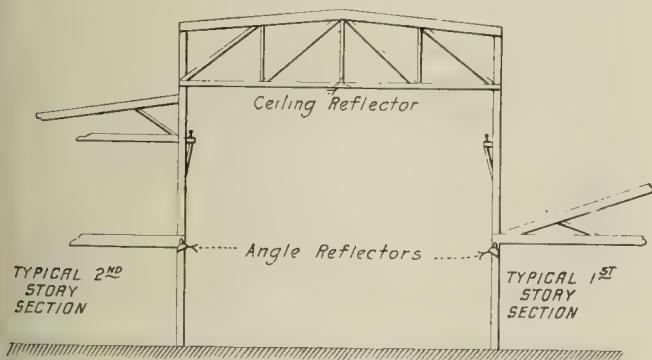
New England. Two 10-in. (25.4-cm.) by 0.25-in. (0.64-cm.) bars per leg are used in the secondary circuit where it runs through the wall, the spacing between phases being $6 \frac{3}{16}$ in. (15.7 cm.). Ebony asbestos wood is used around each pair of bars with slate between the asbestos wood and the building walls. To secure the spacing mentioned asbestos slabs are inserted as shown. The pressure on the buses is 6600 volts.

LIGHTING CRANE AREAS

Use of Angle Reflectors to Deflect Light Rays Toward the Center of the Crane-Way

BY LEO DOLKART

The lighting of crane areas in machine shops and foundries often presents a difficult problem. On account of the necessary clearance for the crane, it is customary to install the lighting units close to the roof or even with the bottom of the trusses. Owing to the



CUSTOMARY AND SUGGESTED PLACING OF UNITS

height, either 750-watt or 1000-watt lamps are necessary. In nearly all cases it will be found that better results can be obtained by the use of angle reflectors when placed about 14 ft. to 15 ft. (4.3 m. to 4.6 m.) above the floor and between the columns and arranged to deflect light rays toward the center of the crane-way. This arrangement will not only cause better distribution, but will do so at an appreciable saving in energy.

The accompanying illustration shows the customary

ceiling unit in dotted lines. The suggested units are shown in solid lines. On a floor plan these units would appear, of course, between the columns. This suggested method of lighting will be found very adaptable to ordnance buildings, where the rifling machinery is generally placed in the crane area and very close to the columns. It will be found that porcelain-enameled reflectors will give better results and at the same time will require less cleaning. Tests show that the width of the area as well as the height of the unit will determine the shape of the angle reflector best adapted for each individual case. Care must be exercised in designing such a lighting system so that no dark areas result along the floor on the center line of the building.

DISTRIBUTION OF CURRENT IN PARALLEL FEEDERS

Simple Method of Determining the Manner in Which Several Circuits Will Share a Load When New Feeders Are Placed in Parallel with Them

BY V. KARAPETOFF

Following is a simple method by which the distribution of alternating current in parallel feeders may be predetermined before laying additional circuits.

Let the resistances of the feeders be r_1, r_2, \dots, r_n , and their reactances x_1, x_2, \dots, x_n , and compute the following quantities for each feeder: Impedance, $z = \sqrt{r^2 + x^2}$; admittance, $y = 1/z$; conductance, $g = r/z^2$; susceptance, $b = x/z^2$. When underground cables and overhead lines are in parallel, some of the reactances and susceptances may be negative, according to whether the capacity reactance or the inductive reactance predominates. For the purposes of this problem either one may be assumed to be negative. The equivalent admittance of all the feeders is:

$$Y = \sqrt{(\sum g)^2 + (\sum b)^2}.$$

The percentages of the total current carried by the individual feeders are as follows: $y_1/Y, y_2/Y, \dots, y_n/Y$. The arithmetical sum of the individual currents is greater than the total current because, generally speaking, they are out of phase with one another.

To illustrate the application of this method, assume an overhead line 1 connected in parallel with an underground cable 2, and let their characteristics, in ohms and mhos per phase, be as follows:

$$\begin{aligned} r_1 &= 0.2; & r_2 &= 0.07; \\ x_1 &= 0.3; & x_2 &= -0.5. \end{aligned}$$

$$\text{Then } z_1 = \sqrt{0.04 + 0.09} = 0.36; \quad z_2 = \sqrt{0.0049 + 0.25} = 0.505,$$

$$\begin{aligned} y_1 &= 2.78; & y_2 &= 1.98; \\ g_1 &= 1.54; & g_2 &= 0.275; \\ b_1 &= 2.31; & b_2 &= -1.96. \end{aligned}$$

From which $Y = \sqrt{(1.54 + 0.275)^2 + (2.31 - 1.96)^2} = 1.85$. Therefore the overhead line carries $2.78/1.85 = 150$ per cent of the total current, and the cable carries $1.98/1.85 = 107$ per cent.

The conditions selected are extreme in that there is considerable current resonance between the overhead line and the cable. With two overhead lines or with two cables in parallel the division of the load is much more uniform.*

*For proofs and details see Karapetoff's book on "Electric Circuit."

CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

COMPANY EXTENDS INTERVAL OF RETURN LAMP RENEWALS

**Study of Operating Conditions Shows that Less than
20 Per Cent of Lamp Service Customers
Ask for Renewals Periodically**

The United Electric Light & Power Company, New York City, has made a careful study of the operating conditions in its lamp department which shows that less than 20 per cent of the lamp service customers ask for renewals when calls are periodically made by the lamp wagons.

In view of this fact, the company has extended the interval between such periodic calls upon lamp service customers from three months to four months. This, however, did not involve any change in the policy of furnishing renewals upon special request.

VALUE OF DEMONSTRATORS IN ELECTRIC RANGE SALE

**Woman Employed in This Capacity by California
Company Outlines Attitude of Women
Customers Toward Her**

Light is thrown on the question of the value of a woman demonstrator in connection with introducing the electric range into homes and keeping the ranges sold by testimony from the Southern California Edison Company, which employs a woman demonstrator to look after the customer after the range has been installed and see that she obtains the best results from electric cooking.

In a paper recently presented before the employees of the company, Miss Ebert, the demonstrator, told of the attitude of women customers toward her and her work as follows:

The demonstrator calls at the homes as soon as possible after the ranges have been installed and explains their operation. If the customer cares to have a demonstration, which is the most practical means of instruction, it is arranged for. Sometimes it consists of the cooking of a meal to show the most economical method of operation, and at other times a baking or broiling operation is all that is desired. Although there are some who hesitate to have a demonstration at first for fear their kitchen is not so modern as their neighbors' or some other trifling reason, they can be persuaded to allow you to help them. The demonstrator carries a cooking outfit with her and can supply any utensils needed. Some of the most pleased customers are people of this kind. They are always glad to have you call when returning to the district.

I am reminded of three women in one neighborhood two of whom had not desired a demonstrator and had had trouble in cake baking. The third woman, a Mrs. Crowe, had had a demonstration and was so delighted that she crowded to the other two until they were willing to have a demonstration and now they are satisfied with their ranges.

There is another attitude which a woman occasionally takes that is very amusing. She thinks the demonstrator

is sent out to teach her to cook and is quite indignant to think she should be taught to cook after years of experience. However, she soon forgets herself and realizes that she is not being instructed in cooking but in the operation of her electric range.

COMBINATION POWER RATE FOR LIMITED-HOUR SERVICE

**New Jersey Small-Town Property Rate Applicable
to All Services Not Requiring Energy Between
Dusk and 10.30 p. m.**

The Commonwealth Water & Light Company of Summit, a New Jersey town of 7500 inhabitants, has in operation a combination power rate for limited-hour service that is applicable to all services that do not require energy between dusk and 10.30 p. m.

The charge consists of two parts, namely, a service and an energy charge. The service charge per kilowatt or horsepower per month is as follows for the maximum kilowatt or horsepower demands specified:

One or less, \$1.50; 1.5, \$1.25; 2 to 4, \$1; 5 to 7, \$0.95; 8 to 9, \$0.90; 10 to 14, \$0.85; 15 to 19, \$0.80; 20 and over, \$0.75.

The energy charge is 2 cents per kilowatt-hour and is additional to the service charge.

These prices are net if paid on or before the tenth day after the mailing of the bill from the post office at Summit, and a penalty of 5 per cent is added thereto in case of non-payment on or before the said date. The demand is determined by taking the full rating of the apparatus connected unless three or more motors are installed on the same meter. When three or four motors are installed the demand for the motors is taken as being 80 per cent of the total rating of all the motors, and for more than four motors 75 per cent, provided that the rating thus obtained shall not be less than would be obtained by omitting any one or more of the said motors. When the connected load exceeds 20 hp. the demand may be determined from the readings of a maximum-demand registering instrument. When a double-throw service switch is installed, so that the maximum possible demand is limited to that part connected to one side of switch, the demand is based upon that part only.

The company will not furnish two-phase service for an installation of less than 5 hp., and for 5 hp. or more only within a limited territory. Service is furnished for motors of undesirable starting characteristics, and customers are advised to consult with the company before purchasing motors. All apparatus served under this rate has to be disconnected at dusk and not again connected before 10.30 p. m.

Twenty-four-hour service for other than lighting purposes may be had on the "limited-hour" schedule by considering each device to be so served as having four times its rated capacity.

LIST OF APPLIANCES AND THEIR PURPOSES

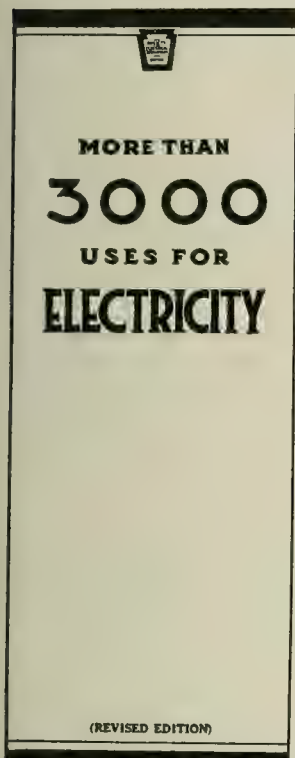
Society for Electrical Development Revises First Edition, Giving 3000 Instances Where Electricity May Profitably Be Used

Although its first edition of a list of more than 3000 instances where electricity may profitably be used in the factory, store, home, mine, in transportation and on the farm, has been out but a few months, the Society for Electrical Development has already issued a revised list.

The purpose of the publication of the list is to help systematize effort on the part of electrical salesmen, to save time and to provide an easier, better means for getting more business in each of the above classes. It is to give systematic suggestions as to how the public might use electricity to help their work—with profit to buyer and seller.

The demand for the first edition was greater than the supply, and the new edition will provide for those who were unable to receive copies of the first edition as well as meet the new demand

sure to arise in the immediate future for a book of this unusually comprehensive description.



CENTRAL STATION COMPANIES AS ADVISERS ON LIGHTING

Inadequate Illumination of Factories Indicates Manufacturers' Need of Technical Advice—Publicity for Consulting Service

BY R. W. ASHLEY

Illuminating Engineer Milwaukee Electric Railway & Light Company

Few central station companies seem to realize how much is to be gained by making an effort to co-operate with their customers in improving the lighting conditions. The revenue to be gained is not the only thing to be considered in caring for industrial lighting business. Most persons expect the central station company to advise them on power and lighting, and the demand for industrial lighting created by factory lighting legislation and conditions brought about by the war makes it almost imperative that central station companies provide one or more engineers to assist the manufacturing customers.

Manufacturers when they are about to improve their lighting installations want some one to advise them who represents a company which will insure them that the improvements will be in accordance with the requirements of the state code and who is not prejudiced against or partial to the equipment of any particular company.

If they know that the central station company has men for this purpose they will usually look to it for advice. This is indicated by data published in the National Electric Light Association reports, which show the amount of industrial work being done by the illuminating engineering division of the Commonwealth Edison Company of Chicago. This company, however, con-



FIG. 1—GENERAL ILLUMINATION FOR SHOE FACTORY

tinually advertises its illuminating engineering division so that the customers will always know that they have such service at their disposal. The advertising is of such a nature that it also gives the customer an idea of the numerous things which the engineer is able to do for him.

The accompanying photographs were taken in one of the many types of factories for which a central station company is called upon to plan the illumination. They



FIG. 2—EVEN ILLUMINATION AT WORKING TABLES

were obtained at night and show the system of illumination which the illuminating engineer of the Milwaukee Electric Railway & Light Company was called upon to plan. This is one of the first shoe factories to be illuminated throughout by general lighting.

In order that the foremen of the factory might be assured that a system of general lighting could be

designed which would give the best results, the lighting in one of the rooms was installed and tried out before the work was started in the remainder of the factory. The system is now complete and giving excellent satisfaction.

Curves and sketches like those shown herewith were used in helping the customer select a practical fixture which would give a wide spread of light on the working place and at the same time protect the eyes of the workmen from the glare of exposed lamps. The same sketches are also useful in determining the hanging height and spacing of the fixtures. The central station man handling such work is always in position to get

the result of work done by the illuminating engineering division of the central station company. Only three of the factories had men in them who knew anything about the principles of good factory lighting. Present records of the Chicago company show that as a result of the work done by the illuminating engineering division many of these factories are now improving their systems of illumination.

Judging from other data which have been collected, it is safe to assume that the foregoing summary is a fair representation of conditions throughout the country. In the near future, however, since many of the state laws demand good lighting and the demands on factories are increasing every day, the changes to systems of good illumination are going to be greatly accelerated. The manufacturers must have some one to give them advice which is in accordance with good usage of illumination and the state code. It is reasonable to expect that many of them will look to the central station company for aid. Each company should have a competent man ready to care for this work, for the manner in which such requests are handled has a reflex action upon the company either for good or for bad that should never be forgotten.

COMMERCIAL DEPARTMENT
WAR-TIME ECONOMIES

Changes in Method of Billing and Meter Reading
and Other Evidences of Effort to Keep
Down Labor Expense

Not only is the operating department to be considered in effecting war-time economies, but also the commercial departments come in for their expense pruning. It is now well recognized that expenses of every character must be carefully watched and unusual methods taken to reduce them where possible.

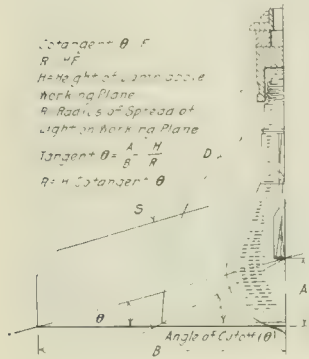
In the commercial department labor expense is the principal item that can be lowered. In a number of companies it will be found to be a case of getting along with the help left, for the army and navy have taken many men.

Combination companies have in many cases instituted a plan of having meter readers read both the gas and the electric meters and having the customer billed for both services on one bill. Aside from the saving in postage, 4 cents per account where receipt is mailed, and in stationery, there is a saving in the number of employees necessary, so that the expense per bill is cut considerably.

The practice of billing bi-monthly or tri-monthly is receiving more attention than ever before. One Middle Western company is using the bi-monthly plan with a reduced force by billing certain customers one month and the others the next. An even load is thus kept on the clerical force and the billing expense is almost cut in two.

Other economies, particularly in the direction of greater efficiency, are being instituted in matters of bookkeeping, filing, form letters, ways of billing, addressing, etc.

The reduction of delinquent accounts is also assuming more importance. Managers are paying more attention to their form letters and to their method of contact with customers.



ANGLE OF CUTOFF θ	COTANGENT F	ANGLE OF CUTOFF θ	COTANGENT F
5°	1.43	24°	2.25
6°	3.51	25°	2.15
7°	8.14	26°	2.05
8°	7.12	27°	1.96
9°	6.3	28°	1.88
10°	5.61	29°	1.80
11°	5.14	30°	1.75
12°	4.70	31°	1.66
13°	4.33	32°	1.60
14°	4.01	33°	1.54
15°	3.73	34°	1.49
16°	3.49	35°	1.43
17°	3.27	36°	1.38
18°	3.08	37°	1.33
19°	2.90	38°	1.28
20°	2.75	39°	1.23
21°	2.60	40°	1.19
22°	2.47	41°	1.15
23°	2.36	42°	1.11

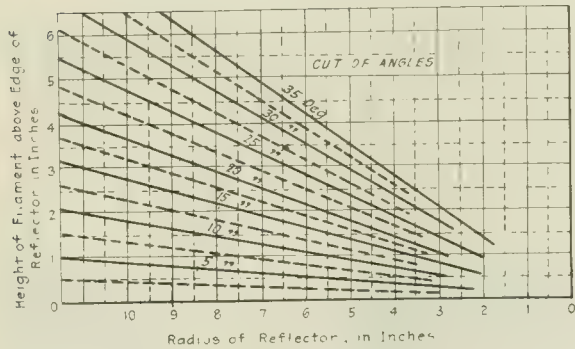


FIG. 3—GENERAL FIXTURE DATA

curves, data and photographs so that he can not only propose an installation that is right but can show the customer why it is right.

RESULTS OF INVESTIGATION IN CHICAGO

Last year the writer of this article had occasion to visit 229 factories in Chicago and inspect the lighting conditions. The factories were in a district which had at the time received no special attention. The following shows a summary of the kind of lighting installations in use:

Electric:	
Drop lights (only).....	103
Drop lights and general lighting.....	32
General lighting only.....	20
Gas and electric.....	23
Gas:	
Gas arcs.....	38
Gas arcs and open-flame.....	2
Open-flame (only).....	3
No lighting.....	8
Total.....	229

Out of the 229 factories, only forty-eight had lighting installations which could be considered adequate. Twenty-nine, or more than 50 per cent of these, were

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Estimating Direct-Current Machine Costs.—When no actual recent cost is available of an exactly identical machine, the estimating of a new size of generator or motor may entail a considerable expenditure of time, and often the costs that are at hand are not in sufficient detail to lend themselves conveniently to manipulation or admit of very close adjustments or pro ratas being made. A handy pro rata rule for obtaining the approximate cost of a new machine, given the cost totals for labor and materials of the basic machine and dimensions of the armature core of the latter and of the one to be estimated, follows: Cost of labor = $\sqrt{d^3} \times k_l$, cost of material = $\sqrt{l} \times d^2 \times k_m$, where d = diameter of core (external) in inches, l = length of core (between end plates) in inches, and k_l and k_m = constants (cost $\div \sqrt{d^3}$) and (cost $\div \sqrt{l} \times d^2$) for labor and material. These will vary according to the particular maker.—*London Elec. Review*, Aug. 17, 1917.

Generation, Transmission and Distribution

Formulas for Calculating the Heat Carried to Waste by the Flue Gases.—E. A. UEHLING.—The author derives a number of simple formulas for determining the heat carried away from furnaces by dry gases, incomplete combustion, water vapor in air, combustion of hydrogen, and moisture and water of hydration in fuel. In addition, equations are given for calculating the theoretical maximum CO₂ obtainable from fuel containing hydrogen, the percentage of excess air supplied, and the percentage of oxygen in the flue gas.—*Bulletin of Stevens Institute of Technology*, April, 1917.

Construction and Operation of Boilers for Intensive Service.—F. MÜNZINGER.—The author of this paper considers modern boiler practice from the standpoint of cheapness obtained by better utilization of constructional materials and higher stressing of the finished equipment. The influence of turbine development on boiler practice has been far-reaching. The possibility of concentrating very high power in single, compact units led to the development of two-story boiler houses. Large overhead bunkers gave way to small pockets directly the coal-handling plant became sufficiently reliable, thus eliminating much heavy ironwork and saving greatly on the size and cost of buildings. By using comparatively small and cheap feed heaters it became possible to add to over-all efficiency while cutting away that portion of the boiler which would otherwise extract heat from the cooled flue gases.—*Science Abstracts*, Section B, May, 1917. (Abstracted from *Zeits. Vereines Deutsch Ing.*, Nov. 11 and 18, Dec. 2 and 9, 1916.)

Electrification of the Riksgrens Railway.—First part of an article describing the Porjus generating plant, which is situated about 164 ft. (50 m.) underground. Space has been provided in the machinery hall for five turbines, of which four have been installed, two being

connected to single-phase generators for railway service, one to a three-phase generator and one to a spare set consisting of a three-phase generator and a single-phase generator connected together. Each turbine is rated at 12,500 hp. Later it is hoped to enlarge the machinery hall to make room for five additional sets. The machines are compounded according to the Danielson system; i.e., the compounding converter is connected to the field winding of the exciter and not to the alternator field. In this way both the compounding transformer and the converter are reduced in size, and it is easier to secure good commutation in the latter. Each generator with its transformer forms an inseparable unit, and the circuit can be opened first on the high-tension side of the transformer, where the generators are also synchronized. Pin insulators designed for 80,000 volts and having a height of 600 mm. (23.6 in.) are used on the transmission system. A couple of flanges are placed immediately below the top support for the conductors, but otherwise the insulators are smooth. Both the top and bottom supports are secured by means of clamps. The high-voltage relays consist of a motor magnet, the movement of the armature being translated to the contact device by a vertical shaft of non-conducting material in the center of the insulator.—*London Electrician*, Aug. 17, 1917.

Fuel Oil and Specifications for Purchase.—ROBERT SIBLEY and CHARLES H. DELANY.—Discussion of the fundamental characteristics of fuel oil, taking into account its physical and chemical qualities. Eleven important points which should be taken into consideration when purchasing fuel oil for power generation purposes are dwelt upon.—*Journal of Electricity*, Sept. 1, 1917.

Installations, Systems and Appliances

Electricity in Madagascar.—An account of how French enterprise has established an electric system in Tananarive, Madagascar, which is satisfactorily providing motor and lighting service in that far-away colony. In 1915 there were 853,645 m. (about 1873 miles) of high-tension and 650,769 m. (about 1046 miles) of low-tension lines (network and transmission) supplying energy to more than 22,000 customers. About 224,000 lamps and 2922 motors were connected to the lines, the motors being rated at a total of 23,188 hp. The article describes the equipment, power house, substations and transmission lines.—*Revue Gén. de l'Elec.*, July 28, 1917.

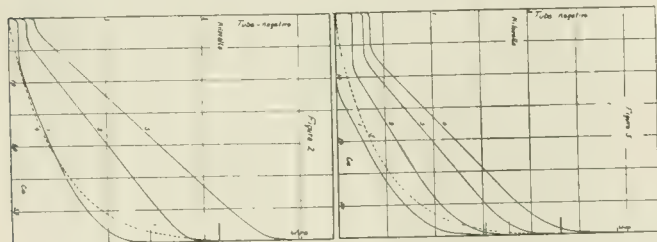
Open and Inclosed Type Fuses.—A. B. EASON.—This article deals with the question of fusing currents in open and inclosed fuses rated at 3 amp. to 100 amp. at 250 volts and 500 volts and 60 amp. to 1000 amp. at 22 volts and 40 volts, the latter being used in telephone exchange work. The open-type fuse considered in this article is one in which the fuse wire is bare and is stretched between two terminals. Along the greater portion of its length it is not in contact with any solid

body. The inclosed fuse considered is one in which the fuse wire is placed in a fiber tube, the space between the tube and the wire being filled with some form of fire-resisting insulating material of a non-hygroscopic nature. The discussion of fusing currents does not cover the semi-inclosed fuses, as it deals with two clearly defined types where the conditions of the wire are supposed to be definitely known; but it includes the case of porcelain handle fuses which hold a bare wire. The various characteristics, advantageous and disadvantageous of these two types of fuse, are summarized in this article.—*Post Office Electrical Eng. Journal*, July, 1917.

Electrophysics and Magnetism

Industrial Lifting Magnets.—J. VICHNIAK.—The lifting magnet is particularly useful for material not easily shackled, such as chips from machine tools, various structural discarded odds and ends, and also for material of regular shape of moderate weight. One unique application is in handling hot billets. These pieces, difficult to attach to the ordinary crane hook when hot, are readily raised and removed by the magnet. Special water-cooled magnets are employed for this service. To increase the capacity when lifting irregular pieces, the Couffinal works at Saint-Etienne have designed a magnet with subdivided vertically movable pole faces. These subdivided faces, by their vertical movement, conform to the irregularities of the pieces lifted and prevent lateral motion as well as increase the lifting capacity. Another special form of magnet for lifting a bundle of rods or other long pieces is provided with a linkage, somewhat after the manner of a clamshell dredge bucket, operating arms that embrace the load held by the magnet. Once in place, the magnet is de-energized and the load is transferred to the arms, thus economizing current.—*Le Genie Civil*, April 21, 1917.

Distribution of Potential in a Corona Tube.—HARRY T. BOOTH.—The distribution of potential between the electrodes of a corona tube was determined for four sizes of wire, for various pressures and potential differences. From these curves the density of the charge along the radius was derived by means of graphical methods. In general the space between the anode and the cathode may be broken up into four regions: (1)



FIGS. 1 AND 2.—DISTRIBUTION OF POTENTIAL BETWEEN NEGATIVE TUBE AND FOUR SIZES OF WIRE ALONG AXIS

A region immediately surrounding the wire, which is characterized by a very large potential gradient. This may be due to the excess of the number of ions or electrons approaching the electrode over the number of those leaving, since the former number includes ions generated at all parts of the field, whereas the latter contain only ions that are generated in the narrow layer close to the wire. Thus, the charges on the excess of negative ions near the wire disturb the electric field so that the potential difference per centimeter, or

the gradient, is large near the surface of the wire. (2) A region of approximately constant force extending from the "surface layer" region adjacent to the wire to a point which varies with the pressure, current and voltage. At the higher voltages the actual potential at a given point in this region is greater than the theoretical electrostatic potential, and the tangent to the curve may be either greater or less. Figs. 1 and 2 show the electrostatic curve (dotted), in comparison with actual curves taken. (3) A region of little or no force near the tube. In passing from the second to the third region the number of positive ions increases (since they are generated in all the space between the wire and the third region), and their charges oppose those on the negative ions to such a degree that not only the negative charges on the ions but also the electrostatic forces due to the configuration of the system are neutralized. (4) A region close to the tube, corresponding to the "surface layer" contiguous to the wire. In this space positive charges accumulated at all the remaining parts of the radial field are predominant, and there is an abrupt cathode drop at the surface of the tube. When the wire is negative and corona appears, a potential curve is obtained which differs somewhat from the positive curves. Large cathode and anode drops appear, and the intervening space has a very small field.—*Phys. Review*, September, 1917.

Electrochemistry and Batteries

The Storage Battery.—L. JUMAU.—First part of an article on the actual state of the storage-battery industry. In this installment the author discusses critically the theory recently put forth upon the functioning of the positive electrode by M. Féry, who holds that when charged this electrode becomes composed of an oxide Pb_2O_3 and that on discharge it is reconverted to PbO_2 . The author opposes to these conclusions the results personally obtained in a great number of analyses and experiments which tend to confirm the view that the positive electrode becomes self-sulphated according to the theory of double sulphating.—*Revue Gén. de l'Elec.*, Aug. 4, 1917.

Units, Measurements and Instruments

Demagnetization of Iron.—ARTHUR WHITMORE SMITH.—The proper magnetization curve for a given sample of iron is not obtained unless the iron has been completely demagnetized. Reversals of the magnetizing current at the rate of once a second may be too rapid for effective demagnetization. When preparing to demagnetize a ring of iron or other magnetic circuit the time required for the magnetic flux to become fully reversed should be determined. This is readily done by closing the galvanometer key after the reversal of the magnetizing current and noting what interval, t , is necessary in order that there shall be no deflection. For complete demagnetization the current should not be reversed faster than once in $2t$ seconds. This interval is not constant even for the same ring, but is longer in the region of greater permeability. In this region, therefore, the current should be reversed more slowly than at higher magnetizations. In every case the reversals should be slow enough to allow the flux to reach its full value before the next reversal. This rule allows faster reversals at the higher magnetizations.—*Phys. Review*, September, 1917.

Alternating-Current Bridge Method of Comparing Two Fixed Inductances at Commercial Frequencies.—T. PARNELL.—The simple Maxwell inductance bridge cannot be used conveniently for the comparison of fixed inductances on account of the tedious double balance necessary. By making use of a current detector whose deflections depend on the component of the current in quadrature with the emf. applied to the bridge it is, however, possible to make the condition for no deflection depend either chiefly on the inductances or chiefly on the

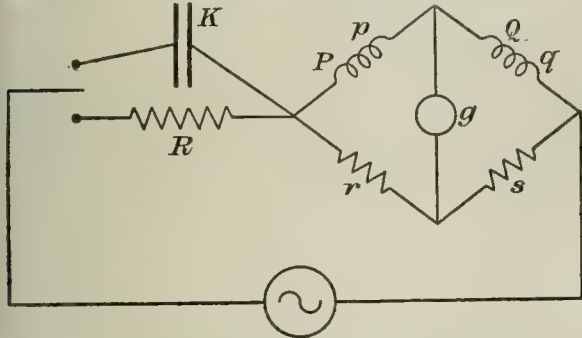


FIG. 3—APPARATUS FOR COMPARING FIXED INDUCTANCES

resistances. The arrangement of the bridge is shown in Fig. 3. With R in circuit, s is adjusted for no deflection; this gives an approximate balance for the inductances. Then, with K in circuit, q is adjusted for no deflection; this gives an approximate balance for the resistances. The process is repeated, and after a few balances values of s and q are obtained that give a balance with either R or K in circuit, in which case the bridge is completely balanced, and $P/Q = p/q = r/s$. In this way an unknown inductance can be balanced against a standard to one part in a few thousand in a few minutes.—*London Electrician*, Aug. 17, 1917.

High-Temperature Measurements with the Optical Pyrometer.—W. E. FORSYTHE.—Various methods employed in the measurement of very high temperatures are discussed, and the practical utility of one of these methods is illustrated by results secured through relatively unskilled observers.—*Gen. Elec. Review*, September, 1917.

Instruments for Electric Measurement.—H. ARMAGNET.—A historical and critical article dealing with both laboratory and industrial measuring apparatus, with indications upon the choice of instruments according to their object and the conditions of their use. In the category of laboratory apparatus, developments in the galvanometer, the manganin resistor, the cadmium standard of electromotive force, condensers of various degrees of exactitude, and series aerial condensers for wireless telegraphy are touched upon. Under the head of industrial apparatus, magnetic galvanometers, thermal, electromagnetic, electrodynamic, electrostatic and induction instruments are dealt with.—*Revue Gén. de l'Elec.*, July 28, 1917.

Telegraphy, Telephony and Signals

Internal Relations in Audion-Type Radio Receivers.—RALPH BOWN.—Experimental curves are shown from which the details of the operation of the audion as a detector in radio-telegraphy are followed. A theory of the action of the gas in the bulb is presented which explains the curves and is in agreement with all the observations. Some of the peculiar features of operation as influenced by the nature and pressure of the

gas, magnetic fields, the circuits employed, etc., are discussed in their relation to the theory and the experimental data.—*Phys. Review*, September, 1917.

Miscellaneous

Electrical Conduction in Metals at Low Temperatures.—FRANCIS B. SILSBEE.—It is pointed out that the phenomenon of critical current is a necessary consequence of the existence of a critical value of magnetic field. The relation between the two is that the critical value of the current is that at which the magnetic field due to the current itself is equal to the critical magnetic field. On account of the great experimental difficulties connected with work in this range of temperature, the quantitative data available for testing this relation are rather scanty as yet, but the data which are available are in satisfactory agreement with the theory.—*Scientific Paper No. 207*, U. S. Bureau of Standards.

Book Review

PRINCIPLES AND PRACTICE OF ELECTRICAL ENGINEERING.

By Alexander Gray. New York: McGraw-Hill Book Company, Inc. 432 pages, illus. Price, \$3.

This second edition of Professor Gray's excellent work is obviously and necessarily an outline, a sound basis for extension by the skillful teacher. One cannot make a treatise on the principles and practice of electrical engineering in any sense complete or satisfactory in detail in the compass of 400 pages, but one can do precisely what Professor Gray has successfully accomplished in setting out an outline of the principal phases of the subject and the chief apparatus necessary for the student to comprehend in such form as to be of great use to the teacher and a valuable guide to the learner through a series of lectures considerably amplified beyond actual matter given in the textbook. With this understanding of its necessary limitations, Professor Gray's book is a most useful one, the more valuable on account of a large group of well-selected problems admirably adapted to enforce the fundamental computations of the text. From this standpoint rather than by the details omitted or under-emphasized should the book be judged, and a judgment so formed is distinctly favorable. The volume is enriched by a particularly good and useful set of illustrations covering a very much wider range and of much more modern and practical character than those usually to be found in textbooks. In another edition the insertion of a carefully selected bibliography at the end of each chapter, pointing out to the student the main sources of detailed and first-hand information, would prove a valuable addition appreciated not only by those who are learning but by those who are teaching. Much of the valuable information on practical matters in electrical engineering is scattered in a way most embarrassing to one who attempts to inform himself from original sources, and these cannot be too often or too pointedly mentioned. All in all, the volume contains a very large amount of well selected and generally accurate information covering an unusually wide range of matters. Its virtues are obvious, and its one noticeable failing is that almost inseparable from so condensed a treatise, the tendency to occasional generalizations.

Scientific and Industrial Research

A Department Devoted to Interchange of Ideas, Investigations Contemplated, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF

Cornell University, Ithaca, N. Y.

FORESIGHT IN RESEARCH WORK

Some Conditions that Are Hindering or Discouraging Research and Suggestions for Their Improvement

BY W. W. STRONG

Advanced thinking and work for the welfare of a people are notoriously ill paid. These efforts may receive wide publicity and the benedictions of all thinking people, but not their money. Research work which is of this type is an absolute necessity if a nation is to be a leader in the modern world, yet the amount we do as a people compared with what we might do and ought to do is incredibly small.

Why does this condition exist? One reason is the lack of appreciation by the public. Furthermore, a very large part of our research workers are dependent upon patrons. Worthy as such patrons are, the method of endowing research should be one of the minor ways of maintaining it.

Moreover, society has failed to give place and influence to the research worker. It has thought it sufficient to give to the investigator a medal or a fellowship in some society years after his work has proved to be successful. Leaders in engineering and scientific advancement have practically no representation in the governing bodies of our cities, counties, corporations, states, or in the nation. Even universities are controlled by business men.

If tariffs and subsidies are necessary for infant industries, then wise aid is required for research work. Our patent system is antiquated, and patent litigation has injured the status of inventors immeasurably. The public utterly fails to appreciate that with the present organization of society only a small amount of research work can possibly possess any immediate value in dollars and cents. Research workers face the difficulty of the crudities of a new process or machine, the lack of commercial aids to its use and a cautious public.

What then are the remedies for this situation? The public must be educated by the press, by the platform, by the government and in the schools to the belief that research work is essential to the advancement and maintenance of civilization, that the reward for research must be more than publicity, medals, etc., and that the nation's leaders must include engineers and scientists.

Research workers should be organized. Very rarely can an old organization accomplish a new task. This new organization should not let itself become controlled by any other than research workers. In other words, research workers should not be as dependent upon business interests as they now are. The incorporation of research interests, somewhat in accordance with the idea of Dr. Cottrell, who was the originator of the Re-

search Corporation, New York City, might improve conditions. In addition, the patent system should be improved so that inventors will be protected and will benefit by their work.

Summary of Investigations, Available Apparatus and Research Suggestions

INVESTIGATIONS UNDER WAY OR COMPLETED (RESEARCH WORK REPORTED SINCE AUGUST 18)*

AGRICULTURE, ELECTRICITY IN.

Experiments are being conducted on stimulation of growth of various vegetables and oats by means of electric discharges. The apparatus consists of a discharge coil, motor-driven current interrupter and Lodge valves. The discharge wires are of steel and are suspended over the field. It is too early yet to judge about the results.—S. E. Britton, Chester, England.†

CONTROL.

An experimental investigation of a new system for automatically regulating the voltage of an alternating-current circuit (just completed).—John Alan Terrell, Rensselaer Polytechnic Institute.

ELECTROMAGNETS.

Experiments on reaction time when closing and opening the circuit.—F. E. Austin, Dartmouth College.

LAMPS.

Tungsten lamps are tested for filament fragility, either hot or cold, under successive blows given in approximately the same manner and degree as the lamp is liable to encounter under actual service conditions. Lamps are swung through an adjustable arc and are tripped automatically by means of a motor-driven triple-pendulum device. Cold breakage is noted by galvanometer deflection. Current used, 0.015 amp. Failure when hot is noted by increased amperage due to shorter filament lengths. Current used is the same as the lamp rating.—O. J. Bliss, Commonwealth Edison Company, Chicago.

SIGNALING.

Methods for signaling by day and by night are being investigated and devised for the Signal Corps. A unique system is being tried out, which promises to be successful.—F. E. Austin, Dartmouth College.

SUGGESTIONS FOR RESEARCH

CORONA LOSS.

The measurement of corona losses at high voltages in a three-phase circuit, in which the three conductors are each in turn composed of three conductors separated from one another by from 12 in. to 20 in. (30.5 cm. to 50.8 cm.). The object of this arrangement is to reduce corona loss without an excessive size of conductor. At the present time we are faced with the difficulty of using higher voltages on account of corona, especially at high altitudes, and this expedient will, I think, be a practical method of increasing the present range with comparatively little complication or added expense. Should a commercial installation come up in which this system would be helpful, it probably could not be taken advantage of at the present time on account of lack of data as to the effect on corona of the separated elements of any one phase.—P. H. Thomas, New York.

CURRENT TRANSFORMERS.

An attachment or a modification of the usual construction that would compensate automatically for the error in the ratio and the phase angle.—Editorial Suggestion.

FLUE-GAS TEMPERATURE RECORDER.

Improvements are desired in electric or other thermometers for indicating and recording the temperature of flue gases in modern power plants. The device should be capable of showing the average temperature over a large cross-section, and the exposed parts must be so made that continuous immersion in hot flue gases would not affect the accuracy of the readings. Instruments of this sort should be so arranged that they can be installed at any convenient distance between the sensitive element or the bulb and the indicating and recording device, without affecting their accuracy. They should be so arranged that checking and calibration can easily and accurately be done.—C. F. Hirschfeld, Detroit Edison Company.

LIGHTNING ARRESTER.

At present there is no satisfactory lightning arrester for use on medium-voltage lines—that is, from 11,000 volts to 45,000 volts—under conditions such as we have in Georgia. The aluminum-cell arrester is not practicable because many stations are miles away from the nearest attendant. A cheap and satisfactory arrester is also needed for the protection of low-voltage customers' watt-hour meters.—E. P. Peck, Georgia Railway & Power Company, Atlanta, Ga.

TRANSFORMERS.

The origin and effect of third harmonics of voltage and current, especially those due to star-connected transformers and to their magnetizing current. I would suggest that measurements be made on a small electric circuit representing proportionately a large power system to determine the amount of oscillation of the neutral point of a star-connected three-phase group of primary windings and how this is affected by saturation in the iron and by the load on the transformer. The investigation should also cover the effect of charging current. What might be a critical condition consists in the grounding of the neutral in an extensive high-tension system by grounding the neutral point of a single-phase bank of star-connected transformers. In such a case we might easily get a triple-harmonic charging current equal to full load of the transformer. What would be the effect of such a current on the triple harmonic of the voltage wave?—P. H. Thomas, New York.

*The names of individuals given after each institution reporting investigations are those of persons with whom others interested should communicate. All institutions reporting research work should give such names.

†Reported in the *Electrician* (London), Vol. 79, page 613.

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

HELP REMAKE THE WORLD

Leading Scientific and Engineering Schools of the Country Voice the Need of Technical Men

Thirty-eight of the leading scientific and engineering colleges of the country are engaged in advertising extensively in the leading daily papers the need which exists for technically trained men in the reconstruction of the world. It is pointed out in the advertisements that war is not only fought at the front, and that if one cannot serve there he should train himself technically to the direct production of clothing, chemicals, munitions and machinery of war. Then, when the days of reconstruction come, he can help to repair the ravages of war.

Extracts from messages delivered by President Wilson, Secretary Baker, Gen. W. N. Black, Major-General Wood and Colonel Tillman, all of which urge the young men of the country to devote themselves to the various branches of engineering education, form part of the advertisement. Attention is directed to the fact that our own railroads and industrial equipment will need rebuilding after the terrible strain of wartime and that the supply of technically trained men does not meet the demand now. When the war is over the demand will be still greater.

PENNSYLVANIA ELECTRIC ASSOCIATION CONVENES

Necessity for Increases in Rates and for Relief in the Present Coal Situation Among War Problems Considered

The tenth annual meeting of the Pennsylvania Electric Association, which was held at Bedford Springs, Pa., Sept. 7 and 8, was devoted exclusively to a consideration of the problems confronting the utilities in that State and attributable chiefly to the conditions arising from the war. It was pointed out by a number of speakers that the industry is to-day facing probably the most serious crisis in its history. The operation of various properties has become exceedingly difficult and has reached a point that tests to the fullest the optimism that has been so distinctly a part of the creed of electrical men. Aside from the address of President George B. Tripp, the only set addresses were made by Joseph B. McCall, president of the Philadelphia Electric Company; John W. Lieb, president of the National Electric Light Association, and W. D. B. Ainey, chairman of the Pennsylvania Public Service Commission.

PLEA FOR SMALLER NATIONAL CONVENTIONS

President Tripp in his address referred to the necessity for higher rates because of increased cost of operation. He was of the opinion that new conditions at

the close of the war may produce a revolution in the industry and that only by the adoption of the most efficient and perhaps drastic methods will the utilities be in a position to cope successfully with the situation.

Mr. Tripp was in favor of making the National Electric Light Association solely a clearing house for policies and a limited amount of technical, commercial and executive matters pertaining to the industry and of increasing the scope of operations of state organizations. He expressed the firm conviction that the conventions of the national body have become unwieldy and inefficient and that the big convention has outlived its usefulness. He voiced the need of a convention of accredited delegates from state sections, together with executive and special representatives of the other classes of membership in the national body. Such a convention, he felt, would make for better efficiency and a stronger association. At his suggestion the executive committee appointed a special committee to review, study and report on a uniform plan for the valuation of utility properties.

THE HIGH COST OF DOING BUSINESS

Mr. McCall before discussing the exact needs of the industry pointed out that it is incumbent upon all to uphold the honor of the country and to aid in every way to keep the wheels turning in supplying materials and supplies and aid and comfort to those who go forth prepared to make the supreme sacrifice. Discussing the present situation, he said that not only have permanent organizations been disrupted but many more demands will be made for the service of the young men in our organizations. Competition for labor has increased to such an extent that the turn-over in labor is alarming. Among unskilled laborers the turn-over in the past six months is approximated at from 200 to 300 per cent.

The coal problem, in Mr. McCall's estimation, is the most serious one at the present time confronting the central stations. In many cases the cost of coal per kilowatt-hour at the bus is practically equal to the total operating busbar cost a year ago. He advised every operating man to buy every ton of coal he could possibly put his hands on and store it, because the combination of the government's demand for coal, the frightful shortage of cars and the shortage and high cost of labor make the outlook for coal this winter serious. Costs have also mounted in other directions. From actual figures taken from purchases made by the Philadelphia Electric Company the cost of wire and cable has increased in approximately two years 138 per cent; iron poles, 100 per cent; boiler tubes, 153 per cent; chemicals, 600 per cent; hardware for pole lines, 125 per cent; lead, 140 per cent; aluminum, 144 per cent; cast copper, 142 per cent; copper tubing, 220 per cent; sheet brass, 200 per cent; steel beams and bars, 208 per cent, and structural steel sheets, 218 per cent. The cost of transformers, feeders, regulators, generating apparatus,

etc., has increased from 30 to nearly 100 per cent in the same period.

Owing to the fact that manufacturers are relying on central stations more and more for power the ordinary and normal demand has been increased enormously. But, while desperate efforts are being made to add to equipment and distribution lines, prices are at the very top notch, and the industry faces the other serious difficulty of securing capital. From this Mr. McCall led to the question of rates and the necessity for obtaining some relief from the commissions. He did not believe in organized efforts for that purpose as it has been demonstrated time and time again that each case must stand upon its own feet. However, Mr. McCall believed that any company affected by the present high costs should lay its case promptly before the commission with the facts properly stated. He recommended also that increases needed to meet present emergencies be made for power and light customers of the wholesale class rather than for the residence class.

THE STATUS OF THE ELECTRICAL INDUSTRY

Mr. Lieb told in some detail of the work of the national committee on gas and electric service and of the assistance it has been able to render the government in getting electricity to the various cantonments and how it has aided in other directions. As to exemptions of men from military service Mr. Lieb said emphasis is now being placed not on whether the man is needed by the company but whether his services are more necessary to the government in his job where he is or in the army. He also dwelt at length on the necessity for higher rates.

Because of the system of regulation to which the industry is committed and in which it firmly believes, the utilities find themselves in a position of diminished flexibility of action and diminished resiliency to meet promptly conditions created by the general industrial dislocation. Central stations are facing not only enormously increased costs for labor apparatus and supplies, but a scarcity and often the impossibility of obtaining any and all of them. Expenses are increasing much more rapidly than revenues and net returns are a diminishing quantity. Hence appeals of the utilities throughout the land for increased rates.

Mr. Lieb recommended that every company see to it that through proper avenues of expression the widest publicity be given the facts and data placed before commissions as a basis for applications for increased rates. Since claims for increases are not heard for or on behalf of groups, they must be presented by the individual company. Each company as its case is presented and its local situation unfolded should see it as a definite part of its public policy to spread the facts before its local public. Mr. Lieb is of the opinion that the industry is approaching the period when high prices for materials and labor are no longer a transitory phenomenon but apt to extend over a large period of time, so that the necessity for increased rates must be considered seriously. He said that the industry has hardly risen to a realization of what this great war really means to the nation, and it is difficult to appreciate all the sacrifices we may be called upon to make; but whatever they are, the utilities of the country are ready to do their part and none will be found more willing to make such sacrifices and to give such co-operation and

support to the government as may be necessary to bring the conflict to a successful conclusion than our own.

ELECTION OF OFFICERS

The officers for the ensuing year were elected as follows: President, Henry N. Müller, Pittsburgh; first vice-president, Thomas Sproule, Philadelphia; second vice-president, Ernest H. Davis, Williamsport; treasurer, W. R. Kenney, Connellsville; secretary, Henry M. Stine, Harrisburg. The executive committee remain the same.

JOVIAN CONVENTION WILL BE HELD AT NEW YORK CITY

Proposals of Vital Changes in Existing Method of Operation to Be Made at Annual Meeting on Oct. 22 and 23

In order to decrease the difficulty of securing the necessary quorum to transact business, the annual convention of the Jovian Order will be held in New York City at the Hotel McAlpin on Oct. 22 and 23.

In announcing the plans for the convention the following statement is made by the order:

The convention will, as of old, and as no other convention does, furnish a common ground upon which shall gather all branches in the electrical field for the charting of co-operative effort to advance those endeavors which affect the industry as a whole.

At no other period in the history of electrical development has it been as necessary as it is to-day that each branch of the industry recognize in a practical manner its interdependence with relation to all other branches and the necessity for co-ordinated effort.

In appreciation of the wonderful vehicle afforded by the Jovian Order to develop to the maximum degree this spirit of intercommunion between all divisions of the industry, a specific, thoroughly workable plan will be presented for the consideration of the convention, whereby Jovianism may be immediately employed for this helpful purpose.

This convention is of utmost importance. There will be presented for its acceptance or rejection extremely vital changes in the existing method of operation of the Jovian Order.

It is the belief of not an inconsiderable number of Jovians that upon the passage of some or all of the proposed amendments depends the future upward progress of the order.

It is needful to place especial emphasis upon this fact—no amendment can be acted upon unless not less than 20 Jovians in good standing are present at the meeting at which the amendment is voted. That number is specified by the Jovian constitution as the required quorum.

To secure this quorum it is imperative that every Jovian who can possibly attend, even at some personal sacrifice shall do so. There will be much in the convention itself that will make the effort worth while, and there are few who cannot find within New York City many ways in which to employ profitably a few extra hours afforded by the trip.

The program will include addresses by capable speakers of national and international fame on subjects bearing upon the newer problems of our industry induced by the European conflict. Throughout the business of the meeting and in a number of specific ways a note of patriotism will run, which will culminate on Tuesday evening with a simple dinner, when the newly elected officers of the order will be welcomed.

No special arrangements have been made for transportation. It will be advisable for delegates to make Pullman reservations at the earliest moment practicable. Frank E. Watts, 30 Church Street, New York City, chairman of the hotel committee, will have charge of reservations.

WAR REVENUE BILL**NOW IN CONFERENCE**

Western Members of House Believe that a Method of Imposing a Tax Upon Electricity Can Be Devised

The war revenue bill was sent to conference between the houses of Congress in the past week. The fate of provisions of this measure will depend very largely upon the members of the House who have been appointed as conferees. These are as follows: Democratic Leader Kitchin and Representatives Rainey, Dixon, Fordney and Moore. The names of the Senate conferees have already been reported in these columns.

When the House of Representatives sent the war revenue bill to conference there was some preliminary skirmishing which might seem to indicate that when the bill comes back before the House for adoption in the form of the conferees' report some attempt will be made to oppose it. There are certain differences between the House and the Senate on this bill, particularly in regard to excess profit taxes and income taxes. Members of the House of Representatives believe that a different method of raising excess profits from that which has been devised in the Senate bill could be provided by the House. Some of the Western members of the House also believe that a method of taxing electricity could be devised. The question will come up for discussion among the House conferees, who are expected before they begin their work with the Senate conferees to ascertain the final opinion of all members of the House interested in the question. The history of revenue bills in Congress, however, is that while they always originate in the House of Representatives they are usually remade and whipped into final shape in the Senate. Under these circumstances it is expected that the war revenue bill, as it has now come to the hands of the conferees, will become a law within ten days or two weeks.

MUNICIPAL ELECTRICIANS**AGAINST CONCENTRIC WIRING**

Annual Convention at Niagara Falls This Week Emphasizes Safety Promotion and Rules of Standardization

Patriotic pledges, action on concentric wiring and the National Electrical Safety Code and numerous other matters received attention from the International Association of Municipal Electricians at the annual meeting in Niagara Falls, N. Y., this week. The sessions were held in the auditorium of the Cataract House.

The association indorsed a telegram pledging support and co-operation to President Wilson which was sent by the executive committee last spring. Its president, Robert J. Gaskill, Fort Wayne, Ind., now serving with the national forces, sent an address calling upon each one to do his part. Acknowledging the greeting, the association sent messages to Mr. Gaskill and to two other members who are enlisted with the nation's defenders, A. L. Pierce, Wallingford, Conn., and George E. A. Fairley, Baltimore. Telegrams were also sent to the wives of these men congratulating them upon the readiness of their husbands to serve the national cause.

A resolution bearing upon concentric wiring was passed at the close of the second day's session on Wed-

nesday. It was offered by W. H. Flandreau, Mount Vernon, N. Y., a member of the sub-committee on bare grounded-return wiring systems of the committee on electric wiring systems, which reported March 1 last.

The resolution says that such systems have great demonstrated disadvantages and no demonstrated advantages from the standpoints of life and fire hazard as compared with present systems of wiring in this country, and that they do not comply with the rules of the National Electrical Code and the National Electrical Safety Code, which meet in a satisfactory degree all conditions obtaining in this country for the best protection of life and fire hazard conditions in step with the progress of the electrical industry. The association, therefore, unqualifiedly indorsed the findings and report of the electrical industry sub-committee on bare grounded-return wiring systems.

R. A. Smith, Norfolk, Va., offered the resolution which was passed on the National Electrical Safety Code. It provides that every member shall be furnished with a copy of the code and that the association recommend to its members that operating companies in the vicinity be requested to live up to the code as far as practicable.

ADDRESS OF THE PRESIDENT

Mr. Flandreau called the convention to order and read the address of the absent president, Mr. Gaskill, which called attention to the fact that one of the most important things in connection with the association is that it meets at a time when a number of organizations, both state and national, have abandoned their conventions under the impression that this would be economical.

"That this association had the fortitude to go ahead and arrange this meeting," said Mr. Gaskill, "shows that we are progressing. Later events, I am sure, will show that we have done the proper thing. We must realize at this time that the business of our country needs to be stimulated and enlarged so as to give the common enemy the knowledge that, in spite of the war, our industry and business will suffer in no way; and as the final winning must be by industry and business co-operation as well as by the force of arms, all things that tend to keep the industry and business on an active plane will have a salutary effect.

"There is no doubt in my mind," he added, "that we as a national association can be of immense benefit to our country. The part that we have as individuals will probably depend on our respective abilities. To some it will mean remaining in our present positions and doing better than ever before. To some it will mean changing to places in the industrial world where they will be of most benefit. To others still it will mean taking up arms and going to the battle front. But no matter what part we as individuals take, we shall all be working toward the same definite conclusion—a world democracy."

R. A. Smith, Norfolk, Va., chairman of the standardization committee, presented a preliminary report. The general plan was indorsed and the committee continued as a permanent standing body. Its report is a comprehensive outline of all of the possible activities of a city electrical department, embracing fire alarm, telegraph, police signal telegraph, construction and operation and lighting and power plants.

C. E. Corrigan, National Metal Molding Company, Pittsburgh, stated in a paper that seventy-one United States and Canadian cities are reported to have established zones in which only metallic construction is permitted.

Mr. Corrigan also said that the fine attitude of this country in fighting for democracy against autocracy without expectation of reward must leave its impress on the world for the betterment of human conditions and affairs. It would seem logical to conclude, he added, that after the great conflict is terminated this foremost republic will enter an arena of activities and importance as the model for the best expression of the individual development and advancement of citizenship and will be called upon hereafter to direct largely the world's developments.

Other papers on the program were: "Phantom Circuit Remote-Control Systems," by H. H. Reeves, General Electric Company; "Practical City Street Lighting," by Frank J. Dix, Fort Wayne, Ind.; "Renewable Types of Inclosed Fuses," by A. L. Eustice, Economy Fuse & Manufacturing Company; "Police Signaling Systems as Affecting Municipal Electricians," by E. E. Salisbury, Gamewell Fire Alarm Telegraph Company; "Buffalo's New Police Signal System," by Gustave F. C. Bauer; "The Growing Tendency Toward Surface Wiring for the Sake of Flexibility and Economy in Many Classes of Buildings," by C. W. Abbott, American Conduit Manufacturing Company, Pittsburgh; "Fire Hazards of Domestic Electrical Appliances," by W. J. Canada, Bureau of Standards, and "Common Battery Service Operating Fire Alarm Circuits," by J. B. Yeakle, Baltimore, Md.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES

**Formal Convention Held in New York City to
Satisfy the Requirement by the Constitution
of an Annual Meeting**

The annual convention of the Association of Edison Illuminating Companies was held in the Engineering Societies Building on Tuesday, Sept. 11, and was called to order by Vice-president L. L. Elden of Boston, in the absence of Major P. Junkersfeld, who is engaged in military service.

In view of the war-time conditions the convention was purely a formal one to satisfy the requirements of the constitution. No papers were read and no entertainment of any kind was provided. There was a limited representation of member companies, principally by delegates from the larger near-by organizations.

The report of the executive committee was presented, and the report of the lamp committee was presented in abstract by its chairman, John W. Lieb.

A committee was appointed to draw up resolutions in memory of the late E. H. Johnson, an honorary member of the association.

A detailed report was presented in behalf of the National Committee on Gas and Electric Service, J. W. Lieb chairman, regarding the work of the Washington headquarters, the Association of Edison Illuminating Companies being one of the national bodies co-operating with the committee.

The convention reflected war-time conditions, and

the session, lasting less than two hours, was taken up with a general discussion of conditions in the industry resulting from the state of war.

BROAD CONSTITUTION FOR ELECTRICAL CONTRACTORS

**James R. Strong Outlines the Plan for Enlarging and
Strengthening the Organization of This
Branch of the Industry**

The proposed constitution and by-laws of the National Electrical Contractors' Association, upon which action is to be taken at the annual meeting in New Orleans in October, will greatly broaden the scope and opportunities of that organization to render useful service to this branch of the industry. Adoption of the new measures will also promote the co-ordination of the industry toward which all other branches are working.

James R. Strong, Tucker Electrical Construction Company, New York, is the chairman of the committee appointed by the executive committee in Chicago on June 19 and 20 to prepare a revision of the constitution for submission at the next meeting. The other members of the committee are William L. Goodwin and Earnest McCleary.

DETAILS OF THE NEW ORGANIZATION PLAN

Mr. Strong in an interview with a representative of the ELECTRICAL WORLD explained the large purpose of the committee and the far-reaching organization which it is hoped will be developed under the new plan. The title of the organization will be changed to National Association of Electrical Contractors and Dealers.

"The revised constitution," said Mr. Strong, "will broaden the membership by providing two classes of members. The first class will be practically the old members, only electrical contractors, who will be called members. The second class, associate members, would include those who sell electrical supplies at retail as a department or minor part of their business, such as hardware stores and department stores; this class was not included under the old constitution. The change in name therefore signifies a real change, bringing in the man who sells supplies as well as the man who installs them; in other words, all of the retailers of electrical supplies as distinguished from the jobbers.

"Membership in the new national association will be held through membership in state and local associations. This plan will lead to more frequent large meetings of contractors in various parts of the country. The new constitution provides for Atlantic, Central and Pacific divisions. They will hold meetings at least twice a year, apart from the national meeting. The divisions are not legislative bodies, but they will afford an opportunity for broader views than the state meetings.

"The divisions will be composed of state associations, which will have about the same functions as the present state associations, except that they have a very important part in national affairs. The state associations in turn are composed of district associations which are divided along territorial lines, that is to say, with a city as the center and the surrounding country. The state meetings would be held twice a year and the district meetings monthly. We expect that this plan will

create a much greater interest in the districts and states in the work of the national association.

"The whole aim of the movement is to educate the contractor, to teach him that he is the retailer and that the jobber is not, to show him how to conduct his business, to fit him gradually to do the merchandising as well as the contracting part of the business, and also to teach him to demand from the manufacturer and jobber a trade protection which he has not now.

"This plan is not new in other lines of business. It is not new in our own business so far as the Pacific Coast is concerned. There this plan has been in operation for three or four years, and it has gradually become very effective and satisfactory not only to contractors but also to their allies in business, the central stations, manufacturers and jobbers.

"It is expected that through the increase in membership which is bound to come under this plan the buying powers of electrical contractors and dealers will be much enlarged and their influence will be felt more and more with other branches of trade.

"Another feature of the new constitution is the system of graded dues, by which the very smallest may be a member for \$5 and the larger payments are based on the amount of business done, making the larger man do his part in proportion to the size of his business, 'as I have every reason to believe he is willing to do.

"The national constitution also provides a form of state constitution. It is along the same lines as the national constitution, and its adoption is obligatory upon the affiliated state organizations. Amendments to the constitutions of state associations do not become operative until approved by the national association executive committee.

"The endeavor is to take all matters which involve association politics out of the hands of the association as a whole and put them in the hands of the executive committee. The object is to bring before the association meeting only matters which affect a man's real business. Therefore the entire management, it is provided, shall rest with the executive committee of seventeen members. Of these, three will be members-at-large, six will be from the Atlantic division, six from the Central division and two from the Pacific division, which is relatively smaller in numbers than the others. This committee will control the affairs and funds. It will appoint the three officers, chairman, secretary and treasurer."

The broad scope of the new organization is indicated by the following extract from the proposed constitution:

The objects for which this association is formed are:

- To promote the welfare of its members.
- To distribute among them the fullest information obtainable in regard to all matters affecting the electrical contracting and retail electrical merchandising business.
- To issue engineering and data sheets required in electrical engineering and electrical contracting problems.
- To collect data relating to the business of electrical contracting and retail merchandising.
- To aid in bringing about more friendly relations between electrical contractors and electrical retail dealers and others engaged in the electrical industry.
- To assist in marketing high-grade electrical material and apparatus of American manufacture.
- To encourage its members in establishing and conducting attractive retail electrical stores.
- To elevate the standard of electrical installations.
- To co-operate with the National Fire Protection Association with a view to improving the quality of electrical material as well as its installation.

To co-operate with the American Institute of Electrical Engineers in the solution of all electrical engineering problems—particularly the preparation of and compliance with standard specifications.

To co-operate with the American Institute of Architects in recommending standard and improved electrical specifications.

To co-operate with all wholesalers of electrical supplies in the study of distribution, standardizing of packages and catalog numbers and in reducing the expense of wholesale electrical merchandising.

To co-operate with the National Electric Light Association, its members and all other public service and municipal electric light and power companies in their endeavor to solve all problems tending to improve service to consumers.

To co-operate with the National Electrical Credit Association.

To collect and diffuse information affecting merchants, manufacturers, builders and others engaged in erecting buildings.

The proposed preamble shows the desire to conform strictly to the law:

Whereas the members of this association desire to conduct the business of the association in conformity with the law, but may from time to time, through mistake, take or decide upon action which may be considered illegal or improper; now, therefore, be it

Resolved, That any and every resolution hereafter adopted or motion hereafter carried by this association or a division or a committee hereof which in the opinion of counsel is contrary to law or to the plan of operation under which the association is then acting shall be for all purposes treated as null and void, and any and all action taken under any such resolution or motion shall be also for all purposes treated as null and void.

It shall be the duty of the national executive committee at its first meeting after election each year, the proposed constitution provides, to select from its membership the individuals to serve as chairmen in charge of the following subjects: Industrial development, universal data and sales book, National Electrical Code, membership, legislation, labor, publication, liability insurance, conventions and meetings, credit, credentials, house wiring, merchandising, jobbers, manufacturers, central stations, architects, engineers. Such member will act as chairman during the consideration of such subject.

ANNUAL MEETING OF IRON AND STEEL ELECTRICAL ENGINEERS

Seriousness Marked This Convention of Electrical Engineers Because of Their Task to Increase Iron and Steel Production

Complete electrical equipment of steel mills, the education of men and standardization of equipment were the main thoughts at the eleventh annual convention of the Association of Iron and Steel Electrical Engineers, held at the Bellevue-Stratford Hotel, Philadelphia, Sept. 10-14 inclusive. The members of the association, who are representatives of the steel mills of the country, came to the meeting in a more serious mood than ever before to discuss plans and advance ideas by which they can further the outputs of their plants in a more economical manner during the present war. Most of the plants are operating twenty-four hours per day, and electricity is playing a greater part every year. The use of electric furnaces and equipment will more than double this coming year, and methods of forwarding this movement were advanced. Central stations will also play a very important part in the steel industry.

The convention opened Monday, Sept. 10, with a business session in the morning, which included the reports of committees and the election of officers. The question of organizing a new committee, to be known as the blooming-mill committee, was discussed, but not decided at the time of going to press. The total attendance of members and guests was about 550.

The officers elected for the coming year are as follows: President, C. A. Menk, superintendent electrical department Carnegie Steel Company, Homestead Works, Munhall, Pa.; vice-president, S. C. Coey, assistant superintendent mechanical and electrical department Youngstown Sheet & Tube Company, Youngstown, Ohio; second vice-president, D. M. Petty, superintendent electrical department Bethlehem Steel Company, South Bethlehem, Pa.; secretary, J. F. Kelly (re-elected), general foreman electrical department National Tube Company, McKeesport, Pa.; treasurer, James Farrington (re-elected), superintendent electrical department La Belle Iron Works, Steubenville, Ohio.

Patriotism was the dominant note at the annual banquet, at which more than 500 guests were present. Gano Dunn, who acted as toastmaster, emphasized the solemnity of the occasion and that each one had an important part to play. The speakers were former Senator Theodore E. Burton of Ohio, F. D. Egan, president of the association during the past year, E. J. Cattell of Philadelphia, John B. Finley, Thomas Raeburn White and C. A. Menk, the newly elected president. Mr. White outlined the objects and means of the League to Enforce Peace.

At the Monday afternoon session Walter Greenwood presented a paper on "Safeguarding Electrical Equipment," and Walter C. Kennedy presented a paper on "Heroult Electric Furnaces." In the discussion of Mr. Greenwood's paper it was strongly emphasized that to minimize accidents the men must be educated to think "safety first" always. Results in the use of various types of safety appliances were given, particularly in the use of fixed stops on runway tracks to prevent cranes passing a given point intermediate between the ends of runways. The general principles that should govern, for safety, in the construction of switches brought out many interesting points. In the discussion of the second paper means for reducing skin effect of the conductors were brought out, the author pointing out that the phases should be broken up, say into six leads, with the phases interlaced. These six, or possibly twelve, leads should run from the transformer to the furnace. The delta connection should then be mounted on the furnace.

Brent Wiley presented a paper on "Factors Relating to the Economical Generation and Use of Electric Power in the Steel Industry," and Joseph McKinley and Ray L. Baker a paper on "Central Station Power Supply to the Iron and Steel Industry," at the Tuesday morning session. In the discussion it was brought out that central station companies are of more value to the steel industry than ever before as they are furnishing excellent service at low rates and are always prepared for emergencies.

A paper on "Electrical Reversing Blooming Mills," by Ralph D. Nye, was read by J. H. Albrecht, and D. M. Petty presented a paper on "Electric Drives for Reversing Rolling Mills," at the Tuesday afternoon session. The first paper gave some data pertaining to and

the results which have been secured from two typical installations. In the second paper the factors that enter into the cost of rolling steel in the mill and how these costs may be kept down to a minimum were discussed. The three items that enter into the cost of rolling steel which are affected by the drive are cost of equipment, efficiency, and reliability. To keep the rolling costs down, the author pointed out, delays must be eliminated. This is best accomplished by designing all parts of the equipment with a large factor of safety, making it simple to operate as well as easy to repair. It was suggested that the rating of reversing mill motors be standardized. The question of whether compounding characteristics are desirable in motors was argued from both sides.

"Fuel Economy by Co-operation in Establishing a Better Practice in the Operation of Stokers and Boilers," by Joseph G. Worker, and "Turbo-Generators," by Richard H. Rice, were the papers presented at the Wednesday morning session. Emphasis was laid on the point that technically trained men should be placed in every boiler plant. An operating force must be built up to take care of high-class equipment to secure results. The smaller plants, where most fuel is wasted, should study and apply methods followed by larger plants to obtain best economy in the operation of stokers and boilers.

On Wednesday afternoon E. H. Martindale presented a paper on the "Manufacture, Selection and Use of Carbon Brushes," followed by a patriotic meeting. The speakers were E. J. Cattell of Philadelphia, Harry S. Brinker, president Lehigh University; Colonel James A. Andrews, New York, and Walter Greenwood. The latter two are members of the association.

On Thursday the reports and recommendations of the standardization committees were presented and discussed. Two papers were presented on Friday, namely, "Grab-Bucket Coal Hoists Operated by Alternating-Current Motors with Dynamic Braking and Regenerative Braking," by James Farrington and R. H. McLain, and "Tool Steel Gears and Pinions for Mill and Industrial Service," by E. S. Sawtelle.

Friday afternoon was spent in the inspection of plants, automobile rides and other entertainment.

UNDERWRITERS WILL DISCUSS CODE REVISIONS NEXT MONTH

The March Meeting of the Association, Which Was Halted by Injunction, Will Reconvene in New York to Consider Changes Then Proposed

Chairman Cabot of the electrical committee of the National Fire Protection Association has issued a call for a meeting to be held in the rooms of the New York Board of Fire Underwriters, 123 William Street, New York, on Oct. 23 and 24. It will be recalled that the biennial meeting of the committee, at which changes and revisions in the National Electrical Code are considered and acted on, was summarily adjourned on March 28 a few minutes after it began owing to an injunction issued to a manufacturer of fuses. That meeting will now reconvene and consider the various reports and suggestions contained in the bulletin issued by the National Fire Protection Association under date of Feb. 15 relative to the code.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Increase in Cost Is Real, Says Maine Commission.—In dismissing a complaint against water rates of the Peaks Island Corporation, the Maine Public Utilities Commission says: "We know that the present cost of operating such a plant is very much in excess of the average cost of equally careful operation during previous years. It would be an insult to public intelligence to claim otherwise. How much more expensive it must be, or how long this condition will continue, no one can tell. But the increase is real, and public utilities, like all other undertakings, must be permitted to consider it to some extent in their rates. The fact that a corporation is a public utility is not sufficient reason why it should pay more for supplies, more for taxes, more for insurance, more for labor, more for everything that goes into the cost of operation, and receive no more for its product, although it may not be permitted to shift the entire burden to some one else. It must stop somewhere, and everybody must bear a share of the increased cost."

Potomac Power Company Rate Case.—The District of Columbia Public Utilities Commission has filed an answer to the bill of complaint of the Potomac Electric Power Company, Washington, in the rate and valuation case, hearings on which have been begun before Justice Hitz. The commission states that the report on the actual cost of the property of the company as disclosed by its records was as accurate as could possibly have been made, considering the way in which the records of the plaintiffs and its predecessors had been kept; that the unit prices applied were fair, just and reasonable, and that all intangible elements of value of every kind and character were carefully considered and received full allowance. "Notwithstanding the obstinate and unhelpful attitude of the plaintiff," continues the answer, "the commission proceeded with its work and completed the report now before the court, both as to the historical cost and reproduction cost, in accordance with the most scientific methods known to valuation bureaus." The commission states that "from its consideration of the fair value of the property of the company and its study and analysis of the rates, tolls and charges being made by the company it appeared to it that some of the rates, tolls and charges were excessive, and in fairness and justice to the public should be reduced." Concerning the contractual relations between the company and the Washington Railway & Electric Company, the commission states that this is open to the

most serious question. It avers that the contract under which the railway company would have the preferential right to receive from the power concern as much electrical energy as it might require—payment to be made at the actual cost of production, inclusive of interest at the rate of 6 per cent a year on the property of the plaintiff employed in such production—never was lived up to; that as a result of modifications in the contract the plaintiff not only received no profit on the electrical energy taken by the railway company and no interest on its investment, but that it paid more than its just proportion of the expenses of generating the power.

Service Charge in New Jersey.—The New Jersey Board of Public Utility Commissioners has denied the application of the New Jersey Northern Gas Company, operating at Hopewell, Pennington and vicinity, for permission to increase the cost of service from \$1.40 to \$1.90 per 1000 cu. ft. In the new schedule proposed by the company a fixed service charge of 50 cents per month in addition to the \$1.40 rate was suggested to make the total noted. The board held that the testimony offered did not indicate how much additional revenue the proposed increased rate would give, and that the practical result of the new rates would be to increase present charges to small consumers and decrease those to large consumers. The board also mentioned that there was no satisfactory proof that the service charge proposed by the company bears a proper relation to the cost of readiness to serve.

Large and Small Consumers.—In a recent decision affecting the Colorado Springs Light, Heat & Power Company the Colorado Public Utilities Commission says: "The consumers of the company may be divided into two general classes. The first of these classes consists of a large number of small consumers whose consumption comprises only a small portion of the annual kilowatt-hour sales. The second consists of a small number of large consumers whose consumption comprises a large portion of the kilowatt-hour sales. The rate paid by the small consumer is based very largely upon fixed charges or upon expenses which are not of a variable nature. Only a very small portion of the rate paid by such consumer is based upon operating expenses, so that as a whole the cost of serving him has not materially increased. The rate paid by the large consumer is based to some extent upon the fixed charges upon the investment in the property assignable to him, but to a greater extent upon operating expenses. The increase in the cost of coal and labor affects materially the cost of serving such a consumer, and the commission is of the opinion that the rate schedules hereinafter provided should be such that a large portion of the company's increase in operating expenses will be borne by its large consumers. The increase hereinafter provided will apply to consumers who use in excess of 85 per cent of the total output of the company."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Commission's Consent Not Required to Remove Wires on Expiration of Franchise.—The act creating the Public Utilities Commission and giving it power to regulate and control public utilities and common carriers did not repeal the statute which expressly gives the mayor and council of cities of the second and third classes the control of the streets, alleys and public grounds of such cities, the Supreme Court of Kansas held (166 P. 572). Where a franchise previously granted by a city to a public utility for the use of the streets, alleys and public grounds on which to erect an electric lighting plant for the distribution of electric light and power has expired, and the city is taking steps to cause the removal of the poles and wires which had been placed there by the public utility, the consent of the Public Utilities Commission for such removal or for the discontinuance of the service which is no longer authorized under the franchise is not required by the statutes of the State.

Prescribing Device for Measuring Quantity of Water.—Where complainant claimed that defendant was violating a grant of water-power rights, but that it was impossible to measure the excess accurately, a judgment requiring defendant to use some device for accurately measuring the quantity of water used was proper, so that it could be inspected by the plaintiff and others interested, the Appellate Division of the Supreme Court of New York held (166 N. Y. S. 311). Where parties to water-power grants practically divided among themselves the remaining water rights, each receiving the same form of deed as descriptive of the rights conveyed, one of these grants could not be construed most strongly against the grantors in the case of an ambiguity. Where a grant has been held to be of so much water as would pass through a prescribed aperture under all the head available, a judgment requiring defendant to take such water through a standard rectangular aperture of metal with square edges, which was to open into a well-secured and tight flume or bulkhead, was proper, since the grant was not capable of interpretation in terms of a constant flow of a given amount of water, because it fixed no definite head, and the effect of the prescribed aperture would regulate the flow to defendant's wheels accordingly, the aperture being a standard orifice the character of which was presumably known to hydraulic engineers at the time when the grant was originally made to the defendant.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

New Stock Offering Contemplated in St. Louis.—The Union Electric Light & Power Company, St. Louis, which sold recently \$1,000,000 of preferred stock to consumers, is considering plans for offering an additional \$1,000,000.

War-Time Values Claimed for Municipal Plant.—The city of Alameda, Cal., claims an additional value in its municipal lighting plant because of the increase in material costs during the last few years. City Manager C. E. Hewes declares that the value of the plant has increased from \$408,000 to \$600,000. His statement is based upon a report prepared by A. D. Goldsworthy.

Valuation in Washington.—The chief engineer of the Washington Public Service Commission has submitted his report on valuation of the water and electric systems of the Washington Power, Light & Water Company at Anacortes, Wash. The work was begun in April of this year. The reproduction cost of the water system is given as \$224,108 and that of the electric system as \$98,413, making the total \$322,521.

Tax Valuations in Ohio.—An announcement from the Ohio Tax Commission shows that since 1910 the tax valuation of light and power companies has been increased 856 per cent. In 1910 the valuation was \$6,387,730, and this year the aggregate is \$54,639,600. The increase over last year is \$8,465,450. The valuations of the various plants range from \$250 to \$22,099,770, the Cleveland Electric Illuminating Company total.

Cleveland Electrical League Furnishes Candy for Pershing's Men.—Recognizing that soldiers need and appreciate "sweets," the Cleveland Electrical League announced recently that it had purchased 2000 lb. of candy to be sent to General Pershing's men in France, and that 100 young women would meet in the league's rooms to pack it. For convenience in transportation the candy was packed in 20-lb. boxes. The work was done under the direction of Secretary R. S. Dunning.

35,300-Kva. Generator Started at Chicago.—The new 35,300-kva. Westinghouse-Parsons turbo-generator which was purchased about two years ago by the Commonwealth Edison Company for installation at the Northwest Station was placed on that company's system for the first time on Aug. 21. Work on the armature for the mate of this unit is nearing completion. A 35,000-kw. General Electric turbo-generator is also being erected. These three units will give the Northwest Station a total rating of 135,000 kva.

Cleveland Municipal Plant Will Get Transformers.—Within a short time the municipal light plant at Cleveland, Ohio, will receive twenty transformers on which shipment had been delayed by an embargo. Mayor Harry L. Davis had written Secretary of War Baker urging that the embargo be lifted on this particular equipment, and stating that plants making war materials would be affected if the transformers were not received soon. Several were burned out during a recent storm and there was not one in reserve at the plant.

High-Priced Coal at Trumbull, Ohio.—The Trumbull Public Service Company, Warren, Ohio, has made recently a contract for coal at \$3.75 per ton at the mine. In commenting upon this E. L. Franklin, general manager of the company, says: "This seems to be an outrageous price, but after canvassing the situation pretty thoroughly we came to the conclusion that it was the best we could do. We are not particularly pleased with our achievements in this coal contract, but we are unable to see any other way out by which we could assure ourselves a supply of coal."

Minimum Charge Increased by Municipal Plant at Cleveland.—Light Commissioner W. E. Davis of Cleveland, Ohio, has announced that a minimum charge of \$1 per month is being required of about 10 per cent of the municipal light plant patrons, while the others are still under the rule requiring a minimum of 50 cents. Those paying the larger minimum are either large consumers or persons to whom the charge is applied at the discretion of the officials. The city may also require a deposit of \$5 under rules of the Board of Control, if it is found necessary to do so.

Cincinnati to Install Boulevard Light System in Business Streets.—The construction of a comprehensive system of boulevard lighting will be begun in Cincinnati (Ohio) within sixty days. The City Council has authorized Director of Public Service Hornberger to advertise for bids for the installation of boulevard lights on Third Street from John Street to Central Avenue, and on Central Avenue from Third to Twelfth Street. Legislation authorizing contracts for the same kind of lights on Main, Vine, Walnut and Eighth Streets will be introduced in the Council in September and other streets will be considered at later meetings.

Lowering of Bond Prices in California.—The San Diego (Cal.) Consolidated Gas & Electric Company has filed with the California Railroad Commission an amendment to its recent application so as to permit it now to issue \$500,000 bonds and to pledge them at not less than 80 per cent of face value to secure an issue of two-year 6 per cent notes to be sold at not less than 98. The company also wants to sell from time to time this \$500,000 issue at not less than 88. In the original application the company estimated that its bonds could be sold at 90, but it says now that it cannot sell them at present or in the near future at this figure, or even at several points less.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

British Columbia Electrical Contractors.—The annual convention of the British Columbia Electrical Contractors was held on Sept. 11 to 15 at Vancouver, B. C. C. H. E. Williams is president of the organization.

Jovian League of New York City.—Robert Adamson, Fire Commissioner of New York City, who was recently nominated on the fusion ticket for President of the Board of Aldermen, spoke at the Jovian luncheon on Sept. 12.

Colorado Association to Hold Annual Convention.—The annual convention of the Colorado Electric Light, Power and Railway Association will hold its annual convention at Colorado Springs, Col., Sept. 20-22. T. F. Kennedy, 900 Fifteenth Street, Denver, Col., is the secretary of this association.

Annual Convention of the National Safety Council.—The sixth annual safety congress of the National Safety Council was held at the Hotel Astor, New York City, on Sept. 10 to 14. One of the special features of the congress was the National Exposition of Safety and Sanitation at the Grand Central Palace. A co-operative arrangement was made with the American Museum of Safety as the result of which there was one national comprehensive safety exhibit this year.

Electrical Contractors' Association of Massachusetts.—This association will hold its annual meeting at Worcester, Mass., Sept. 20, at the Hotel Bancroft. At this meeting William L. Goodwin of California will outline a plan which he proposes to submit to the members of the National Electrical Contractors' Association at New Orleans in October. The proceedings of the meeting will be reported to the meeting of the National Electrical Contractors' Association at New Orleans by the directors from Massachusetts.

Kansas City Society Has Outing.—The Southwest Illuminating Society, at present composed of dealers selling fixtures in Kansas City, Mo., held an outing recently that indicated the good-fellowship that prevails and the extent of the organization. The society is proceeding with its important work of developing a credit interchange department and is planning extensive educational work on cost systems. A. Viner, elected secretary at the organization meeting last April, has resigned, and James Mundstock, of the Western Chandelier Company, has been elected to succeed him. The society now has thirty members, including a few salesmen who hold individual memberships.

Frank Wright, Collingswood, N. J., has been appointed superintendent of the municipal electric lighting plant of Quakertown, N. J.

C. B. Hayden, formerly district inspector for the State Engineering Department of Wisconsin, has been appointed to succeed J. N. Cadby, who has resigned.

Charles B. Hart, former head of the new-business department of the Fort Wayne & Northern Indiana Traction Company, has been made manager of the light and power department of this company.

Boyd E. Hannon has resigned his position as manager of the Sacramento (Cal.) division of the Great Western Power Company, having enlisted in the Signal Reserve Corps of the United States Army.

J. N. Helpbringer has resigned as power plant engineer of the Firestone Tire & Rubber Company to become superintendent of power plants of the Kansas Gas & Electric Company, with headquarters at Wichita, Kan.

Ernest S. Meyers, former manager of the light and power department of the Fort Wayne & Northern Indiana Traction Company, has resigned to accept a similar position with the Vicksburg (Miss.) Light & Traction Company.

C. S. Jenner, assistant general manager Porto Rico Railway, Light & Power Company, San Juan, P. R., has resigned, to enter business on his own account. Mr. Jenner has successively held the positions of auditor, controller and assistant general manager.

D. R. Shearer, formerly engineer for the Boone Fork Lumber Company, Shulls Mills, N. C., has opened an office in the Burrow Building, Johnson City, Tenn., for the practice of engineering, specializing in the design of steam, hydroelectric and automatic power plants of several types.

John H. Lucas, who has been president of the Kansas City (Mo.) Light & Power Company since its reorganization and separation from the railway interests, has retired. Mr. Lucas had previously been general counsel for the light company and for the Metropolitan Street Railway Company, the predecessor of the present Kansas City Railways Company. He is nearly seventy years of age.

Joseph F. Porter, president of the Tri-City Railway & Light Company, Davenport, Iowa, has been made president of the Kansas City (Mo.) Light & Power Company. Mr. Porter has held the presidency of the Davenport company since 1906. In addition to being president of the Tri-City Railway & Light Company, Mr. Porter was president of the Tri-City Railway Company, the People's Light Company, the Clinton, Davenport & Muscatine Railway Company, the Moline, Rock Island & Eastern Traction Company, the Moline Lighting Company, the People's Power Company and the Moline-Rock Island Manufacturing Company. Mr. Porter was born in Harrison County,

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

Iowa, in 1863, and was graduated from the State College at Ames in 1884. Following his graduation he took part in the construction of electric lighting and street railway properties for the Edison interests and for J. G. White & Company at a number of points, among which were Des Moines, Iowa; Appleton, Wis.; Chicago; Abilene, Kan.; Kansas City, Mo.; New York City, and Alton, Ill.

Henry Nicola Müller, superintendent of distribution, Duquesne Light Company, Pittsburgh, Pa., was elected presi-



H. N. MÜLLER

dent of the Pennsylvania Electric Association at its annual convention last week. Mr. Müller was born Nov. 30, 1874, at Steubenville, Ohio, receiving his early education at public schools. He first entered the electrical profession with the Westinghouse Electric & Manufacturing Company and in 1899 joined the old Allegheny County Light Company, where he was placed in charge of electrical repairs and tests. Two years later he was appointed electrician and shortly afterward took active charge of the laboratory of the company. In 1904 he was appointed engineer of tests and later electrical engineer. On the establishment of the present distribution department in Jan. 1, 1910, Mr. Müller was appointed superintendent. Mr. Müller has taken an active interest in association work, and in addition to the N. E. L. A. section of the Duquesne Light Company, in which he takes a prominent part, he is a member of the underground and electrolysis committee of the N. E. L. A. and also of the code committee of the American Institute of Electrical Engineers.

Obituary

Dugald G. Porter, general manager of the People's Power Company of Rock Island and Moline, son of Joseph F. Porter, former president of the Tri-City Railway & Light Company, died of typhoid fever at his home in Moline, Iowa, Sept. 1.

John M. Winslow, sixty-one years of age, one of the pioneer telephone builders of the State of Washington, recently died at his country home near Silver Lake, Snohomish County. Mr. Winslow was born in Philadelphia. As a civil engineer he was engaged for a number of years in Mexico. Going to the Pacific Northwest, he settled in Tacoma, and fifteen years ago he went to Seattle to reside. Shortly afterward he purchased an interest in the old Independent Telephone Company in Everett, eventually becoming manager of the concern. When the Independent Telephone Company consolidated with the Puget Sound Telephone Company, operating in Snohomish and Whatcom Counties, Mr. Winslow became secretary-treasurer of the new company. He held this position and was active in the company's affairs up to the day of his death.

Edward H. Johnson, a pioneer in the electrical industry and one of the first presidents of the Edison Electric Light Company, New York, which was founded on Oct. 16, 1878, died on Sunday at his home in New York City in his seventy-second year. For a number of years Mr. Johnson was the personal representative of Thomas A. Edison in a commercial sense. He looked after the financial interests of the Edison companies in the 80's and had considerable influence in the early days of the industry. He was instrumental in interesting the financial interests of the country in electric light properties to the extent that they invested heavily in them. He was always working to extend the service and make it popular with the public. In many ways he was a pioneer. Mr. Johnson was not only one of the founders of the Edison electrical interests of various kinds in this country, but was also a pioneer in a most notable way in regard to the electric power industry and was for many years at the head of the Sprague motor system. He was also an advocate of interior concealed wiring, and his own private house in New York City was the first example of cove lighting. He put into use the first systems of concealed wiring through the Interior Conduit & Cable Company, developing gradually from plain paper to brass and thence to the iron tube which is now so universally in use. It is interesting to note that he was probably the first to light Christmas trees electrically. For a number of years Mr. Johnson was in Europe, where he sought to introduce electric railroading on a large scale. More lately he had taken up the introduction of paper bottles for the delivery of milk and water, in place of glass, believing that this was a development that had become inevitable and necessary.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

COPPER WIRE THE MARKET BAROMETER

General Conditions Underlying Present Demand for Wire, with Certain Indications of Tendencies Now Prevalent

One of the electrical commodities which in normal times are probably the best barometer of business in the electrical industry is copper wire. Wire shows which way the wind blows. If business is good, the demand for wire is proportionate, and vice versa. Besides, if the complexion of the market changes, the sale of wire clearly indicates it.

To-day the market for electrical goods is at its height; never has it been greater. However, the demand is not created by the regular buyers of normal times, but rather by those trades the business of which has been greatly stimulated by war conditions, the industrials. Building operations in most sections have fallen to a minimum. Government operations have been on a large scale.

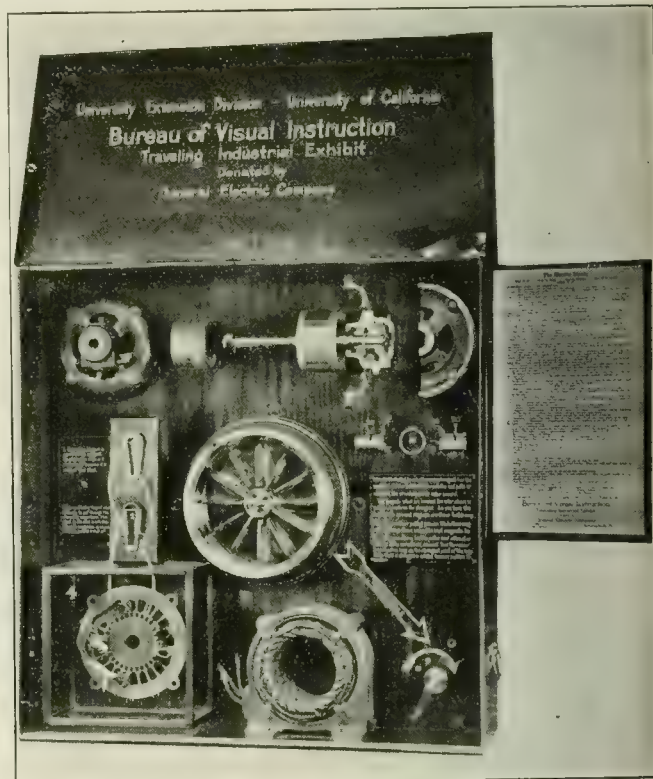
This is the character of the market for electrical goods and in like manner for wire. Wire is one of the first of the commodities to feel the effect of local conditions. In Chicago, for instance, at the present time the wire market is very uncertain because of the wiremen's strike. Demand is quiet. There is, however, a ray of hope because certain of the contractors have obtained some large contracts and are anxious to begin operations, and it is believed in some quarters that they may effect a compromise.

In neighboring cities in the Middle West, however, where local conditions are better, the wire market is responsive and business is reported as fairly good. In New York, on the other hand, where realty interests find it difficult to obtain money at a satisfactory price, the market is quiet.

Another indication of the sensitiveness of the wire market is the present condition brought about by the government's hesitation in fixing a price for copper. The wire market is very uneasy, and orders are more of the hand-to-mouth nature. Many contractors are holding off with the belief that copper may be placed at a lower figure and therefore the wire base fall. In this connection it has been hinted that even if wire base does drop a couple of cents the net price of wire will not vary because the discount may be pared sufficiently to make up the difference.

The drop in the cotton market had no apparent effect on insulated wire. For some time it has been pretty generally understood that the big controlling factor in the price of insulated wire was no longer copper. Cotton has had a very important part. However, manufacturers have laid in large stocks of cotton or have contracted for futures at high prices, so that any break in the cotton market makes no impression on insulated wire prices.

flashlamps, percolators, irons, storage batteries and the telephone. These go to grammar schools from the fifth to the eighth grades, and to night schools to a certain extent. The exhibits have been supplied by various manufacturers and are sent out to be operated by the regular teachers.



ELECTRICAL DISPLAY IN TRAVELING EXHIBITION

There is here shown the electric motor exhibition of the General Electric Company. All of the essential parts are shown, and to one side is a 10-in. by 16.5-in. sheet explaining what a motor is, what it does, how it works and how it is made.

ENGLISH ELECTRICAL MANUFACTURING OUTLOOK

Reorganization Believed to Be Necessary in the Case of Some Very Large Corporations in Great Britain

An outline of the industrial outlook in England, written by Charles H. Haddrell for one of the leading English technical journals, the *Engineer*, makes some rather interesting and perhaps significant remarks about the English electrical manufacturing industry which are quoted in the following paragraphs:

"Electrical manufacturing has never reached a satisfactory position. The majority of British electrical manufacturing companies are financial failures. Reorganizations calling for a writing down of the capital stock or for an assessment of the stockholders have been much too frequent. The remedy is to have fewer manufacturers, and each one to have sufficient strength and resources to be able

UNIVERSITY EXTENSION TRAVELING EXHIBITION

California Institution Has Educational Scheme Which Includes Numerous Products of an Electrical Nature

An educational campaign now under way in California under the direction of the University of California is far-reaching. This university extension scheme provides for the shipping around the State of a collection of educational exhibits among which are many electrical goods. The electrical subjects thus far covered are motors, ranges, lamps,

to manufacture standardized products and to educate and convince purchasers that he is working for their benefit as well as for his own.

"The electrical manufacturers have been fighting among themselves for the small home market, instead of going out into foreign markets and bringing home the trade of the world. A few powerful firms would be of inestimable value to the country, and a capitalization of from £10,000,000 to £20,000,000 for each would not be excessive. A period of from five to ten years would be required to get such concerns into a good working condition.

"Another instance of the conditions existing in the electrical manufacturing industry will demonstrate that the British manufacturer has not realized the possibilities of the industry. The production of continuous-current motors in Britain is much larger than that of alternating-current induction motors, whereas the contrary should be the case. Considering the world at large, alternating-current apparatus is predominant. All the new power stations of any appreciable size furnish power from alternators, driven either by steam turbines or by waterwheels, and although a certain amount of continuous current is supplied through converter substations, it is considerably more economical to transmit high-tension current and employ step-down transformer substations. The demand for induction motors is already great and will undoubtedly increase very rapidly. South Africa, Australia, Canada and many other countries are growing markets for this class of apparatus.

"The electrical branch of the engineering industry is now of great commercial importance, and it is rapidly becoming more important. It is very unfortunate that there are no electrical manufacturing firms that can rightly be called pre-eminent. There are many small concerns, but none comparable with the leading firms of the world. Some of the leading British firms have not paid a dividend for ten years, and it cannot be expected that capitalists will be interested in such industries."

METAL MARKET CONDITIONS

Copper Stiffens in Price on Sale of Large Tonnage to Allies at 25 Cents

The general tone of the different metal markets is uncertainty. Some metals are stronger this week and others have softened. Lead and aluminum are off, while copper and tin are higher. Copper is from a cent and a quarter to a cent and a half higher than a week ago. This advance is due to the confirmation by the copper committee of the sale of 75,000,000 lb. of copper to the Allies at 25 cents. It is consequently felt that the minimum price to be established by the government will not be less than 25 cents. It was in response to this feeling that copper rose to its present level.

Aside from the sale to the Allies the market has been dull, and normal quotations for electrolytic were as follows on Tuesday: September, 26.37½ cents; October, 26.25 cents; November, 26 cents, and fourth quarter, 26 cents.

NEW YORK METAL MARKET PRICES

	Sept. 4			Sept. 10		
	£	s	d	£	s	d
Copper:						
London, standard spot	120	0	0	120	0	0
Prime Lake	27.00	to	28.00*	27.00	to	28.00*
Electrolytic	25.50	to	25.75*	26.37½	to	26.62½*
Casting	25.00	to	26.00*	26.25	to	26.50*
Wire base	32.00	to	33.00*	32.00	to	33.00*
Lead, trust price	10.50			10.00		
Nickel, ingot	50.00			50.00		
Sheet zinc, f.o.b. smelter	19.00			19.00		
Spelter, spot	8.05			8.05	to	8.17½
Tin, Straits	61.25			61.50		
Aluminum, 98 to 99 per cent.	43.00	to	45.00*	41.50	to	42.50*

OLD METALS

Heavy copper and wire	23.00 to 24.00	24.00 to 25.00
Brass, heavy	15.00 to 16.00	15.50 to 16.50
Brass, light	12.00 to 12.25	12.00 to 12.50
Lead, heavy	9.00 to 9.25	8.25 to 8.50
Zinc, old scrap	5.50 to 6.00	5.50 to 5.75

*Nominal.

THE WEEK IN TRADE

ALTHOUGH local conditions may arise which produce disturbances in the market such as the I. W. W. agitation in the Northwest and the wiremen's strike in Chicago, in general the electrical industry has settled down to a steady business the total volume of which has never before been equaled. Just at present prices are continuing firm. The industry seems to be marking time in this respect. The government's decision regarding basic metals is eagerly awaited, and there are reasons for believing that a favorable price will stimulate certain trades, thereby increasing the demand for electrical staples. Cooking appliances advanced this week. Deliveries seem to be improving, although there may be a setback within the next month due to the movement of troops. Labor conditions show no change, nor does it seem probable that the final calling of the draft men will be very seriously felt, because by that time there will be released for the work many thousands of laborers and mechanics now engaged in cantonment construction,

NEW YORK

Business continues steady with maintained volume. The total demand is large, and both jobbers and manufacturers are very busy. As for the past half year or more, the demand has come from abnormal channels. The building trades, except in the industrials, are quiet. A meeting was set for Thursday afternoon under the auspices of the Building Material Exchange of New York to discover whether there is any fixed reason why building construction should not be permitted to proceed during war time.

There seems to be no doubt that the city is underconstructed. Recent developments point to the present market as the high-water line for prices of building materials, and in fact some materials, of which brick and steel beams and bars are instances, have already softened somewhat.

The contractors and fixture houses are suffering most acutely now from the dearth of new building. Other trades, however, are generally busy, and it is doubtful if deliveries of many of the wiring staples could be had if a large amount of new building were suddenly projected.

IRON CONDUIT.—There is little change in the conduit market. Prices are the same with no indication of a change. The government has taken practically all of the available pipe, and manufacturers' warehouse stocks in the East are reduced to almost nothing.

POLE-LINE HARDWARE.—Much better deliveries are now being obtained on braces, bolts and other similar hardware. Goods cannot be had in three to four weeks.

WALLACE LAMPS.—An advance of 10 per cent was announced for Sept. 10, on account of the cost of raw materials and labor and because of improvements in the base weight of the lamps.

FIXTURES.—Owing to the very small amount of building going on, fixture houses are experiencing very dull times. The number of apartments being built is very small.

WIRE.—On the whole local demand is quiet. What business there is is coming mostly from the industrials. There have been some orders for quite a few thousand feet of No. 14, but the amount represented in dollars and cents has been small. There has been no change in base over last week. Copper softened a bit and cotton broke a good many points, but wire manufacturers were not inclined to make any concessions.

LIGHTING GLASSWARE.—Replacement demand is very strong for new types of glassware. Fixture glass has fallen off owing to the slump in fixture demand. Although there have been a number of price advances lately, it is anticipated that another advance will take place when fires are started for the fall and winter. It is expected that considerable difficulty will then be experienced in obtaining labor and that the cost from this cause will be materially increased.

HEATING APPLIANCES.—The new prices go into effect this week. Advances took place on practically all of the

household cooking material. Toasters are now quoted at \$5 minimum. One manufacturer put 6-lb. irons up to \$5.50. Heating pads also went up. New prices now range from \$7.50 to \$8.50. There is a steady demand for appliances, principally from jobbers for small customers. Department stores are buying and central stations appear to be well stocked for the present. There has been a call from celluloid manufacturers for hotel griddles to be run on low heat for softening purposes. The recent law prohibited the use of an open flame for this purpose.

DRY BATTERIES.—Local demand is very large. One manufacturing concern reports the largest business it has ever had and that it is impossible to supply batteries fast enough to keep up with consumption. This concern is now two carloads behind in local deliveries. Flashlamp demand has occasioned a large increase in battery output. Prices have not changed since the end of June, nor is any advance expected for the next month at least.

FLASHLAMPS.—Government purchases have materially increased the demand. Every regular soldier has been provided with a flasher, and government orders have been placed in other directions. Besides, the National Guard units now stationed at different concentration camps have been large purchasers of flashlamps. During the last week or ten days a falling off in sales has been noticed, in one case as much as 10 per cent, owing to the close of the vacation period. Prices are the same as they always have been.

CHICAGO

In the Middle West business in some quarters is reported steady, while others say that the last week or two has fallen somewhat behind expectations. Prices remain about the same, except that copper is a little weaker. There is no noticeable change in credits and collections. Industrial business continues to be the most important factor in the market, although it is said that some central stations and telephone companies are purchasing equipment needed to put their lines in shape to withstand the rigors of the coming winter.

The National Bank of the Republic, Chicago, in its "Review of Business" under the date of Sept. 5, has the following to say regarding business in general: "The readjustment of business to a war basis is proving more protracted than was at first anticipated. While business interests generally agree that profit should yield precedence to patriotism, the continued delay in making known the exact extent of governmental price control and taxation has reduced the buying of the country to a hand-to-mouth basis. . . . Thanks to the quiet placing of huge government contracts and to the generous bookings of civilian business of past months, industrial activity shows no diminution. The hardships imposed on manufacturers and merchants by the slow delivery of essential materials and manufactured goods are being gradually eliminated as a result of the supervision exercised by the Railroad War Board over the loading and movement of freight."

WASHING MACHINES.—Every washing machine manufacturer, large and small, is working his plant to the limit of its capacity. Jobbers claim that the washing-machine business is especially good in the Middle West, because jobbers are pushing washing machines harder than they ever did before. Although the washing machine is one of the highest-priced household electric devices, it is enjoying the greatest popularity of all of them just now.

POLE-LINE EQUIPMENT.—There is some buying by companies wishing to put their lines in shape for the winter, but owing to the high prices the fall demand is considered sluggish.

COPPER WIRE.—Some jobbers are selling on a 37-cent base, and some on a 35-cent base. The market looks weak, this tendency being created by the fact that it seems the government will establish a 25-cent base.

ELECTRIC RANGES.—The fact that some business in electric ranges is still being booked appears to strengthen the argument that these devices have passed the stage where the market is entirely a seasonable one.

DRY BATTERIES.—Jobbers report that business in dry batteries is good, in spite of high prices.

INCANDESCENT LAMPS.—Stocks of incandescent lamps, especially in the smaller sizes, are still very low, owing to the inability of factories to meet the demand. The type C lamp, which is needed most in industrial lighting, is much easier to get than the smaller sizes.

BOSTON

Business continues in heavy volume as the fall trade opens in lines of electrical products associated with industrial service. Jobbing interests report a slight falling off of orders in some localities, but the increasing demands of the war are likely soon to offset any reduction in total business so far in sight. This fall the distorting effect of the war upon business is more apparent; some branches of trade are stimulated beyond previous expectations, while others are affected adversely. The time has now come when further postponement of renewals in the street-lighting field cannot be long extended, and business is brisk in reflectors and ornamental poles. Price advances of \$1 to \$1.50 were scheduled for Sept. 15 on many kinds of electric heating apparatus, but little fear is expressed by the more progressive central stations that the public will fail to absorb this increase without difficulty. Some improvement in inquiries for electric ranges is noted. In most lines of work deliveries are little if any better. The labor situation is improving with the settlement of the strike of Boston & Maine shopmen this week, and the gradual mobilization of drafted men at the cantonments is unquestionably giving employers time to make better adjustments of their organizations than would have been the case had the European methods of assembly been followed. Collections are about the same as last week. Some increase is noted in the wiring of large residences, but new construction in the residential field is still far below normal. The prospects at this writing are rather poor for residential wiring this fall. Motor-driven coal-loading machinery is in great demand.

APPLIANCES.—Business is excellent, despite price increases. Light, portable electric cooking devices are increasing in favor. The trade in heating pads is very promising with respect to early fall, current fuel prices undoubtedly stimulating these.

REFLECTORS.—Street-lighting business is better than last year. Few large jobs are being handled, but replacement orders are numerous and deferred extensions of local service are being completed. Prices are somewhat higher than last year, but there is no indication of any further advance, despite increasing cost of materials and transportation.

VAHEY FAULT LOCATORS.—The Lundin company reports its entire stock sold out, with a brisk demand for these testing sets.

STREET-LIGHTING ORNAMENTAL POLES.—Quotations are being made for immediate use only. Demand is heavy and materials are difficult to obtain on anything like satisfactory deliveries.

FANS.—Movement in fans is very dull, pending the return of a belated warm spell. Some central station buying at costs warranting carrying fans over until next season is reported.

MOTORS.—Diverse reports are in hand as to motor scarcity. Some of the larger central stations maintaining substantial motor stocks appear better satisfied with the situation than for some time. The industrial demand is still very large in volume. On the whole, it appears as though at least a temporary improvement could be recorded in the delivery situation of standard sizes of motors.

WATERWHEEL GOVERNORS.—Deliveries are improving and factory stocks are increasing in this equipment. At present deliveries of governors are on a better basis than of waterwheels. Plants are active in filling orders, but owing to prevailing dullness in new hydroelectric plant construction the outlook for new business is at present rather unsatisfactory. Unquestionably the restrictive policy of the government with respect to water-power development affects

the situation adversely. There is a healthy demand for small waterwheels, but large work is not at present coming forward as it would under proper government policies. Manufacturing interests report serious reductions in their forces due to volunteering and the draft, coincident with the falling off of new business. Prices are high. Proposals have been in great demand during the last four months.

WIRE AND CABLE.—Deliveries are very poor in many lines, compared with normal times. Government orders are very active. Railroad embargoes are impeding industrial movement except in connection with military service.

LAMPS.—The lamp situation is better than a year ago, larger stocks being carried by jobbers and manufacturers. Predictions are unsafe, however, owing to the large numbers of employees of manufacturing plants entering military service, and transportation facilities are such that further restriction may be placed on shipments, with resulting possibility of shortage in the late fall or early winter. It is unlikely that the lamp business of 1917 will show the expansion of a year ago, and it is rumored that the government may soon address central stations, municipal plants and electric railways urging them to decrease the use of light as much as possible for the present.

FLASHLIGHTS.—An excellent vacation trade in this apparatus is reported. Substantial buying for army and navy service is noted.

STEAM PLANT CONDENSING EQUIPMENT.—Demand is very heavy. Deliveries are not improving, and industrial business of quasi-war origin holds the center of the stage. No present signs of improvement are recorded, despite high price levels.

ATLANTA

General business is decidedly good, and practically all factors in the Southeast continue in large volume and high activity. Although labor was scarce and material was high, Atlanta nearly doubled the value of its building operations for August as compared with the same month of last year. The value of building permits for the first eight months of this year as compared with the first eight months of 1916 showed a gain of \$1,348,000. There are a number of buildings, mostly of the residential type, being planned in local offices of architects. Work is expected to start on them as soon as cantonment work ceases, easing up on the labor situation and releasing hundreds of skilled laborers.

The Georgia Railway & Power Company expects to complete its single track to Camp Gordon by Oct. 15, and the entire double track by the time the new rotary station is completed near Buckhead. This extension calls for approximately 10 miles of track.

Electrical work at Camp McLellan, Anniston, Ala., was held up temporarily owing to lack of material, but at the present time work is progressing satisfactorily in every direction.

The double track from Montgomery, Ala., to Camp Sheridan for trolley operation will be completed in thirty days, it is reported.

All wiring and electrical installation work at Camp Gordon, Atlanta, is progressing nicely. Contractors report electrical work 70 per cent completed.

TEXTILE MOTORS.—The pressure in this line has almost decreased to a point of dullness. While the erection of a number of new mills is contemplated, there is a good deal of hesitancy with respect to new undertakings, doubtless due to the question of price fixing. Then, too, the uncertainty of the coal situation has effected the central station power business, in that the mechanically driven mills are awaiting new coal prices before purchasing motors at present prices and deliveries.

WIRING SUPPLIES.—Manufacturers report an exceptionally good business for this week. No change in prices has been reported and deliveries remain about the same.

INSULATED WIRE AND CABLE.—The demand is good for nearly all standard sizes of wire, but a slight decrease in inquiries is noted for larger cables. This line has enjoyed a very active year to date; in fact, authentic sources report an increase of 50 per cent for the first eight months of the year as compared with 1916.

LIGHTNING ARRESTERS.—Sales for the Southeast covering the last thirty weeks are away above last year. Normally this line has a steady market, but this year's business has set a new record.

INDUSTRIAL CONTROL EQUIPMENT.—Business continues unusually active and the outlook is decidedly favorable. Sales are running 10 per cent above last year. Deliveries are slowing up.

LARGE APPARATUS.—Manufacturers report a number of inquiries received, but they cannot improve long promises on shipment. A few large deals are pending which will probably be closed very soon.

POLE-LINE MATERIAL.—The call for hardware, glass and porcelain insulators is steady and prices remain firm.

COPPER.—Comparatively firm, but with slight indications of weakness from certain sources.

SEATTLE

Dealers in Seattle and immediate vicinity report no noticeable increase or decrease in sales over last week. Business is satisfactory, considering conditions, which are unsettled in general. No particular line boomed during the week, although the sale of lamps is expected to increase because of the heavy fall rains and the dark days which have started. Some difficulty is being encountered in obtaining and retaining a stock of lamps. Prices along all lines remain steady, with no noticeable increase. Freight conditions are easy, there being no trouble experienced in this connection. Pole and cross-arm dealers are obtaining plenty of poles and cars, but are having serious difficulty in securing and holding crews to do their work. Former fall activity, according to large dealers, will not materialize. Sales do not warrant heavy buying for stocks, and dealers will not load up at top prices. Enough will be purchased to fill demand, which will increase somewhat when mills and logging camps resume full operations. No decrease in demand is anticipated. Any change will be upward. Building is at a standstill, with no indications of resumption in Seattle. Portland reports building operations for August 50 per cent less than for August last year. It is believed that this ratio in most cases will apply to nearly every city in the Northwest, with the exception of Spokane.

Credits and collections are satisfactory. The week saw a general resumption in lumber cutting throughout the State, according to mill and camp operators. Labor organizations on strike deny this, and say that the strike is all but won. Some mills, however, are running on a ten-hour basis, and the market has visibly stiffened. The failure of lumber manufacturers to deliver their orders to the Alaska Railway Commission may result in delaying construction of the line.

CONDUIT.—Demand from shipyards is steady, with indications of an increase when protected yards begin operations. Prices are firm.

HOUSEHOLD APPLIANCES.—It is believed that the demand will increase materially with the closing of the summer season. Certain large dealers will push sales on some lines.

INDUSTRIAL EQUIPMENT.—Demand for motors, wire, cable and the like will increase at the end of the present lumber difficulty.

SAN FRANCISCO

Business in general was very good last week, industrial demands being particularly active. Demands for heating appliances continue to show improvement. Orders for electric ranges from the country and from suburban towns show a noticeable increase, though city trade is light. Washing-machine demand continues to improve, probably owing to lack of household help, which has created an active demand for electrical appliances to lessen the burden of service. Business in flashlights is good owing to their use by soldiers in the various encampments and to the fact that they are sent by friends to soldiers who have already left the city. Small dealers are carrying good stocks of socket devices and are prepared to take care of present and future needs. Collections show a steady improvement right along.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor		List, per 1000 Ft.
B. & S. Size		
No. 14 solid.....		\$61.00
No. 12 solid.....		71.00
No. 10 solid.....		90.00
No. 8 solid.....		106.00
No. 6 solid.....		145.00
No. 10 stranded.....		95.00
No. 8 stranded.....		115.00
No. 6 stranded.....		160.00
No. 4 stranded.....		205.00
No. 2 stranded.....		266.00
No. 1 stranded.....		315.00

Twin-Conductor		List, per 1000 Ft.
No. 14 solid.....		104.00
No. 12 solid.....		135.00
No. 10 solid.....		185.00
No. 8 stranded.....		235.00
No. 6 stranded.....		370.00
No. 4 stranded.....		575.00

NET PRICE PER 1000 FT.—NEW YORK

Single-Conductor		Less than coil.....	Coil to 1000 ft.....
No. 14 solid:		\$54.90 to \$61.00	48.80 to 59.17
No. 12 solid:		63.90 to 71.00	56.80 to 68.87

Twin-Conductor		Less than coil.....	Coil to 1000 ft.....
No. 14 solid:		\$78.00 to \$104.00	75.00 to 80.00
No. 12 solid:		121.50 to 135.00	108.00 to 130.95

DISCOUNT—CHICAGO

Single-Conductor		Less than coil.....	Coil to 1000 ft.....
		+10%	-10%

Twin-Conductor		Less than coil.....	Coil to 1000 ft.....
		+10%	-10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	-10% to 12%
1/5 to std. pkg.....	10% to 20%
Std. pkg.....	34% to 44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+20% to 12%
1/5 to std. pkg.....	Net to 20%
Std. pkg.....	30% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28	.29

BATTERIES, DRY—Continued CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 30.....	.35	.35
50 to barrel.....	.3175	.3275
Barrel lots.....	.2875	.2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less than Coil	Coil to 1000 Ft.
3/8-in. single strip.....	\$67.50 to \$75.00
3/8-in. double strip.....	71.75 to 75.00
1/2-in. single strip.....	90.00 to 100.00
1/2-in. double strip.....	95.00 to 100.00

NET PER 1000 FT.—CHICAGO

Less than Coil	Coil to 100 Ft.
3/8-in. single strip.....	\$75.00
3/8-in. double strip.....	78.75
1/2-in. single strip.....	100.00
1/2-in. double strip.....	105.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
3/4.....	.15	2.....	.55
1.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$55.00	\$24.50-\$25.50
1/4-in.—	\$40.00-\$60.00	\$27.00-\$30.00

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$36.65 to \$55.00	\$27.50
1/4-in.—	\$40.00 to \$60.00	\$30.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List	Elbows, List
1/4.....	\$0.05
3/8.....	.06
1/2.....	.07
3/4.....	.10
1.....	.13
1 1/4.....	.17
1 1/2.....	.21
2.....	.28
2 1/2.....	.40
3.....	.60

DISCOUNT—NEW YORK

Less than 2500 lb.....	3.8% to 8%	5.8% to 10%
2500 to 5000 lb.....	6% to 11%	8% to 13%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

Less than 2500 lb.....	3.8% to 8%	5.8% to 10%
2500 to 5000 lb.....	6.8% to 11%	8.8% to 13%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

Net.....	\$3.50
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CHICAGO

Net.....	\$3.75 to \$4.20
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FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	.28%
1/5 to std. pkg.....	.38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	.28%
1/5 to std. pkg.....	.38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.75 to \$6.30
1/5 to std. pkg.	4.50 to 5.25
Standard package, 500.	List, each, \$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500.	List, each, \$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt-B	100	\$0.27
60-watt-B	100	.36
100-watt-B	24	.65
75-watt-C	50	.65
100-watt-C	24	1.00
200-watt-C	24	2.00
300-watt-C	24	3.00
Round bulbs, 3 1/4 in., frosted:		
15-watt-G 25	50	.50
25-watt-G 25	50	.50
40-watt-G 25	50	.50
Round bulbs, 3 1/2 in., frosted:		
60-watt-G 30	24	.72
Round bulbs, 4 1/4 in., frosted:		
100-watt-G 35	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$30.00 to \$34.88
Coil to 1000 ft.	21.00 to 26.52

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$37.20
Coil to 1000 ft.	27.90

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	\$15.00 to \$29.00
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CHICAGO

Net per 100	\$14.58 to \$34.00
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OUTLET BOXES

	List, per 100
Nos.	
101—A, A1 1/2, 4 S.C., 6200, 320	\$30.00
102—B.A., 6200 S.E., 300, A.X. 1 1/2,	
4 S.	30.00
103—C.A., 9, 4R. B 1 1/2	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list	List to 33%	List to 27%
\$10.00 to \$50.00 list	List to 42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list	40%	35%
\$10.00 to \$50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$14.00 to \$20.00
1/5 to std. pkg.	13.00 to 15.00
Standard package, 2200.	List per 1000, \$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80 to \$20.54
1/5 to std. pkg.	14.80 to 19.24
Standard package, 2200.	List per 1000, \$20.

PORCELAIN KNOBS

NEW YORK

	Std. Pkg.	3500.	Std. Pkg.	4000
Per 1000 Net	5 1/2 N.C.—Solid Nail-it—N.C.			
Less than 1/5 std. pkg.	\$10.50 to \$18.00			\$28.00
1/5 to std. pkg.	9.75 to 11.10			21.50

CHICAGO

	Std. Pkg.	3500	Std. Pkg.	4000
Per 1000 Net	5 1/2 N.C.—Solid Nail-it—N.C.			
Less than 1/5 std. pkg.	\$11.85			\$30.75
1/5 std. pkg.	11.10			24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/2-in. cap key and push sockets	500	\$0.33
1/4-in. cap keyless socket.	500	.30
1/2-in. cap pull socket.	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No. Fuse

	List
High Grade:	
30-amp. S. P. S. T.	\$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	List to	%
High Grade:		
Less than \$10 list	List to	—5%
\$10 to \$25 list	11%	to 16%
\$25 to \$50 list	14%	to 24%
Low Grade:		
Less than \$10.00 list	5%	to —5%
\$10.00 to \$25.00 list	11%	to 16%
\$25.00 to \$50.00 list	14%	to 24%

DISCOUNT—CHICAGO

Less than \$10 list	+5% to 5%
\$10 to \$25 list	11% to 16%
\$25 to \$50 list	14% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp., three-point	100	.54
10-amp., three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to Net
1/5 to std. pkg.	Net to 15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

	List, Each
Union and Similar	
No. 155	\$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list	List to 23%	18%
\$2.00 to \$10.00 list	20% to 23%	18%
\$10.00 to \$50.00 list	23% to 30%	18%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list	25% to 50%	20% to 40%
\$2.00 to \$10.00 list	25% to 50%	20% to 40%
\$10.00 to \$50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

Net price	\$3.10 to \$3.50
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CHICAGO

Net price	\$3.50 to \$4.50
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WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

No. 18, less than full spools	\$0.52
No. 18, full spools	0.48

CHICAGO

	Per Lb. Net
No. 18, less than full spools	\$0.065 to \$0.6885
No. 18, full spools	0.5285 to 0.56

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net
Less than 500 Ft.	500 to 1000 to 5000 Ft.
No. 14	\$15.00-18.00 \$12.00-14.50 \$11.50-12.50
12	21.06-28.35 18.96-24.30 18.01-20.25
10	29.60-39.83 26.64-34.14 25.31-28.45
8	42.40-56.49 38.16-48.42 36.25-40.35
6	72.19-89.39 64.98-76.62 61.73-63.85

CHICAGO

	Price per 1000 Ft. Net
Less than 500 Ft.	500 to 1000 to 5000 Ft.
No. 14	\$18.00 \$16.00 \$14.00
12	25.99-28.63 21.96-24.54 20.13-22.50
10	36.49-40.28 30.84-34.44 28.27-31.57
8	48.84-51.83 43.80-44.77 40.15-44.77
6	70.24-81.93 63.85-69.24 56.54-57.47

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$40.25 to \$45.00
25 to 50 lb.	39.25 to 42.00
50 to 100 lb.	38.00 to 38.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	41.85 to 45.50
25 to 50 lb.	40.85 to 44.50
50 to 100 lb.	39.85 to 43.50

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

One-Piece Ground Clamps

Ground clamps made entirely of copper and in one piece are manufactured by the H. B. Sherman Company of Battle Creek, Mich. The roll portion for soldering is turned in to rest against the opposite end of the clamp, preventing the ends from tipping together when tightened, holding the gears parallel and assuring the largest amount of drawing power. A screw-driver is the only tool necessary for the application of this clamp, which is made in three sizes.

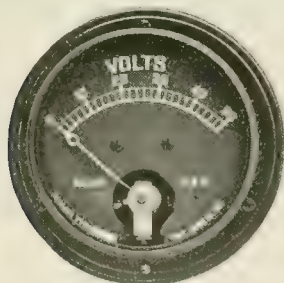
Radial-Flow Fan

The Green Fuel Economizer Company of New York City has developed for direct connection to steam turbines for motors a fan known as the radial-flow fan. The design of this fan is much along centrifugal pump lines and is such that the path of the air or gases through the fan has the least resistance consistent with ease of manufacture and results in efficiency that is far above that usually met with in fans for forced and induced-draft service, it is claimed.

This fan lends itself to direct connection to alternating current motors at the higher synchronous speeds, which enables use to be made of small and compact driving units. These fans are also applicable to induced-draft and various types of exhaust service, particularly mine ventilation, where the higher pressures are desirable.

Miniature Meters for Commercial Circuits

The General Electric Company has developed round voltmeters and am-



PERMANENT MAGNET MOVING COIL PRINCIPLE USED

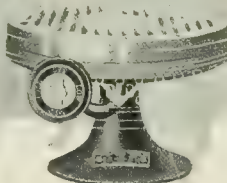
meters 2¼-in. (5.2-cm.) in diameter which give accurate readings on direct-current circuits ranging from 10 volts to 150 volts and 10 amp. to 150 amp., respectively, it is claimed. These instruments, known as type DM, utilize the

D'Arsonval permanent magnet moving-coil principle. The voltmeters have self-contained resistance and the ammeters have self-contained shunts up to 40 amp. Extremely light-weight moving elements are used with hardened polished points and jeweled bearings. The zero adjustment is made by a small screw in front at the base of the instrument.

In order to obtain complete and permanent insulation all parts of the measuring element are mounted on a bakelite base. The scale and mechanism are protected from foreign substance by a drawn brass cover carrying a round glass dial. For convenience in reading, a metal scale plate is used with black background and white needle and scale markings. All instruments are back-connected for front of board mounting.

Electric Coffee Urn Heater

An electric coffee urn heater that has an adjustable base so that the burner may be raised to meet the bot-

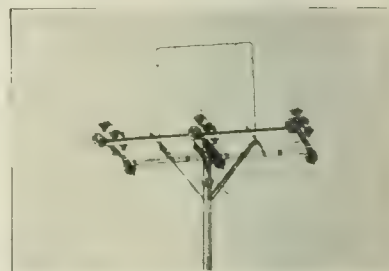


PHANTOM VIEW OF COFFEE URN AND HEATER

tom of the urn has been developed by the Hughes Electric Heating Company, 5660 West Taylor Street, Chicago. This heater is made in three sizes, 880 watts, 1100 watts and 1500 watts, and is furnished with a three-heat switch. The maximum height is 10 in. (25.4 cm.) and the minimum height 6 in. (15.2 cm.). It has a black enamel stand and a gunmetal-finish switch. This heater is equipped with a surface burner composed of coils of resistance wire securely fastened in the grooves of a high heat-resisting composition plate which in turn fits snugly in a special thick, heavy asbestos composition receptacle. The resistance wire is drawn from a composition of 80 per cent nickel and 20 per cent chromium. The wire coils are not harmed by liquid boiling over on them, it is claimed.

Air-Brake Switch with Rack for Ground Wire

The accompanying illustration shows a method employed by the Delta-Star Electric Company of Chicago for mounting its standard three-pole type "PM" 33,000-volt, 200-amp. air-break switch on a Bates expanded steel



GROUND WIRE IS FASTENED ON RACK

transmission pole. To enable carrying an overhead ground wire straight through the line, the cross-arms are provided with an auxiliary rack to which is fastened the overhead ground wire. The switch is provided with a manually operated remote-control interlocked mechanism, enabling all three poles to be simultaneously opened or closed by means of a locking-type handle. When desired the operating shaft can be extended so that the switch handle is near ground level. The complete switching, cross-arm and pole equipment is shipped ready for immediate assembly, thus reducing cost.

Electric Vulcanizer

An electric vulcanizer that has only two parts has been placed on the market by the Premier Electric Company of Chicago, Ill. The two parts consist of a heating disk with a long flexible cord and plug to fit any light socket on an automobile and a clamp to hold the disk in position. It is claimed that this vulcanizer will make a patch in ten minutes.

Split Porcelain Knob

The Findlay Electric Porcelain Company of Findlay, Ohio, has developed an interchangeable knob which interlocks and cannot get out of alignment either while being installed or afterward, it is claimed. It is pointed out that all the pieces are just alike. The breaking of one section does not destroy a whole knob. The wire grooves are deep and hold the wire perfectly without injuring the installation, it is said.

Disconnecting Pot-Heads

Disconnecting pot-heads that consist of three distinct parts—base, body and top—are made by the Electrical Development & Machine Company of Philadelphia. The metal base has in-



SCREW-CONTACT DISCONNECTING POT-HEAD

corporated in it a standard sheath clamp and static protection member. The body, which attaches to the metal base, is of porcelain or metal. For single-conductor pot-heads porcelain bodies are generally used, while metal is standard construction for multiple-conductor types.

The outlet tube or bushing for any one type of pot-head is the same design for one, two, three or four conductors. The fluting, length of tube, etc., vary, however, with the potential requirements of service. This outlet tube is sealed at the top with a watertight cap, which in turn is covered by a porcelain cap, so that whether in service or disconnected the pot-head is protected against the entrance of any moisture, it is said.

In addition to the porcelain cap, a small composition cap is supplied as a covering for the bare disconnecting terminal, which partly protrudes above the porcelain cap. This composition cap is taped to the outgoing wire and thus affords an easy method of disconnection without danger of water leaking into the pot-head top.

Non-Raveling Tape

To meet the scarcity of woven tapes for insulating purposes a cambric tape has been developed by Freyberg Brothers, Inc., New York City, which has a fast edge even though it is not woven. A special process in making this tape is used which prevents the edges from unraveling. The tape is said to have the same mechanical and electrical properties as the woven tape, and it is somewhat cheaper to manufacture. It can be made in any desired width, and while it can be secured in several thicknesses, 6 mil. (0.24 in.) is the thickness most generally used.

Outdoor Switch-House Construction

A very open type of outdoor switch-house construction, which, it is claimed, provides the maximum of accessibility, has recently been brought out by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. In switch houses of this description the oil circuit breaker is mounted on a specially constructed bracket and the meters are mounted on a slate slab. The bracket is so designed that it will take different sizes of breakers.

This method of mounting the circuit

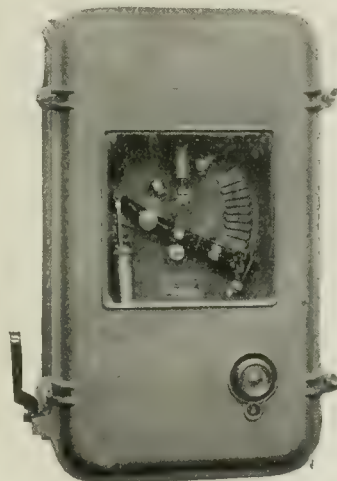
breaker has the advantage of being easily accessible for the inspection of wiring, removal of oil tanks, inspection of contacts and replacement of fuses protecting the voltage transformers.

A ground-mounted switch house with panel-mounting circuit breaker has also been developed. The circuit breaker and instruments are all mounted on one slate slab, and while the construction is not so open as with the bracket-mounted breaker, it has a very neat and pleasing appearance.

Control Panels for Printing Presses

The Igranic Electric Company, Ltd., of 147 Queen Victoria Street, London, England, has developed a standard panel which for reciprocating and small rotary printing presses contains all the apparatus that is necessary for the control of the press by push buttons.

All of the apparatus is inclosed in an iron housing with hinged glazed door on the front, the housing being fitted with lugs so as to permit of its



CONTROL PANEL FOR MOUNTING ON PILLARS OR WALL

being easily bolted to the wall. The handle of the double-pole isolating switch is external to the housing and is so interlocked with the door that the latter cannot be opened unless the isolating switch has first been opened, and conversely the isolating switch cannot be closed unless the door has first been closed. The operating handle of the speed-regulating rheostat projects through the front of the cover in a convenient position, and beneath this handle is a small window through which may be seen a figure indicating the position of the regulating lever.

Bench Conduit Bender

The Henderson Electric Company of Ampere, N. J., is making a one-piece conduit bender designed to be mounted on a post or installed flat on a bench. Any combination of bends and offsets may be made with this device, the manufacturer points out, without kinking or flattening. Three sizes are

made to handle 1/2-in., 3/4-in. and 1-in. (1.27-cm., 1.9-cm. and 2.54-cm.) conduit respectively. The Western distributor of the bender is M. B. Austin & Company, 700-710 Jackson Boulevard, Chicago.

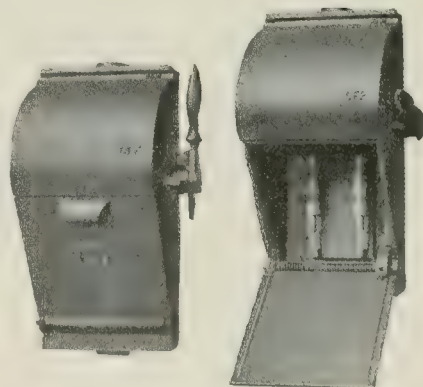
Electric Vacuum Cleaner

An electric vacuum cleaner provided with a convenient snap switch on the handle is announced by the Hurley Machine Company, Clinton and Monroe Streets, Chicago. A rubber comb is used on the floor piece, and the manufacturer calls attention to the fact that this feature enables the machine to pick up hair, threads, ravelings and all other surface dirt. This nozzle may be raised or lowered to suit the conditions of operation. Special attachments are made for cleaning moldings, portières, walls, mattresses and upholstery. The motor is mounted so that the axis of its shaft is horizontal. The body of the machine is of steel, welded into a solid piece. The construction is rugged, yet the cleaner weighs less than 9 lb. (4.1 kg.).

Switch with Live Parts Totally Inclosed

The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has brought out a switch which consists of an ordinary single-throw knife switch and inclosed fuse holders mounted in a strong cast-iron box, with an operating handle outside the housing. The box is designed for conduit connection and has a partition separating the switch blades from the fuse holders.

The upper or switch compartment can be opened only by removing two machine screws. The lower or fuse compartment, containing the fuses and fuse holders, is the only part of the switch that need be opened, and then only to replace blown fuses. The door of this compartment is so interlocked with the switch by a vertically acting push rod which engages a boss on the



SWITCH CANNOT BE CLOSED WHEN DOOR IS OPEN

fuse-compartment door that it can be opened only when the operating handle is in the off position and the circuit broken. Furthermore, with the door of this compartment open it is impossible to close the switch.

Trade Notes

JOHN B. PRICE, district manager for the Mechanical Appliance Company of Milwaukee, has opened an office at 515 Mercantile Library Building, Cincinnati, for that company.

PHILIP VALK, purchasing agent for Schuurman & DeJong, Amsterdam, Holland, and the Holland-Bombay Trading Company, Ltd., Amsterdam, has moved to 309 Broadway, New York City.

SAMUEL SWETT, manufacturers' agent, importer and exporter, 149 Broadway, New York City, states that he has recently been appointed the exclusive agent in the United States for George Cradock & Company, Ltd., of Wakefield, England, manufacturers of wire and wire rope.

THE CURRAN SIGN COMPANY, Spokane, Wash., specialist in electric signs, plans to extend its business field to include the entire Spokane district and is placing salesmen in the field. The company now does a heavy business in Montana, where it has representatives.

THE NATIONAL LAMP WORKS, through George H. Johnson, architect, have filed plans with the city building department at Cleveland, Ohio, for a warehouse for the works, to be built at 1131 East 152d Street. It will be 145 ft. by 266 ft. in dimensions and cost \$160,000.

THE WESTINGHOUSE LAMP COMPANY, 165 Broadway, New York, is making rapid progress in the construction of its new plant on Pennington Avenue, Trenton, N. J., and plans for the immediate installation of equipment. The company expects to commence operations at the new works in the near future.

J. F. PORTER, formerly president of the Tri-City Railway & Light Company, Davenport, Iowa, is the new head of the Kansas City (Mo.) Light & Power Company. Mr. Porter succeeds John H. Lucas, who had been president of the company since its reorganization and separation from the railway company.

THE CLEVELAND SWITCHBOARD COMPANY, Cleveland, Ohio, having lost its plant through the destruction by fire of the building in which it was located, has purchased a site on East Seventy-ninth Street, just south of the Cleveland & Youngstown Railroad, where a new factory will be erected. The loss of the company by the fire is estimated at about \$20,000.

THE BRYANT ELECTRIC COMPANY of Bridgeport, Conn., announces the appointment of George H. Williams, formerly New York representative of Gillinder & Sons Company, to take charge of its New York office, 51 East Forty-second Street. Mr. Williams takes the place of Robert Abbott, who as a member of the Roosevelt hospital unit is now in France.

THE PEERLESS INTERNATIONAL CORPORATION, 50 Pine Street, New York City, has been organized to conduct an export, import and general engineering and contracting business, with the following officers and board of directors: Alfonso Kaufman, president; Simon Weiner, vice-president; F. A. Beardsley, secretary; William M. Blain, treasurer; Walter W. Birge, president Air Reduction Company, and L. K. Comstock, president L. K. Comstock & Company.

MEETING OF GEAR MANUFACTURERS' ASSOCIATION.—A meeting of the American Gear Manufacturers' Association was held at the Edgewater Beach Hotel, Chicago, Ill., Sept. 14 and 15. Papers on the following subjects were presented: "Advertising Don'ts," "Heat Treating and Hardening of Gears," "Inspection of Gearing," "Spur Gearing by the Rotary or Disk Cutting Process," and "Spur Gears by the Shaper Method." F. W. Sinram is president of the association, H. E. Eberhardt vice-president, F. D. Hamlin secretary, and Frank Horsburgh treasurer.

GRAY & BARASH COMPANY, Inc., has leased an entire block at Horton Avenue and Colorado Street, Seattle, Wash., on which a plant will be immediately erected. The company is swamped with orders for electrical machinery and equipment for the many new vessels either under construction or about to be built. The company has occupied a store at First Avenue South and Jackson Street for fourteen years, but the business on hand necessitates expansion. There are enough orders ahead to keep the proposed new plant running for a long period. The company recently closed contract for supplying equipment for a new paper mill, in addition to a number of recent orders for ship equipment.

J. MILTON AYER has resigned from the engineering staff of the Boston (Mass.)

Elevated Railway to become treasurer of the Day Baker Motor Truck Company of Boston. Mr. Ayer was closely associated with the development of the rapid-transit system of the Boston company, following a term of service in a central station heating organization. He was educated at the University of Maine and at Harvard University, and for some years has been actively engaged in investigations for executive officials. In his new work he will be associated with the development of the New England agency for the C. W. Hunt Company's products, including the Hunt industrial electric truck and conveying machinery, the Atlantic electric truck and the Hurlburt gasoline truck.

Trade Publications

VACUUM CLEANERS.—The Hurley Machine Company of Chicago is distributing a leaflet descriptive of its Thor No. 5 vacuum cleaner.

RANGES.—The Standard Electric Stove Company of Toledo, Ohio, is distributing a calendar for September and a folder descriptive of its electric range.

FLOODLIGHTING PROJECTORS.—The George Cutter Company of South Bend, Ind., has issued two bulletins descriptive of its universal floodlighting projectors.

FORCED-DRAFT APPARATUS.—The B. F. Sturtevant Company of Hyde Park, Boston, Mass., has prepared catalog No. 236, descriptive of its steel-plate fans, multivane fans and turbovane fans.

SWITCHES.—The Arrow Electric Company of Hartford, Conn., has prepared a bulletin describing electrotypes this company is furnishing for advertising purposes. The list includes information on pull switches, standard duplex receptacles, electrotypes push-button switches, current taps, pull socket attachments and lock sockets.

STORAGE BATTERIES.—Bulletin No. 610, descriptive of Edison storage batteries in lumber transportation, has been prepared by the Edison Storage Battery Company, Orange, N. J. These batteries are for use with lumber tractors, industrial locomotives and surface carriers. Illustrations of actual installations are given, together with a description of the battery.

STEAM TURBINES.—Single-stage and multi-stage steam turbines and reduction gears are illustrated and described in bulletin No. 3, published by the Moore Steam Turbine Corporation of Wellsville, N. Y. This bulletin discusses the present status of single-stage steam turbines, multi-stage turbines, standardized methods of manufacture, and construction of this type of turbine as made by this company.

PUMPS.—The Worthington Pump & Machinery Corporation, 115 Broadway, New York City, is distributing bulletin W-600-A, descriptive of its Worthington volute centrifugal pumps. The purpose of this catalog is to illustrate and describe the different types of volute pumps manufactured by Henry R. Worthington, to set forth the advantages of each, and to give such information as will be of interest to the prospective purchaser and operator. The Worthington turbine pumps are described in another catalog which this company has prepared.

WATER PIPE.—Michigan combination steel and wood water pipe is illustrated and described in a bulletin prepared by the Michigan Pipe Company of Bay City, Mich. This book gives in a concise, straightforward manner facts that are of interest to consulting engineers, superintendents, engineers of water works and others having liquids of any nature to convey. Various tables on water supply and other technical data which by actual experience have been found valuable on account both of their scope and their convenient form are given. The bulletin is well illustrated and has been carefully prepared.

PORTABLE ELEVATOR.—Bulletin No. 43, entitled "The Steel Giant," is a twenty-page booklet just issued by the New York Revolving Portable Elevator Company, Jersey City, N. J., which describes the unusual uses in which their "revolver," sometimes nicknamed "the Steel Giant," has been employed. Among these may be mentioned the erecting of overhead motors and taking them down for repairs, erecting and repairing overhead shafting, overhead drilling, whereby a man and a portable drilling outfit may be quickly and safely elevated to the place in which the drilling is to be done; loading heavy cases and bales from sidewalks onto trucks; loading freight into cars, piling goods inside freight cars, storing sheet iron, elevating heavy dies to presses, etc.

New Incorporations

THE GUARANTY ELECTRIC WORKS, Burley, Idaho, have filed articles of incorporation with a capital stock of \$5,000.

THE SHANER ELECTRIC COMPANY, McKeesport, Pa., has been incorporated by F. H. Emerson, with a capital stock of \$10,000.

THE ILLUMINAL CORPORATION, New York, has been organized by Sachary Werschansky, Richard E. Berthod and G. Sus with a capital stock of \$10,000.

THE DEARBORN ELECTRIC LIGHT & POWER COMPANY, Dearborn, Mo., has been organized by W. H. Gabbert, Morris Putlick and R. H. Bruce. The company is capitalized at \$5,000.

THE GRAND RIVER HYDROELECTRIC COMPANY, Tulsa, Okla., has been organized by H. C. Holderman, C. H. Fenstermacher and J. H. Rothhammer. It is capitalized at \$10,000.

THE JACKSON LIGHT & ICE COMPANY, Jackson, Ky., has been incorporated by A. H. Hargis, J. S. Redwine and L. Hays Jr., with a capital of \$12,000. The company will operate a local lighting plant.

THE IROQUOIS PUBLIC SERVICE CORPORATION, Syracuse, N. Y., has been incorporated, with a capital of \$1,500,000, by L. S. Chapman, Robert Love, Martin G. Grossman and A. S. Ellis of Syracuse.

THE AMBOY LIGHTING COMPANY, Perth Amboy, N. J., has been incorporated with a capital of \$15,000, by S. and E. Hyman and Morris Weinstein. The company proposes to engage in a local electrical business.

THE EASTERN CONNECTICUT POWER COMPANY, Hartford, Conn., has been organized by Robert W. Perkins of Norwich for the purpose of selling and manufacturing electricity. The capital stock of the company is \$1,000,000.

THE MODERN ELECTRIC LAMP COMPANY, INC., New York, has been organized for the purpose of selling electrical fixtures. The company is capitalized at \$3,000 and has been organized by Elias Tauber, Joseph Goldstone and George R. Rubin.

THE STAMFORD ELECTRIC & MANUFACTURING COMPANY, Stamford, Conn., has been organized by Edward Heitman and Edith B. Heitman of Stamford and Andrew Baile and John D. Baile of Montreal. The company is capitalized at \$50,100.

THE SUPERIOR ELECTRIC MANUFACTURING COMPANY, Cincinnati, Ohio, has been incorporated with a capital stock of \$10,000. The incorporators are Walter W. Tangeman, Frank W. Willey, Harry P. Mefford, Charles L. Tangeman and Fred J. Wray.

THE HAMTRAMCK LIGHT COMPANY, Hamtramck, Mich., has been incorporated to sell electrical supplies. The company has been incorporated by Max J. Kogan of Hamtramck, Maurice Schlusel and Mark Sugarman of Detroit. The company is capitalized at \$5,000.

THE ALABAMA STORAGE BATTERY COMPANY, Birmingham, Ala., has been incorporated with a capital stock of \$6,000. The officers of the company are: H. W. Matthews, president; Fred Sintes, vice-president, and C. R. Matthews, secretary-treasurer.

THE TIFFANY NEVER-WIND CLOCK CORPORATION, Buffalo, N. Y., has been incorporated with a capital stock of \$150,000. The incorporators are F. N. Gunnison, I. L. Kisk and W. C. Newcomb, all of Buffalo. It is proposed to manufacture electric clocks.

THE BAY RIDGE ELECTRICAL COMPANY of Brooklyn, N. Y., has been incorporated by D. F. McDonald, A. M. Stagg and J. F. Warner, 1466 Nicholas Avenue. The company is capitalized at \$5,000, and proposes to deal in automobiles, motor vehicles and do a general motor business.

THE AUTOMATIC STRAIGHT AIR BRAKE COMPANY, New York, has been organized with a capital stock of \$5,000,000. The officers of the company are: H. I. Miller, president; K. B. Conger, vice-president and treasurer; A. M. Trueb, secretary and auditor; G. C. Pierce, chief engineer, and S. C. Neale, consulting engineer.

THE AUTOMATIC CONTROLLER & MANUFACTURING COMPANY, Salt Lake City, Utah, has been incorporated for the purpose of manufacturing electrical appliances. The officers of the company are: Cleveland Redfield, president; J. W. O'Brien, vice-president; Thomas L. Whitehill, treasurer; William J. Stone, secretary. The company is capitalized at \$100,000.

New England States

BROWNVILLE, ME.—The Brownville Electric Light & Power Company has petitioned the Public Utilities Commission for permission to issue \$5,000 in capital stock, the proceeds to be used for extensions to plant and system.

LAKE VIEW, ME.—The Lake View Electric Company has petitioned the Public Service Commission for permission to issue \$3,000 in capital stock.

RANGELEY, ME.—The electric plant of the Quosoc Light & Power Company was recently destroyed by fire.

VAN BUREN, ME.—The Public Service Commission has authorized the Van Buren Light and Power District to issue \$35,000 in bonds, the proceeds to be used for the purchase of the property of the Van Buren Light & Power Company and for extensions and improvements.

BOSTON, MASS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 28 for furnishing and installing interior lighting fixtures in the United States appraisers' stores at Boston, Mass. Drawings and specifications may be obtained at the above office.

PITTSFIELD, MASS.—Work has begun on the addition to the power plant of the Pittsfield Electric Company, which, with equipment, will cost about \$300,000. The output of the plant will be increased by 2500 kw.

PROVIDENCE, R. I.—An underground conduit along Second and Brow Streets is being installed by the Narragansett Electric Lighting Company which will carry the high-tension transmission line which now extends across the Watchemoket section from the power station south of Mauran Avenue to Red Bridge. The line supplies energy to the mills in Phillipsdale.

NEW LONDON, CONN.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 24 for construction of two buildings for officers' quarters, including electric-lighting and heating system, at the submarine base at New London, Conn.

PLAINVILLE, CONN.—The Trumbull Electric Company is building an addition, 50 ft. by 100 ft., four stories, to its plant, which will give it a total space of 110,000 sq. ft.

Middle Atlantic States

BINGHAMTON, N. Y.—Orders have been placed by the Binghamton Railway Company for two new generators, to cost about \$40,000.

BROOKLYN, N. Y.—The Atlantic Avenue Business Men's Association has petitioned the Department of Water, Gas and Electricity to replace the gas lamps now in use with electric lamps.

BROOKLYN, N. Y.—Plans are being prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for additions to hydraulic plants of the structural and machine shops at the Navy Yard, Brooklyn, to cost about \$75,000.

BROOKLYN, N. Y.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 18 for furnishing distilling plants and motor-driven potato peelers at the navy yard, Brooklyn, N. Y. Proposal blanks may be obtained on application to the above bureau or to the supply officer, navy yard, Brooklyn, N. Y.

BROOKLYN, N. Y.—Bids will be received by the New York Municipal Railway Corporation, 85 Clinton Street, Brooklyn, until Oct. 1, for the construction of trainmen's building, signal towers, circuit breaker houses and additional platforms and control facilities in connection with the Coney Island terminal. Plans and further information may be obtained upon application to office of the chief engineer, 85 Clinton Street, Brooklyn.

BUFFALO, N. Y.—Ground has been broken for an addition to the plant of the Ericsson Manufacturing Company to increase its facilities for manufacturing the Berling magneto. The company manufactures shop telephones, magnetos and other electrical apparatus.

NEW HAMPTON, N. Y.—The contract for the construction of the new power house at New Hampton Farms has been awarded to Nielsen & Miller of Middletown.

THIELLS, N. Y.—Bids will be received by Frank A. Vanderlip, president of the board of managers of Letchworth Village, 7 Wall Street, New York City, until Sept. 28 for construction of additional central heating plant; building eight cottages (I, J, K, L, M, N, O and P), assembly hall and industrial building, including heating,

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

plumbing and electric work, at Letchworth Village, Thiells. Drawings and specifications may be consulted at Letchworth Village, at the office of board of managers, 7 Wall Street, New York City; at the New York office of the Department of Architecture, Room 1224, Woolworth Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

THIELLS, N. Y.—Bids will be received by Frank A. Vanderlip, president of the board of managers of Letchworth Village, 7 Wall Street, New York, until Oct. 5 for construction, heating, plumbing and electric work for Attendants' Home and Service Building; heating work, underground piping and conduit; plumbing work, underground sewer and water connections; electric work and underground conduits; construction work of bridge across creek at Letchworth Village, Thiells. Specifications may be seen at Letchworth Village, Thiells, at the office of the board of managers, 7 Wall Street, New York City, at the New York office of the Department of Architecture, Room 1224, Woolworth Building, New York City, and at the Department of Architecture, Albany. Lewis F. Pilcher is state architect.

WATERTOWN, N. Y.—The Northern New York Utilities, Inc., has petitioned the Public Service Commission to issue \$198,700 in capital stock and \$477,000 in bonds, the proceeds to be used for the completion of an electric transmission line from Natural Bridge to South Edwards and for reimbursement of the company's treasury.

AMPERE, N. J.—The Crocker-Wheeler Company is reported to be planning to erect a five-story reinforced-concrete plant, 100 ft. by 200 ft., at Fourth Avenue and Twelfth Street, to cost about \$163,000. The company has also acquired the plant of Edward Maher's Sons, iron founders, 216 Berlin Street, Newark, which it will enlarge and improve.

BAYONNE, N. J.—The Public Service Electric Company has submitted a proposal to the City Commission for the installation of a temporary arc lamp system on lower Broadway, instead of the ornamental lighting system to be installed in accordance with the contract with the city. The company agrees to install the ornamental system during the coming year. About \$20,000 will be expended for street-lighting improvements.

CAMDEN, N. J.—Contract has been awarded by the Department of Public Property of Camden for the erection of a machine shop, 38 ft. by 110 ft., one-story high, at Fifth and Arch Streets, for municipal work.

WOODSTOWN, N. J.—The Borough Council has awarded a contract to the Electric Company of New Jersey to furnish electricity for the waterworks. The five-year lighting contract, which has just expired, will be renewed.

CHALFONT, PA.—The Borough Council is considering establishing an electric-lighting system in Chalfont. It is proposed to secure energy from the Lansdale plant if possible.

COATESVILLE, PA.—A franchise has been granted to Paul S. Stansbury to construct and operate an electric railway from the business section of the city to Honeybrook and vicinity to furnish service to the iron and steel works, about 2 miles distant.

CONEMAUGH, PA.—The Borough Council has decided to close down the municipal electric generating plant and purchase energy to operate the local system from the Citizens' Light, Heat & Power Company of Johnstown. A three-year contract with the Citizens' company is reported to be under consideration.

PHILADELPHIA, PA.—The Penn Chemical Company is reported to be erecting a new power station, at a cost of about \$35,000.

PHILADELPHIA, PA.—The Public Service Commission has granted the Suburban Gas & Electric Company permission to issue \$168,000 in bonds, the proceeds to be used for expansion of system.

POTTSTOWN, PA.—Plans are being considered by the Pottstown & Phoenixville Railway Company for extending its electric railway from Linfield to Spring City, a distance of about 21 miles.

READING, PA.—A franchise has been

granted the Reading Transit & Light Company to construct and operate a single-track railway along Canal Street, south of Chestnut Street.

WILMINGTON, DEL.—The Wilmington & Philadelphia Traction Company is planning to construct an addition, 54 ft. by 64 ft., to its plant at Eighteenth and Buena Vista Streets, to cost approximately \$55,000.

BALTIMORE, MD.—Work has begun by the United Railways & Electric Company on the installation of automatic electric signals on its railway to Sparrows Point and Bay Shore Park, including 54 stations.

ASHLAND, W. VA.—The installation of a new ornamental street-lighting system, to cost about \$15,000, is under consideration by the City Council.

WHEELING, W. VA.—Bids will be received at the United States Engineer office, Wheeling, W. Va., until Oct. 2 for construction of a fireproof power house at Dam No. 24, Ohio River.

NORFOLK, VA.—Contract has been awarded by the United States government for the erection of power plant for the United States naval base at the site of the Jamestown Exposition to J. W. Danforth Company of Norfolk. The contract calls for erection of plant and distribution system, with exception of boilers.

WASHINGTON, D. C.—The power house of the Washington & Old Dominion Railway Company at Roslyn will be closed down and energy to operate the system will be purchased from the Potomac Electric Company.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 17 for jet condensers and pumping equipments at various yards. Specifications (No. 2546) can be obtained on application to the above bureau.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 28 for furnishing and installing interior lighting fixtures in the United States appraisers' stores at Boston, Mass. For details see Searchlight Section.

WASHINGTON, D. C.—Plans are being prepared for the Bureau of Yards and Docks, Washington, D. C., for a new five-story pattern shop, six-story machine shop, steel forging works and brass foundry, with other structures, to be erected at the navy yards on the Atlantic Coast. F. R. Harris is chief of bureau.

WASHINGTON, D. C.—Recommendations for public improvements in Columbia Heights have been filed with the Commissioners of the District of Columbia by J. Clinton Hlatt, secretary of the Columbia Heights Citizens' Association, which include improvements to lighting system on a number of streets, removal of trolley poles along Georgia Avenue north of Florida Avenue, new street signs, etc.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Philadelphia, Pa., Schedule 1472—6000 detonators (electric and combination fuse and electric) for use with trinitrotoluol. Brooklyn, N. Y., Schedule 1471—30 motor-driven potato peelers and spare parts. Boston, Mass., Schedule 1474—miscellaneous ammeters (switchboard type), miscellaneous blocks, cartridge type fuse, etc., brackets (bronze finish), 10,000 hard rubber insulating bushings, 100 Bosch spark coil buttons, 550 rubber ear cushions, miscellaneous igniters, magnetos, fittings, etc. Washington, D. C., Schedule 1473—two geared head lathes, 14 in. by 6 ft. bed, motor attached; three motor-driven single-spindle boring machines, two motor-driven, single spindle, vertical boring machines, one each motor-driven rod and dowel machines, Nos. 2, 4 and 5; Schedule 1467—one motor-driven key-seating machine. Las Animas, Col., Schedule 1459—one motor-driven cutting and pipe threading machine. Application for proposals should designate the schedule desired by number.

North Central States

HOLLY, MICH.—The installation of electrically operated pumps at the waterworks pumping station is under consideration by the City Council, at a cost of about \$15,000. It is proposed to install two pumps at present, but eventually five pumps will be installed.

NASHVILLE, MICH.—The installation of an ornamental lighting system is under consideration.

PORTLAND, MICH.—The Village Board has appropriated the sum of \$3,200 for the installation of a new ornamental lighting system in the business section, to cost about \$3,200.

ST. JOHNS, MICH.—The Board of Public Works has been authorized to purchase a 10-in. electrically operated rotary pump to replace the present steam pump at the pumping station, to cost about \$2,000.

AKRON, OHIO.—The contract for street-lighting expires on Oct. 4, 1917. The city, it is announced, will engage an expert engineer to aid in making the new contract. The cost of the present system is \$50,000 for incandescent lamps and \$13,000 for arc lamps per year.

BLUFFTON, OHIO.—Bonds to the amount of \$35,000 have been sold, the proceeds to be used for reconstruction of the municipal electric-light plant and water-works system.

CANTON, OHIO.—The Canton & Ohio River Railways Company, recently organized with a capital stock of \$10,000, contemplates the construction of an interurban railway from Canton to Wheeling, a distance of 105 miles.

CLEVELAND, OHIO.—Bids will be received at the office of purchases and supplies, City Hall, Cleveland, until Sept. 21 for structural steel work for the division of light and heat. Specifications may be obtained on application to the office of the division of light and heat.

MADISONVILLE, OHIO.—The City Council has decided to close down the municipal electric-light plant. Electrical service will be supplied by the Union Gas & Electric Company of Cincinnati.

MIDDLETOWN, OHIO.—Arrangements are being made for the installation of an ornamental lighting system on Michigan Boulevard, a suburb of Middletown.

YOUNGSTOWN, OHIO.—The Republic Railway & Light Company, it is reported, is securing a right of way for the erection of a high-tension transmission line through the southwest section of the city.

JENKINS, KY.—The Consolidated Coal Company, it is reported, is interested in the construction of an electric railway in Jenkins, to connect with Burdine, Dunham, East Jenkins, McRoberts, Fleming and Haymond.

OWENSBORO, KY.—The Owensboro City Railroad Company is planning to build several miles of additional street railway lines, connecting with important suburbs.

RIDGE FARM, ILL.—Steps have been taken to organize a company to build an electric line between Clinton and Ridge Farm. For further information address John W. Foster, Ridge Farm.

MANITOWOC, WIS.—The capital stock of the Green Bay & Eastern Railway Company has been increased from \$50,000 to \$3,000,000. The company is contemplating the construction of an electric railway from Manitowoc to Green Bay, thence to Sheboygan, a distance of 70 miles.

MARINETTE, WIS.—The Brown Mitcheson Company, it is reported, is building a large addition to its electric plant.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company has recently placed a contract with the Locomotive Pulverized Fuel Company, 30 Church Street, New York, N. Y., to equip the 2500-hp. boilers at its Oneida Street plant with apparatus for the burning of pulverized coal.

OSHKOSH, WIS.—The capital stock of the Universal Motor Company has been increased from \$25,000 to \$50,000, the proceeds to be used to double the output of electric-lighting units designed especially for army field service.

WAUWATOSA, WIS.—The construction of a central power plant to furnish electricity for lamps and motors to all the county institutions is reported to be under consideration. F. C. Phelps of Milwaukee is county clerk.

DONNELLY, MINN.—The question of issuing \$14,000 in bonds for the construction of a municipal electric-light and power plant in Donnelly is under consideration.

RICE, MINN.—Bids will be received by D. I. Bouch, village clerk, until Sept. 21 for construction of an electric transmission line and distribution system for the village of Rice. Plans and specifications are on file in the office of the village clerk and in the office of Earl D. Jackson, consulting engineer, Capital Bank Building, St. Paul, Minn.

RICE, MINN.—Bonds to the amount of \$8,000 have been voted for the erection of an electric transmission line from Little Falls to Royalton. Energy to operate the local system will be supplied by the Royalton Power & Light Company, which secures its supply from the Little Falls

(Minn.) Power Company. Earl Jackson of St. Paul is consulting engineer.

ST. PAUL, MINN.—A proposal to replace the gasoline lamps now in use on the Mississippi River Boulevard from Summit Avenue to Fort Snelling with electric lamps has been submitted to the City Council by Commissioner Keller.

ST. PAUL, MINN.—Plans are being considered by the City Council for the installation of ornamental lamps on all the important highways of the city. The extension plans for 1917 provide for the erection of 459 additional lamps. Other ordinances calling for the installation of 1506 more ornamental lamps are under consideration by the Council.

CEDAR RAPIDS, IOWA.—The Iowa Railway & Light Company of Cedar Rapids has been granted a franchise by the Board of Railroad Commissioners to erect and maintain electric transmission lines on certain roads and highways in Greene County.

CRESO, IOWA.—Bids will be received by B. F. Davis, secretary of board of education of the independent school district of Cresco, Cresco, until Oct. 3 for the construction of a grade school building and a vocational school building, including general construction, heating and ventilating, plumbing and electric work. Copies of plans may be obtained at the office of G. L. Lockhart, Endicott Building, St. Paul, Minn.

DES MOINES, IOWA.—The erection of 250 additional electroliters in the metropolitan lighting district is under consideration.

HUMBOLDT, IOWA.—The Board of Railroad Commissioners has granted the Northern Iowa Gas & Electric Company of Humboldt permission to erect and maintain electric transmission lines on certain roads and highways in Humboldt County. The company has also been granted a franchise to erect electric transmission lines on certain roads and highways in Wright County.

INDIANOLA, IOWA.—Bids will be received by the city of Indianola until Oct. 1 for furnishing and installing three triplex, motor-driven pumps, electric control equipment for motors, transformers, motor-generator set and three-panel switchboard. For details see Searchlight Department.

SAC CITY, IOWA.—At an election held recently the proposal to issue \$50,000 in bonds for the installation of an electric-light and power plant was carried.

SUTHERLAND, IOWA.—Plans are being prepared for the construction of a telephone building for the Sutherland Telephone Company, to cost about \$25,000. Bids for construction of building, it is understood, will soon be asked for. H. L. Eddington is manager.

KANSAS CITY, MO.—The Wyandotte County Commissioners have refused to grant the Kansas City Railways Company the privilege to erect cables on the new Central Avenue viaduct to connect the Kaw River power house with the power plant at Second Street and Grand Avenue.

DUNN CENTER, N. D.—The local municipal electric-light plant has been taken over by the Dunn Equity Elevator Company, which will operate the plant, using excess power at its elevator.

CHADRON, NEB.—Both the lighting and telegraph companies are removing poles from the principal business streets, prior to the installation of the proposed new electrolit lighting system that is to be installed in the business section of the city.

WESTERN, NEB.—Bonds to the amount of \$10,000 have been voted for the installation of an electric-lighting system.

ANDALE, KAN.—The installation of an electric-light plant and ice factory in Andale is reported to be under consideration by the Otto Weiss Company.

AUGUSTA, KAN.—Extensions and improvements are being made to the municipal electric-light plant, including the installation of new electric generators and additional pumps.

BARNES, KAN.—The installation of an electric-lighting system in Barnes is under consideration.

CANEY, KAN.—The property of the Caney Electric Light & Railway Company has been taken over by the Kansas Light & Power Company, recently organized by H. A. Carmichael of Duluth, Minn., and others. The present plant will be rebuilt and additional machinery installed.

GREAT BEND, KAN.—The contract for electric wiring for the new court house at Great Bend has been awarded to the Cates Electric Company. The cost of the building is estimated at \$190,000.

GRENOLA, KAN.—Bonds to the amount of \$15,000 have been voted for improvements to the municipal electric-lighting system. W. B. Rollins, Railway Exchange, Kansas City, Mo., is engineer.

HOE, KAN.—The Council has passed an ordinance granting a franchise to the Riverside Light, Power & Gas Company to furnish electricity for lamps, heat and motors in Hoe.

SAWYER, KAN.—The installation of a municipal electric-light plant in Sawyer is under consideration.

Southern States

RICH SQUARE, N. C.—Improvements are contemplated to the plant of the Rich Square Light & Power Company, including the installation of a crude-oil engine. Equipment, it is understood, has been purchased.

STOVALL, N. C.—Samuel C. Howard, it is reported, is planning to construct a dam and install hydroelectric plant and to build a corn mill in Stovall.

MARIETTA, GA.—Arrangements are being made by the Glover Machine Works for the construction of a new steel foundry and forge shop. The plans provide for the installation of a new electric furnace.

PALMETTO, GA.—Plans are being considered for the installation of electric equipment at the Palmetto Cotton Mills.

SAVANNAH, GA.—Work has begun on the foundations for the new electric plant at the marine training camp at Paris Island.

KEY WEST, FLA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 28 for a refrigerating plant in the United States Marine Hospital at Key West. Copies of specifications may be obtained at the above office or at the office of the custodian at Key West.

JEFFERSON CITY, TENN.—The local electric-light plant, owned by John J. Lawrence, has been sold to Mr. Goughnour of Newport. Improvements to the plant and system are contemplated by the new owner.

MEMPHIS, TENN.—Bids will be received at the office of the Mississippi River Commission, First and Second Districts, Custom House, Memphis, until Sept. 26 for furnishing one boiler feed pump, feed water heater, centrifugal sand pump, engines and single drum hoist. Further information may be obtained on application to the above office.

NASHVILLE, TENN.—The construction of a new power house at the Fisk University is under consideration.

ANNISTON, ALA.—The Southern Bell Telephone & Telegraph Company has authorized an expenditure of \$75,000 for improvements in connection with the proposed extension to Camp McClellan, which will include the installation of additional section of switchboards in the Anniston exchange. The company is installing an exchange at the camp to which 125 telephones will be connected. The work will also include the erection of 35,000 ft. of cable and over 150 miles of open wire.

MOBILE, ALA.—The Kelly-Atkinson Construction Company of Chicago, Ill., it is reported, will build a power plant in connection with its proposed new shipbuilding plant on a site recently acquired in Mobile.

MONTGOMERY, ALA.—The Montgomery Light & Traction Company is contemplating the construction of a substation equipped with five rotary converters with accessories.

FERNWOOD, MISS.—Work is progressing rapidly on the construction of the power plant of the McComb-Magnolia Light & Railway Company in Fernwood. This plant will supply energy to operate the car line from McComb City to Magnolia, a distance of 7 miles, as well as for lighting both cities. The electric generating plants at Magnolia and McComb City will both be closed down upon completion of the local plant.

HATTIESBURG, MISS.—Lighting service and electricity for pumping water at the military camp at Hattiesburg will be supplied by the Hattiesburg Traction Company.

TUPELO, MISS.—Bids, it is reported, are being received by the Tupelo Elevator Company for elevator and grist-mill machinery and power plant equipment for a daily capacity of 40,000 bushels.

ALEXANDRIA, LA.—The contract for the installation of electrical equipment at the army cantonment now under construction at Alexandria, has been awarded to the Interstate Electric Company.

DE RIDDER, LA.—Preparations are being made to rebuild the electric-light plant of the De Ridder Light & Power Company, at a cost of about \$10,000. A power house, 72 ft. by 36 ft., will be erected and new equipment, including a 150-kw., three-phase, 60-cycle generator and engine, directly connected, and switchboard will be installed.

Machinery, it is understood, has not been purchased.

WESTWEGO, LA.—Steps, it is reported, have been taken by Leo. A. Marrero of Gretna to organize a company to construct and operate an electric-light plant and water-works system in Westwego.

ADDITIONTON, OKLA.—At an election to be held on Sept. 20 the proposal to issue \$5,000 in bonds for the installation of an electric-lighting system will be submitted to the voters.

BEAVER CITY, OKLA.—Approval has been given to the \$8,000 bond issue, recently voted for the installation of a municipal electric-light plant. Bids for construction of plant, it is understood, will soon be asked.

HENRYETTA, OKLA.—The Henryetta-Dewar-Kusa Traction Company has been granted a franchise to construct and operate an electric railway to connect Henryetta and Kusa. Bonds have been voted and about two miles of rails laid. J. J. Harrison is general manager.

MIAMI, OKLA.—Improvements, involving an expenditure of \$150,000, are contemplated to the municipal electric-light plant and water-works system.

WAUKOMIS, OKLA.—The local municipal electric-light and power plant, it is reported, has been purchased by the Central Light & Power Company. The system will soon be taken over by the company, which will establish a 24-hour service, securing energy from the transmission line from the Enid plant.

BELLS, TEX.—The Texas Power & Light Company, it is reported, is contemplating the construction of a substation here and the erection of a high-tension transmission line from Bells to White-wright.

HOUSTON, TEX.—The Houston Electric Company has been granted a franchise to build an extension to Camp Logan.

MARFA, TEX.—The property of the Marfa Electric Light & Ice Company has been purchased by Morrison & McCall of St. Louis, Mo. The new owners, it is said, will install additional machinery and greatly increase the output of the plant.

Pacific and Mountain States

ARLINGTON, WASH.—The auxiliary steam plant of the Coast Utilities Company serving Arlington with electricity for lamps and motors was recently damaged by fire. Machinery, including boiler, engine, generator, motors, pump, switchboard, etc., were damaged. Arrangements are being made to rebuild the plant and install new equipment at once.

EVERETT, WASH.—The United States Government has refused to grant the application of the city of Everett for a site on the Sultan River within the Forest Reserve. Reported in the issue of Sept. 8 that the City Commissioners had closed a site on the Horseshoe Bend on the Sultan River.

PROSSER, WASH.—The Prosser Light & Power Company has applied for a 50-year franchise to operate in Prosser.

SEATTLE, WASH.—Bids are being received by the secretary of the Port Commission for the installation of electric-light and power systems in the new annex to the grain elevator.

SEATTLE, WASH.—The Puget Sound Pulp & Power Company, recently organized with a capital stock of \$16,000,000, contemplates the construction of a paper mill and power plant in the Puget Sound district.

SEDRO WOOLLEY, WASH.—Bids submitted for boilers for the power house at the State Insane Asylum near Sedro Woolley have been rejected as too high. New bids will be asked for. George W. Lawton, Alaska Building, Seattle, Wash., is architect.

ASHLAND, ORE.—The large concrete dam of the California-Oregon Power Company at Copco is reported to be nearing completion. The initial installation will provide for a development of 50,000 hp.

PORTLAND, ORE.—The Interstate Bridge Commission has decided to install a new motor-generator set to furnish energy to operate the span of the Interstate Bridge. The cost is estimated at \$5,250.

SUMPTER, ORE.—The electric plant of the Sumpter Light & Water Company, it is reported, will be rebuilt at once.

ARCATA, CAL.—The Western States Electric Company of Eureka, it is reported, contemplates rebuilding its entire local system.

BLTYHE, CAL.—A franchise has been granted to the Southern Sierras Power

Company of Riverside to construct and operate an electric-light plant in Blythe for a period of 50 years. Plans are under way for the construction of the proposed plant.

FRESNO, CAL.—The State Railroad Commission has granted the San Joaquin Light & Power Company permission to sell \$745,000 in bonds, the proceeds to be used for extensions and improvements to its system.

FRESNO, CAL.—The distillery, engine house and equipment, and power plant, etc., of the St. George winery, located about 3 miles from Fresno, was recently destroyed by fire, causing a loss of between \$50,000 and \$60,000.

GILROY, CAL.—The State Railroad Commission has granted the Coast Counties Gas & Electric Company permission to operate in Gilroy under a franchise granted by the city. The Counties Coast Company has leased the local system for a period of ten years.

LOS ANGELES, CAL.—A permit has been granted by the city of Los Angeles to Los Angeles County to erect a power house, tunnel and stack at 1126 Mission Road, to cost about \$38,500.

LOS ANGELES, CAL.—Bids will be received by the Board of Supervisors of Los Angeles County, Los Angeles, until Sept. 24 for the construction of power house and tunnel at the County Hospital in the city of Los Angeles. H. J. Leland is county clerk.

LOS ANGELES, CAL.—Plans are being prepared by the Bureau of Architecture for a power plant to be erected at the Ingle-side Jail, to cost about \$15,000. The station will also house a central heating system. Bids will be asked for construction of same as soon as plans are completed.

LOS ANGELES, CAL.—Negotiations, it is said, are under way by the Edison Electric Company of Los Angeles for the purchase of the Shaver Lake power site from Ira Bennett. The company, it is stated, contemplates the development at that site. With the diversion of the waters of Pittman Creek into the Shaver basin, it is estimated that 45,000 kw. could be developed.

OAKLAND, CAL.—The erection of new lamp standards and appliances on North Broadway is under consideration.

RIALTO, CAL.—The Fontana (Cal.) Power Company is planning to construct a new hydroelectric power plant in Lytle Creek Canyon, near Rialto. The plans provide for an initial capacity of 15,000 kw. McKeen & Miller, Monadnock Block, Chicago, Ill., are engineers.

SACRAMENTO, CAL.—Plans have been filed with the City Commission by Thomas Coulter, commissioner of public works, for a new electrically driven pump to be installed at the city pumping plant.

SACRAMENTO, CAL.—The Pacific Gas & Electric Company has been awarded a contract to furnish Camp Fremont with electricity. Work has begun at the camp, where substations are being erected, rights of way secured, etc.

SAN FRANCISCO, CAL.—The Great Western Power Company has completed a high-tension transmission line from Las Plumas to Veramount station. The line will supply energy to mines in the vicinity of Crescent Mills, including the Philadelphia Exploration Company's holdings, Crescent Mine and Green Mountain. It will also serve as an auxiliary for Engle's copper mine during the winter months. The line may be extended later through Genesee to supply electricity to the Walker Copper Mine.

SAN JOSE, CAL.—The State Railroad Commission of California has authorized the San Jose Railroads and the Peninsular Railway Company to transfer to the Pacific Gas & Electric Company an electric transmission line, including poles, wires, etc., right of way of the two railroads from San Jose to Saratoga, also the stationary motor system of the railroads in Santa Clara County, for \$62,500. The companies are authorized to execute a contract for the sale of electric energy.

WATSONVILLE, CAL.—The Coast Counties Gas & Electric Company has submitted a proposal to the city of Watsonville offering to install 142 new street lamps, consisting of 80 80-watt lamps, 37 100-watt lamps and 25 250-watt lamps, at a cost of about \$5,000.

ABERDEEN, IDAHO.—The Idaho Power Company, it is reported, is contemplating extending its system into the outlying districts 4 or 5 miles north of Aberdeen.

RIRIE, IDAHO.—Application has been made to the Public Utilities Commission by the town of Ririe asking that the Utah Light & Power Company be compelled to extend its service lines into Ririe.

AJO, ARIZ.—Plans are being prepared by the New Cornelia Copper Company for a smelting plant of 2000 tons daily capacity, to cost approximately \$1,500,000, and an oil flotation plant of about 5000 tons capacity. Extensive electrical equipment will be required for these installations, including motor drives for flotation plant. The company has recently placed its 5000-ton copper leaching plant in operation.

GLOBE, ARIZ.—Application has been made to the Corporation Commission by W. W. Shenk of Globe for permission to organize a company to construct a hydro-electric power plant on the Colorado River to supply energy to operate electric railways.

HARLEM, MONT.—The contract for the pole line and switchboard, including commercial and lighting circuits, has been awarded to the Electric Construction Company of St. Paul, Minn., at \$10,490. The Fairbanks-Morse Company was awarded contract for equipment, at \$9,380.

TROY, MONT.—The Council has granted a franchise to William B. McDonald to install and operate an electric-light plant in Troy. A. P. Tills is local representative.

DENVER, COL.—A new Curtis steam turbine is being installed at the Platte Street power station of the Denver Tramway Company. The engines will, with one or two exceptions, be retained as a duplicate source of power in case of emergencies.

TEXICO, N. M.—The State Line Utilities Company, recently incorporated with a capital stock of \$30,000, is planning to construct and operate an electric-light plant in Texico for the purpose of supplying electricity here and to other towns in this section.

Canada

OLDS, ALTA.—The Olds Electric Company, recently incorporated with a capital stock of \$20,000, is planning to install an electric-light plant.

LONDON, ONT.—Plans have been approved by the Ontario Railway and Municipal Board for the proposed additions to the London Street Railway.

OSHAWA, ONT.—The erection of an electric transmission line from Lindsay to Oshawa, for auxiliary service, is under consideration by the Ontario Hydro-Electric Power Commission.

PICTON, ONT.—The Hydro-Electric by-laws recently voted on by the municipalities of Picton, Wellington and Bloomfield were carried.

TORONTO, ONT.—The Canadian National Carbon Company is contemplating the construction of a power house.

TORONTO, ONT.—The directors of the Canadian National Exhibit, it is reported, are considering the construction of an auxiliary electric power plant in the near future.

CEDARS, QUE.—The Unit Construction Company, Guaranty Building, St. Louis, Mo., it is reported, has been engaged to design and construct an addition, 600 ft. by 130 ft., to the power plant of the Cedars Rapids hydroelectric development at Cedars, to cost about \$250,000.

THREE RIVERS, QUE.—Plans are being prepared by the Shawinigan Water & Power Company of Shawinigan Falls for a clearance conductor span, 5000 ft. long, over the St. Lawrence River at Three Rivers, for the transmission of electricity which will supplement the submarine cable already installed.

THREE RIVERS, QUE.—Preparations are being made by the Three Rivers Shipyard Company for the construction of a new shipyard, to cost about \$125,000. The company is reported to be in the market for a 15-ton electric crane; 15-hp. to 75-hp. electric motor; a large B.C. fir lumber band saw working at angle; a 16-in. planer; air compressor or blocker.

LUMSDEN, SASK.—The Council is considering the purchase of the local electric-light plant, to be owned and operated by the municipality.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing agent, the Panama Canal, Washington, D. C., until Oct. 1, for electric wire, fans, fixtures, bells and fittings, steel angles and plates, etc. Blanks and further information relating to this circular (No. 1163) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New

York City; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

PANAMA.—Bids will be received at the office of the purchasing officer of the Panama Canal, Washington, D. C., until Sept. 25 for an incinerating plant, marine boiler fittings and auxiliaries, generating set, gasoline motor, steel plates, gas engine, etc. Blanks and further information relating to this circular (No. 1167) may be obtained

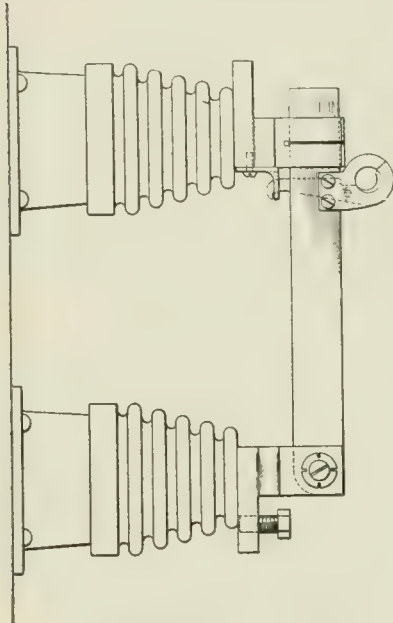
from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

MADRAS, INDIA.—The United States consul at Madras, India, writes that Best & Company (an English firm at Madras) has applied to the government of Madras for a license to supply electrical energy

under the Indian electricity act within the municipality of the town of Madura for lamps and motors. A street-lighting system is to be established in at least 36 streets. The town of Madura is situated 344 miles south of Madras on the main railroad to Ceylon, and has a population of about 134,130. For further information address Best & Company, Ltd., First Line Beach, Madras, India.

1,238,755. SECONDARY OR STORAGE BATTERY; Bruce Ford, Philadelphia, Pa. App. filed Feb. 3, 1915. Improvements.

1,238,768. INSULATOR; Gregory C. Hill, Victor, N. Y. App. filed March 3, 1917. Improved construction in which a durable locking element is provided which may be positioned between the members of the insulator after the insulator members have been fitted together.



1,238,845—Locking Switch

1,238,776. THERMOSTATIC TRIP-SWITCH DEVICE; Jesse Jackson, Kokomo, Ind. App. filed Sept. 24, 1915. For electric stoves and ovens.

1,238,792. ELECTRIC HOT PLATE OR HEAT UNIT; Maurice E. Louth and Jesse Jackson, Kokomo, Ind. App. filed July 28, 1915. Means of utilizing the maximum of the heat developed.

1,238,793. ELECTRIC HEAT-STORAGE HEATING UNIT; Maurice E. Louth and Jesse Jackson, Kokomo, Ind. App. filed Sept. 13, 1915. Has a number of interchangeable sub-units which are easily removable and replaceable.

1,238,799. CONNECTOR FOR FLEXIBLE ARMORED CONDUCTORS; Louis Marchand, Jr., Pittsburgh, Pa. App. filed Jan. 30, 1915. Improvements.

1,238,845. LOCKING SWITCH; Peder C. Thoner, Everett, Mass. App. filed Oct. 30, 1914. Adapted for high-voltage circuits.

1,238,850. PORTABLE ELECTRIC LIGHT; George W. Wacker, Rutherford, N. J. App. filed April 2, 1916. Tubular.

1,238,868. ELECTRIC LIGHTING APPARATUS; Charles Wirt, Philadelphia, Pa. App. filed Jan. 5, 1915. Improvements.

1,238,869. AUTOMATIC REGULATOR FOR COMBINED DYNAMO AND STORAGE-BATTERY CIRCUITS; Albert E. Doman, Elbridge, N. Y. App. filed Sept. 9, 1911. Improvements.

1,238,885. JUNCTION BOX; Albert Chmela, Newark, N. J. App. filed Jan. 26, 1916. Adapted to be opened and inspected easily.

1,238,923. DYNAMO-ELECTRIC MACHINE; Carlton L. Kennedy, South Braintree, Mass. App. filed April 5, 1916. Such as are used in the transmission of ether-wave signals or for any purpose where an unusually high frequency is requisite.

1,238,949. SEPARATING DEVICE; Montgomery Sleeth, Bellevue, Pa. App. filed Jan. 23, 1916. Relates to magnetic devices for separating extraneous metallic articles from bulk cotton or the like.

1,238,975. SIGNALING APPARATUS; Henry R. Worthington, Dunnfield, N. J. App. filed Feb. 26, 1910. Provides means which

in times of fog, rain or snow will enable officers in command of ships to give definite information to every one in their vicinity as to the position of their ships and the direction in which they are moving.

1,239,005. INCANDESCENT LAMP-ATTACHING MEMBER; Arthur L. Harris and Eugene F. Casanova, San Francisco, Cal. App. filed May 10, 1916. May be secured to a pocket without being screwed into engagement therewith.

1,239,008. ELECTROMAGNETIC WINDING; Clark T. Henderson, Milwaukee, Wis. App. filed July 6, 1914. May be readily and thoroughly impregnated.

1,239,012. ELECTROLYTIC CELL; Noak V. Hybinette, Christiania, Norway. App. filed May 22, 1913. Means for use in the electrolytic deposition of copper from solutions containing iron and copper.

1,239,019. WRAPPING MACHINE; Nafew J. Lloyd, Butte, Mont. App. filed Dec. 5, 1914. Article being wrapped is automatically fed in position for receiving the wrapping material.

1,239,054. ELECTRIC PUSH-BUTTON; William Sparks, Jackson, Mich. App. filed April 25, 1913. Improvements.

1,239,056. ELECTRIC MOTOR; William Sparks, Jackson, Mich. App. filed Sept. 11, 1914. For electrically operated horns.

1,239,062. LOCKING SWITCH; Peder C. Thoner, Everett, Mass. App. filed Dec. 2, 1916. For high-voltage circuits.

1,239,078. FLASHLIGHT; Bernard Benedict, New York City, N. Y. App. filed Nov. 19, 1915. Pocket.

1,239,140. FIRE-ALARM APPARATUS; Alberto Torchio, Oyster Bay, N. Y. App. filed Jan. 12, 1917. Improvements.

1,239,141. ELECTRIC SIGNALING APPARATUS; Frank S. Tucker, Boston, Mass. App. filed April 25, 1913. Improvements.

1,239,145. X-RAY APPARATUS; Julius B. Wantz, Chicago, Ill. App. filed Jan. 29, 1914. Relates also to the supporting of a fluorescent viewing screen for use in connection with the X-ray tube.

1,239,146. X-RAY TABLE; Julius B. Wantz, Chicago, Ill. App. filed Feb. 16, 1914. Improved.

1,239,178. PROCESS FOR OBTAINING ALKALI-EARTH METALS; William M. Grosvenor, Ridgewood, N. J. App. filed Feb. 3, 1916. Particularly adapted to the obtaining of metallic magnesium.

1,239,182. MOUNTING SHELL FOR INCANDESCENT ELECTRIC LAMPS; Edwin W. Hender, Watertown, Conn. App. filed March 29, 1917. For ceiling or side-wall lighting.

1,239,199. SWITCH LOCK; Benjamin H. McNeil, Chicago, Ill. App. filed March 17, 1917. For attachment to motor vehicles to prevent the theft or unauthorized use thereof.

1,239,214. ELECTRIC FURNACE; Edgar F. Price, Port Chester, N. Y. App. filed Feb. 1, 1917. Hearth constitutes one of the furnace electrodes or circuit terminals.

1,239,215. ELECTRIC FURNACE; Edgar F. Price, Port Chester, N. Y. App. filed Feb. 1, 1917. Provision of a novel and durable form of electrical connection for a movable electrode of such furnaces.

1,239,243. HOLE PLUG FOR JUNCTION BOXES AND SIMILAR STRUCTURES; Charles Wuensch, St. Louis, Mo. App. filed April 21, 1916. Improvement.

1,239,249. RECTIFIER FOR ALTERNATING CURRENTS; Edwin C. Ballman, Kirkwood, Mo. App. filed Aug. 6, 1914. Vibrating type.

1,239,257. ELECTRICALLY HEATED SEAM RUBBER; Edwin N. Chandler, Braintree, Mass. App. filed May 3, 1917. For use in connection with boots and shoes.

1,239,275. CONTROL SWITCH FOR ELECTRIC LAMPS; Eliot Keen, Brooklyn, N. Y. App. filed Aug. 4, 1915. In appearance and mode of operation it resembles the conventional wall push switch.

1,239,317. LAMP SOCKET; George B. Thomas, Bridgeport, Conn. App. filed April 6, 1916. Improved.

1,239,320. APPARATUS FOR DETECTING SUB-AQUEOUS SOUNDS; Francois Van Esbroeck, London, England. App. filed July 31, 1916. Designed to discover the presence in the vicinity of a submarine or submersible vessel by the vibrations from its screw propellers.

1,239,322. ELECTRIC THERMAL CUT-OUT DEVICE; Louis Vecchio, Albany, N. Y. App. filed Dec. 9, 1916. Capable of being placed in position as a unitary element.

1,239,325. ELECTRIC WATER HEATER; Ernest C. Webster, Oakland, Cal. App. filed Sept. 18, 1915. Improvements.

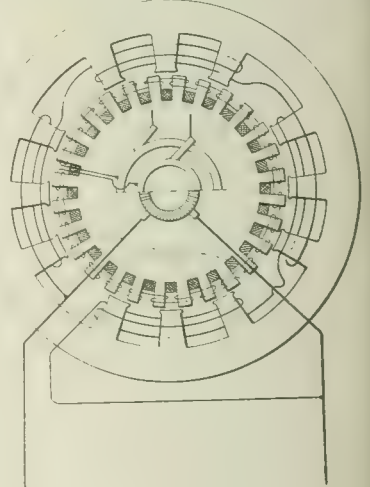
1,239,339. MAXIMUM-DEMAND INDICATOR; John T. Beechlyn, Lynn, Mass. App. filed Nov. 11, 1913. Movable member is maintained in the position to which it has been moved when the consumption of energy in the installation is interrupted, and is not returned to its initial position until the interval of measurement is fully completed after the consumption of energy has been resumed.

1,239,344. ELECTRICAL GUN; Levi M. Bowman and William A. Smith, Tulsa, Okla. App. filed May 29, 1917. Primary object of the invention is to provide a gun which may be made safe from accidental discharge, and after having once been sighted the pulling of the trigger to fire the gun will not pull the gun off from the object sighted at.

1,239,357. RELAY; Hiram D. Currier and Lawrence Ericson, Chicago, Ill. App. filed Oct. 9, 1915. For use in connection with telephone apparatus.

1,239,381. SIGNALING SYSTEM; John C. Francis, Canton, Mass. App. filed July 12, 1916. Fire alarm.

1,239,383. FIRE AND RAIN ALARM; George M. Gebhard, Rochester, N. Y. App. filed Feb. 16, 1916. Improvements.



1,238,923—Dynamo-Electric Machine

1,239,410. CABLE CONSTRUCTION; Ernest B. Livy, Richmond, Va. App. filed Nov. 17, 1916. Provides for the filling of these cables by the use of a material which is strong and durable, virtually weather-proof and waterproof, and a good dielectric.

1,239,413. INCANDESCENT LAMP; George M. J. Mackay, Schenectady, N. Y. App. filed March 25, 1916. Improvements.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN

Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, SEPTEMBER 22, 1917

No. 12

Engineering College Registration

WE PUBLISHED last week a table summarizing the replies from sixty-two engineering schools or engineering departments of universities in the United States as to the actual or anticipated effects of the war upon their student enrollments. The results are still in doubt and cannot be fully determined for another month, but the indications are that the freshman class will be unusually large, the sophomore class about the same as usual, the junior class largely depleted, and the senior class very small.

The reasons for such a condition of things in our technical colleges are not far to seek. The seniors have already either enlisted or entered government work for the war. On the other hand, the youths of college-entering age are seeking engineering and applied science training in increasing numbers. The war has revealed to all countries the vast national importance of technical training in some branch of science, so that even in times of peace hereafter we may expect to see more and more men graduate from science colleges for professional work. If war is essentially an engineering enterprise on a national scale, the vocations of peace are steadily becoming molded into engineering departments in a broad sense of that term.

This tendency of the times toward the study of applied science constitutes no disparagement to other branches of learning, such as the belles lettres, philosophy and history. It would be a sorry world in which all of the non-technical studies were suppressed. It merely means that under the pressure of war, and also of war's aftermath in peace, the studies and occupations which are devoted to the beautiful must perforce give way to the studies and vocations of necessity. Art may be considered, in one sense, as the cream of human production, and a world without art would be a dreary dwelling place; nevertheless, in times of need and tribulation art must give place to business and to the sciences that produce necessities.

We may expect, therefore, to find that the non-technical colleges will suffer in their student enrollment by the war much more than the technical colleges, because not only will they lose in their graduating classes by enlistment but they may also expect to lose in their entering classes. If so, however, we may well hope that the setback will be but temporary. Not only do more lads go to arts colleges now than formerly, with a tendency in that direction yet greater for the future, but it is only reasonable to expect that the best men destined for technical training will take a preliminary training in arts. Any professional course in applied science calls for four years of hard and intensive scientific study. Those who

have sufficient capital and ability will prefer to take some of the humanities before commencing such a specialized curriculum. While, therefore, the world's work will continue to demand applied science increasingly, there will always be room, in normal times, for the study of the beauties and amenities of life.

Coal Shipments

IT IS time that the government took hold in earnest to put in active operation its measures for the establishment of proper coal supply for industries. There has been complaint, sometimes reasonable and sometimes unreasonable, that serious disturbance has arisen from the government taking coal supplies for its own use. This, of course, it has a perfect right to do, but immediately following the development of such a necessity should come extremely active measures to prevent the breakdown of necessary power supply and unnecessary interference with manufacture. But the exigency of war is upon us, and it is up to those who use coal to take every measure to secure and maintain a suitable supply. Public service plants certainly deserve preferential treatment on account of their peculiar functions, but they are not in the least excused thereby for trusting to luck, not exercising ordinary prudence in accumulating reserve and seeing that their supply is not curtailed by speculators looking for a rise. Here is where the government can do a very important work by applying without delay the necessary pressure to secure the mining, transportation and delivery of fuel, and particularly the suppression of speculative attempts to hold up shipments.

Recommendations on Nitrate Supply

WE COMMEND to our readers as of exceptional interest and importance at the present time the report which we publish this week of the recommendations made by the nitrate supply committee to the government regarding methods of obtaining a proper supply of nitrates for military and industrial use. Congress has appropriated \$20,000,000 for initiating such work, and the technical problem of supply was placed in the hands of an extremely well-chosen and able committee. The most striking feature of the report is that after careful consideration the committee advises against the electrical methods of the fixation of nitrogen which require large water-power developments, and recommends the more direct chemical methods which require a minimum amount of power and do not demand any expensive developments. It advises the immediate expenditure of less than \$4,000,000 and the location of a plant near

the proposed new explosives factory of the government.

In the judgment of the committee, the very large supply of extremely cheap electric power necessary to work the arc or cyanamide processes is not available in this country within reach of the points where the resulting nitric acid would have to be used for the war requirements of the nation. A development of hard on to half a million horsepower would be required, and the difficulties of transportation either of the product to suitable manufacturing points or of the raw material to points conveniently reached by electric transmission are so considerable that a choice of processes is indicated such that the whole industry can be more efficiently concentrated. There is an additional advantage in that large water-power developments are slow in the making and the critical need of the government just now is for nitrates in large quantity at the earliest possible moment. The next step should be to hasten the construction of the plant recommended since the element of time is clearly all-important.

The Thermal Conductivity of Armatures

THOSE who are interested in the technique of design of electrical machinery will find exceedingly instructive data presented in George E. Luke's paper in the current issue. It is, of course, a commonplace of designing that so far as efficiency is concerned there is little room for even small improvement. When nineteen-twentieths or more of the mechanical energy supplied is transformed into electrical energy at the terminals, or vice versa, improvement from a commercial standpoint must take place along some other line than raising the efficiency. Practically, as Mr. Luke notes in his introductory sentence, the problem before the designer now is to get as much output as possible out of his material at substantially a fixed grade of efficiency, and this in turn is a matter of getting rid of the heat by improved ventilation of the structure, forced draft if necessary, and every device that can tend to keep up the output without raising the temperature to a dangerous point.

Mr. Luke's very careful research was made to determine the heat conductivity of the laminations both along the sheets and across the mass. These two conductivities determine the rate of flow toward the exterior, where cooling can be carried on, and hence the temperatures and temperature gradients with which the designer has to deal. The work seems to have been carried on with unusual precautions to assure a high degree of precision in the measurements. The results were secured both on silicon steel, now widely used, especially in transformers, and the high-grade soft steel very largely employed for armature work in general. In the former case the sheets are practically insulated with a film of oxide, in the latter with varnish. The most striking feature of the results is that the thermal coefficient of the ordinary soft-steel lamination was more than twice that of the silicon steel, a result, to be sure, to be expected from the relative electrical conductivity of the two materials, but important to be verified as a

practical matter. The lower loss of energy in the silicon steel goes far to compensate for the decreased thermal conductivity, particularly in cases like transformer building, while the ordinary steel permits readier cooling in the structures like large turbo-generators where the output has to be pushed to the limit. It is again a nice question of balance between the heat generated in various parts of the structure and the facilities for getting rid of this heat through conduction to a point at which it can readily be carried off.

Regarding Transformer Performance

ON ANY large system of distribution it is by no means easy to keep thorough track of the scattered transformers of all sizes and under all conditions of load. Even with the most careful systematization, it is none too easy to be able at a glance to tell what each transformer supplies, what its rating is, what the load is, how long it has been in service, and whether it is in good or indifferent condition. The recording scheme of the Columbus (Ohio) company, which we describe elsewhere, is one of the most effective from the standpoint of service that we have had the pleasure of seeing, and no more complicated than the necessities of the case actually demand. Its most important features have to do with the relation between the location of the transformers in customers' service and the load conditions. To begin with, a circuit book gives by a system of numerical groups the location, phase connection and other details regarding each transformer there in service. This enables the sizes and phase positions of transformers to be looked up quickly as a preliminary to other work.

Working along with this is the customer's file, the full record of connected load, troubles and the like, together with the location number of the transformer, the circuit and the phase, and other minor matters. This file is of particular use in handling troubles inasmuch as it enables an immediate location of probable transformer difficulties when complaints begin to come in. The load details from the customer's file are in a special transformer load book, checked with the former record and kept up to date, the point being that by this means a conspect view can be had of the load conditions of each transformer, leading to definite hints regarding the desirability of replacing it. This load record leads in turn to a record of annual tests made on all line transformers worked pretty nearly up to their rating, where trouble may impend the next season. The fundamental idea of the system is to keep at hand the information ready for instant use. The data regarding customers, transformers and load, and the close relation of these established, have more than once worked out to advantage, for instance in case of having to cut out a transformer, of which notice can be immediately given by telephone to the customers, owing to the closely summarized arrangement of data. On any large system some such scheme of record is necessary, but the time to begin it is when the company is growing past that stage in which the line foremen depend on memory.

Power Surveys in Industrial Plants

WITH many industrial plants business has increased so rapidly during the last two years that there has been little time to analyze the conditions of motor service. Not a few of these plants are running at substantially full capacity; in many quarters labor is far from plentiful, and attention must be focused first upon getting out the product. Power users should not make the mistake, however, of assuming that because their motor equipment is adequate for the present production rates, nothing remains to be done along the line of improvement in applications of the various types of drives.

It is not beside the mark to say that in very many factories motors are now at work, under the stress of war conditions, under loads unsuited to their best performance. Excessive overloads, temporary or protracted, underloads, driving machinery at speeds only approximating the proper figures, makeshifts in driving arrangements put through to get the equipment moving regardless of losses in mechanical transmission, waste of energy in motor-controlling devices unsuited to the particular layout, and unsatisfactory control itself, are some of the matters worth looking into.

A power survey can be carried out in many cases at small expense for equipment, and the actual work can often be done in the "off-peak" periods of the industrial engineer's duties. One of the best things about it, compared with a general steam plant test, is that it can be handled at the convenience of the engineer in charge and very frequently with little or no interference with regular production. Perhaps the two most important points—motor loading and conditions of mechanical drive efficiency—can be determined in numerous instances without stopping the output for more than five minutes. The day is likely to come when ammeter jacks will be provided in motor circuits as logically as provision is made for the use of the indicator in the reciprocating steam engine; certainly, in the case of 50 hp. and upward a motor is of enough importance as a consumer of energy to warrant fairly frequent tests of its loading conditions. And it is unsafe to assume that the stated load on a motor a year ago has remained the same. There is no better check upon the friction conditions of the shafting, belts, gearing or coupling than is afforded by systematic and accurate series of motor input readings with portable instruments.

Lighting Residence Streets

THE paper by James R. Cravath in the current issue takes up one of the knottiest problems with which the illuminating engineer has to deal, the lighting of the scattered residential districts of a comparatively small city. The situation is complicated by the fact that the transition from a fairly well-built residential street to a sparsely settled country road is so gradual that it is almost impossible to perceive any reasonable line of demarcation. It therefore happens that while the real necessities in a case change from street lighting to country road lighting, a bald statement of the fact would be invidious and a compromise has to be effected.

Mr. Cravath's fundamental theorem, that lamps where street lighting is attempted at all should not be spaced more than 500 feet or 600 feet (152.4 m. to 182.8 m.) apart, is a good starting point for dealing with a proposition of this kind. Lamps thus spaced, unless of power altogether unsuited to such a situation, really give no perceptible light midway of the spacing. They merely are bright spots seen at a distance. They are, however, even if not particularly powerful, of advantage as markers of the way. They furnish a modest illumination near the lamps, fading rapidly off into practical absence of light, but they do point the line of the street, its crossings and sidewalks, and to this degree they are of importance.

From this extremely modest scale of illumination residential street lighting may grade up into really fine illumination. The first step upward consists in abandoning the usual arrangement of a lamp at each street crossing and beginning to put lamps midway of the blocks. As to the size and location of lamps, this is a perennial puzzle on account of cost and the fact that residential streets are so generally lined with trees which stand in the way of good distribution of light. Posts on the curb become almost useless in some streets, and lamps must either be placed on brackets well out from the curb or on cross-suspensions. Where lamps are placed only on the corners, the latter procedure is commonly the more convenient. Where the blocks are very long a rather long bracket arm commonly meets requirements. The whole task of adequately lighting a residential street requires a vast amount of judgment and finesse rather than scientific calculation of illumination values, and Mr. Cravath's excellent discussion of the subject will be found most helpful to those who have to undertake such work.

IN the next issue of the **ELECTRICAL WORLD** will be presented the second installment of an article on the rehabilitation and extension of the Ashley Street station of the Union Electric Light & Power Company, St. Louis, Mo. This section will outline the changes which are being made in the circulating-water-supply system for the condensers and will dwell on the methods of overcoming certain difficulties encountered. Graphical presentation of electrolysis data will be another subject which will be discussed. Among the advantages of the system which will be described are: (1) Ease with which satisfactory and un-

The Coming Issues

desirable conditions can be observed from the data, and (2) possibility of making a permanent record which can be modified as conditions change. Results of an investigation by a Middle Western company to determine the life and costs of treated cedar poles will also be discussed in the Sept. 29 issue. The discussion of the residential street-lighting problem, the first part of which appears in the current issue, will be continued next week, when attention will be devoted to such phases of the subject as the selection of proper lamps and accessories, pole heights and suitable ornamental pole systems.

Heat Dissipation a Problem in High-Rated Units

Limits of Efficiency Practically Reached in Electrical Apparatus
—Present Task Is to Cheapen Cost of Construction
and Build Equipment with Higher Rating

BY GEORGE E. LUKE

Princeton University, Palmer Laboratory

PRACTICALLY, the limit of efficiency for modern dynamo-electric machinery has been reached, so the big problem now confronting designers is to cheapen still further the cost of production and build higher-rated units.

The largest factor in the above problem is the dissipation of the heat due to the losses. It is along this line that the greatest advance is being made and will continue to be made. By improving means of getting rid of this heat smaller and consequently cheaper machines can be built. That the ratio of the kilowatt output to the square feet of external radiating surface is increasing at such a rate that it seems to have no limit still further illustrates how the problem of removal of the heat losses is getting to be a bigger problem each year.

This paper will outline the results of an investigation to determine the resistance to the flow of heat both along and across the laminations, the latter part taking into account different pressures upon the laminations. These coefficients of thermal conductivity must be known in order to predetermine the temperature rise of rotating machines and transformers, for by far the greater part of the losses must be conducted through the iron part of the apparatus. Especially is this true in the case of the rotating electric machinery. The coefficients are required in order to select properly the type of ventilating duct, whether radial or longitudinal, and to determine the required size and spacing.

SCOPE OF INVESTIGATION AND METHOD USED

The investigation is divided into two parts: First, the determination of the thermal conductivity across the laminations with varying pressures; second, the de-

termination of the thermal conductivity along the laminations. More than 500 punchings of each material were carefully calipered and the average thickness found.

An absolute method of measurement was used; namely, knowing the quantity of heat flowing and the temperature gradient between two fixed points, the coefficient of thermal conductivity can be calculated, since

$$W = KA \frac{\theta_1 - \theta_2}{t} \text{ or } K = \frac{Wt}{A(\theta_1 - \theta_2)}$$

where W = watts flowing after a steady state has been reached,

K = coefficient of thermal conductivity in watts per deg. C. per inch of path,

K_1 = value of K along the laminations,

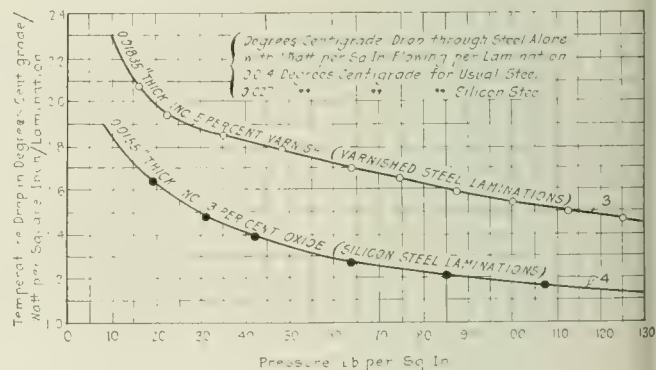
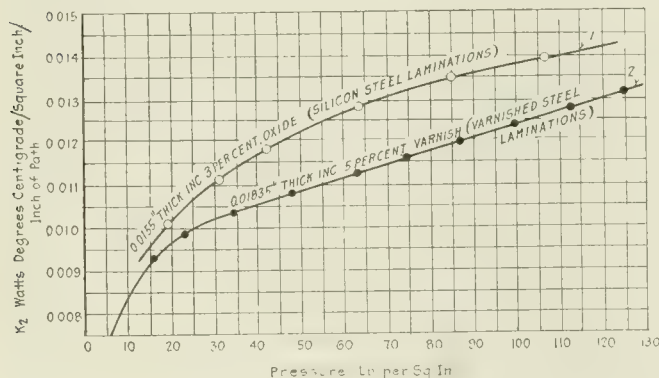
K_2 = value of K across the laminations,

A = cross-sectional area in square inches at right angles to the flow of heat,

t = the length of path between the fixed points in inches,

$\theta_1 - \theta_2$ = the temperature gradient between the fixed points.

The variation of K with temperature was not considered since it is so small that it may be neglected here. The method used, an original one, obviated the loss of heat on the ends which is always present in the usual methods. The heating coil was placed in the middle with the same number of sheets on both sides, while the cooling plates were on the ends. Thus the only leakage was through the sides and this was reduced to a minimum by 5 in. (12.7 cm.) of packed cotton wool, which is one of the best possible insulators. The



FIGS. 1 AND 2—VARIATIONS OF THERMAL COEFFICIENT OF CONDUCTIVITY AND TEMPERATURE DROP WITH CHANGE OF PRESSURE ON LAMINATIONS

termination of the thermal conductivity along the laminations. In both cases two grades of commercial laminations were used, one the usual varnished-steel sheets supposed to be 0.017 in. (0.43 mm.) thick such as are used in all electrical machines, the other silicon-steel sheets such as are used in transformers and insulated with the oxide only. This grade was supposed to be

method, which is based upon the equality of flow of heat to each end, was practically due to the number of sheets used. The heat flow given by the test data secured was very closely divided, judging by the temperature gradient.

Copper-constantan thermocouples were placed symmetrically on four sides of the laminated block, four

being used at each position, making sixteen couples in all. The four units of each set were connected in series so as to give greater accuracy in reading the temperatures. This arrangement also gave the average temperature at that point and compensated for any irregularities in the thermocouple wire. Each of the four sets of couples was read separately. Each of the two cold-end and hot-end readings were averaged, thus getting the average temperature gradient between the two fixed points.

The thermocouples were made of No. 36 silk-insulated wire, and leakage was prevented by treating them with insulating varnish and baking. They were carefully calibrated so as to read correctly to 0.1 deg. C. The cold ends were placed in cracked ice in a dewar bulb. The emf. was read with a Leeds & Northrup potentiometer.

Two circular copper cooling plates, $\frac{1}{2}$ in. (1.27 cm.) thick, were used. The path of the water was a spiral of ten turns to the center of the plate and then a similar path to the periphery again. This gave a practically constant-temperature plate.

The heating coils were made of No. 18 Comet resistance wire. One was wound spirally in the form of a circular disk, the other being a square plate held together by two copper plates. Both coils were treated with insulating varnish and baked. Potential taps were soldered on the terminals.

To find the effects of pressure upon the flow of heat across the laminations an apparatus was arranged consisting of a portable crane and lever, so that any definite pressure could be maintained upon the laminations. From twenty-four to thirty-six hours had to elapse before thermal equilibrium could be established for each run. The watts input was maintained very constant by using storage batteries. By adjusting the quantity of cooling water used the difference between the temperature of the inlet and outlet water was maintained less than 0.1 deg. C.

ANALYSIS OF RESULTS

The results obtained are plotted in the four curves of Figs. 1 and 2. Curves 1 and 2 show that the coefficient of thermal conductivity rises from some point near zero very rapidly at first until the laminations are pressed fairly close together and then increases at a practically constant but decreased rate. On this part of the curve the increase in pressure decreases the air space between the plates only a very little, hence K_2 changes only slightly. There is no doubt that somewhere beyond the range shown the curve becomes practically horizontal. However the straight part of the curves will give those values of K_2 corresponding to pressures used in practice. K_2 for silicon steel is greater than for the varnished-steel laminations in spite of the fact that the silicon-steel sheets are thinner and the steel itself has a lower conductivity. This is explained by the fact that the oxide, not only being thinner, has a much higher thermal conductivity.

Curves 3 and 4 give the temperature drop per lamination when 1 watt is flowing across 1 sq. in. (6.5 sq. cm.) of laminations for the different pressures. They show a drop of 1 deg. C. to 2 deg. C. per lamination. This drop is composed of the drop through the oxide layer of varnish and the drop through the steel itself, which is negligible in comparison with the other. How-

ever, if all of the drops are calculated their sum will not equal the measured drop. The difference is the so-called contact drop. Dr. E. F. Northrup¹ measured this contact drop between two plane pieces of copper and found it to be about 1 deg. C. with the plates under pressure and with 1 watt flowing across 1 sq. in. (6.5 sq. cm.) of surface. The contact drop, no doubt, makes up the largest part of the temperature drop, especially with the plates under high pressure, as the air film is small. The contact drop varies greatly with the material and nature of its surface, so it is impossible to find a suitable formula for the value of K_2 . Furthermore, the thicknesses of the oxide, varnish and air films are practically impossible to estimate to any fair degree of accuracy.

From the values of the coefficients (calculated) of thermal conductivity along the laminations (see table), it may be seen that the usual steel lamination has a conductivity of over twice that of the silicon steel. This result is to be expected since the electrical conductivity of the two materials bears about the same ratio. This is another disadvantage in the use of silicon steel for rotating electric machines, especially in large turbo-generators, where the heat problem is a very vital one. However, at the larger frequencies its low iron loss would probably more than offset its poor conductivity for heat.

Values are also given for this coefficient through the steel alone, that is with a cross-section based upon the actual steel. The thicknesses taken for the varnish and oxide represent the average of over 100 measurements.

COMPARISON OF RESULTS WITH PREVIOUS DATA

Only two similar experiments were found on record in any of the standard journals or periodicals. Both of these were made in the year 1907, one by T. M. Barlow in England,² the other by Dr. Ludwig Ott in Germany.³ Both of these men used material which is not commercial to-day, paper insulation being employed between the sheets. The details and results of their investigations are therefore hardly comparable with the information given herewith, but a comparison is given below:

	Dr. Ott	Mr. Barlow	Writer's Value
K_1	1.45	1.49	0.542 for silicon steel 1.210 for usual steel
K_2	0.0135	0.0146	0.0130 silicon steel 0.0114 usual steel

Dr. Ott also developed the formula

$$K_2 = \frac{a + b}{\frac{a}{A} + \frac{b}{B} + \frac{1}{C}}$$

where a and b are the thicknesses of the iron and insulation respectively, A and B are the coefficients of conductivity respectively, and C is the conductivity of the surface.

Without considering the difficulty in finding the constants a , b , A and B , the factor C makes this formula impracticable since its value has more weight in determining K_2 than all of the others and it can be only estimated since it varies between the wide limits of 0.5

¹ "Some Aspects of Heat Flow," *American Electrochemical Society Journal*, No. 24.

² *Transactions* (British) Institution of Electrical Engineers, Vol. 40.

³ *Transactions* Verein deutscher Ingenieure, Vols. 35 and 36.

and 0.04. The writer has found no published values of the coefficients of heat conductivity for silicon steel, hence can make no comparisons.

The error in measuring the watts input and the tem-

CALCULATED VALUES FOR THE COEFFICIENT OF THERMAL CONDUCTIVITY ALONG THE LAMINATIONS

SILICON STEEL

Average thickness (inches) with oxide (3 per cent).....	0.01546
Coefficient of thermal conductivity in watts per square inch per inch of path, per deg. C.....	0.542
*Coefficient exclusive of 3 per cent oxide (through steel alone)	0.558

VARNISHED STEEL LAMINATIONS

Average thickness with 5 per cent varnish, inches.....	0.01803
Coefficient of thermal conductivity in watts per square inch per inch of path, per deg. C.....	1.21
*Coefficient exclusive of varnish (through steel alone)...	1.27

*The coefficient for the steel alone is based upon the actual thickness of the lamination minus the thickness of the varnish or oxide.

perature was less than one-half of 1 per cent in the investigation to which this paper refers, and the leakage was less than 1 per cent, so that the accuracy of the values found is greater than necessary for practical purposes.

TESTING TRANSFORMER OIL BY USE OF MEGGER

Advantages of Megger Test Over Two Methods Now Used Extensively Are Cited—Data on Effect of Moisture and Temperature

BY R. W. SORENSEN

Professor of Electrical Engineering, Throop College of Technology, Pasadena, Cal.

Clean, dry transformer oil of good quality is now such a common commodity as to be almost forgotten as a subject for engineering discussion. This fact must not be taken as an indication that its maintenance in such a condition can be accomplished without frequent and proper inspection and testing, followed by filtering when required.

At the present time all the power companies whose

Both of these methods, while not in any sense prohibitive, are rather costly and difficult, the first being so because of the weight of the apparatus to be transported, and the second in that the bottles can be kept absolutely dry only with difficulty and are liable to breakage during transportation.

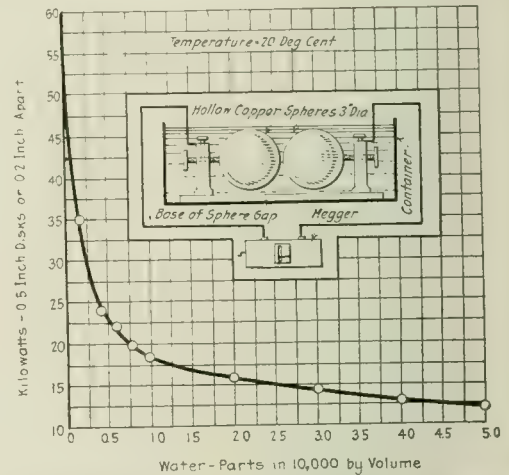
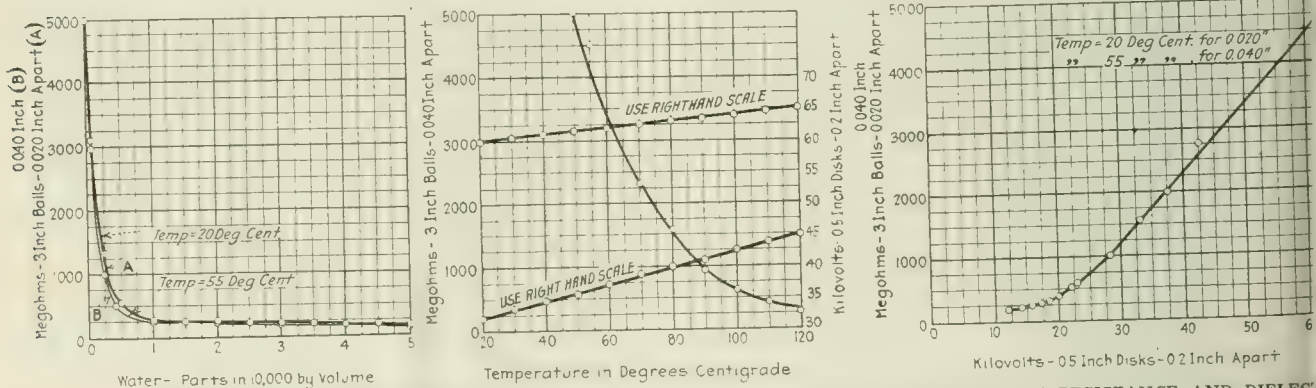


FIG. 4—ARRANGEMENT OF TEST APPARATUS AND EFFECT OF MOISTURE ON DIELECTRIC STRENGTH

A large number of tests with a 1000-volt, 500 megohm megger, to determine its value as a field instrument for indicating the condition of the oil in transformers operating on a system, were recently carried out by Roy T. Richards at the Throop College of Technology, Pasadena. The results of these experiments, may be seen by the accompanying curves, demonstrating that those conditions which influence the results obtained by high-potential tests also influence in the same general way the results obtained by the megger. In fact, the only condition which seems to present the possibility of difficulty in translating the results obtained by one method of test into those of another method is the greater influence of temperature change on the megger readings as shown by Fig. 2. Even this difference is practically obliterated, however, when the relation between megger and dielectric-value readings is compared (Fig. 3) and account is taken of the f



FIGS. 1, 2 AND 3—EFFECT OF MOISTURE ON INSULATION RESISTANCE; VARIATION OF INSULATION RESISTANCE AND DIELECTRIC STRENGTH WITH TEMPERATURE, AND RELATION BETWEEN MEGGER READINGS AND DIELECTRIC VALUES WITH ADDITION OF MOISTURE

methods are known to the writer test the oil in all transformers at stated periods, either by transporting a testing transformer to the station where the transformers whose oil is to be tested are operating or, what is more frequently the case, by sending to the testing laboratory bottles containing samples of the oil in ques-

tion. Both of these methods, while not in any sense prohibitive, are rather costly and difficult, the first being so because of the weight of the apparatus to be transported, and the second in that the bottles can be kept absolutely dry only with difficulty and are liable to breakage during transportation.

In Fig. 4 is shown the most satisfactory apparatus for use with the megger that could be conveniently made with the materials available.

Lighting of Streets in Residential Sections

General Principles for Observance in Lamp Spacing and Location with Overhead Circuits Under the Conditions That Are Normally Found to Exist in Small Towns and Cities

BY JAMES R. CRAVATH

Previous articles of this series have taken up the general principles of street lighting and the available equipment, such as lamps and lamp supports. The present article is to show the application of these principles to the design of lighting in residential districts in small cities and towns.

ALTHOUGH residence streets may be placed in classifications which differ considerably and although there is a wide variation in the character of such streets, it must always be kept in mind that the conditions on any street to-day may not be those of a few years hence, so that certain general methods of treatment should be adopted which will permit of changes as the occupancy and importance of a street changes. If we classify streets according to population and importance, we start with the outlying, sparsely settled districts, coming gradually into more densely settled areas and finally merging on semi-business and business streets. We may also have to consider in some cities certain of the better residential streets where, by special assessment or otherwise, an underground system with ornamental lamp standards is desired. It may be assumed at the outset that in towns of 50,000 population and less, such as we are considering, underground distribution for the great bulk of the residential street lighting is out of the question on account of the expense involved. Many of the problems in connection with residential streets are common to all classes of streets where overhead wires are used. The various questions will be taken up here as applying to all kinds of residential streets in which overhead wires are used, except where it is specifically mentioned that they apply to a certain class only.

SPACING OF LAMPS

In most outlying districts which are sparsely settled the maximum proper distance between lamps is an important question. On account of the small population



FIG. 1—LACK OF TRIMMING DEFEATS THE LIGHTING

there is always a temptation to which city councils are prone to yield to space lamps at such absurdly long intervals that they are of little value. Intervals of 800 ft. to 1500 ft. (243.8 m. to 457.2 m.) between lamps are by no means uncommon in outlying districts, and in fact were also extremely common in the ordinary built-up residence portions of small towns until very recently. This was because the arc lamp was the only lamp used in street lighting in many towns, and in order to spread out the street-lighting appropriation over a sufficient area with such large and expensive units the long intervals were resorted to.

These long intervals usually mean a spacing of lamps at every other street intersection.

Now without regard to the population or importance of a street there is a certain maximum distance between lamps which cannot be exceeded in good practice as demonstrated by long experience. This maximum permissible spacing is about 500 ft. to 600 ft. (152.4 m. to 182.8 m.), depending somewhat of course upon local conditions and the lengths of block. When this is much exceeded the streets midway between lamps are so much darker than near the lamps that starlight and moonlight would usually be preferable. An isolated lamp by itself is of very little value for street lighting if the approach to it is dark.

It is then safe to put down as a first principle that the foregoing maximum spacing of about 600 ft. (182.8 m.) should not be exceeded, and that after this is reached reduction of cost is to be obtained by reducing the size of the lamps rather than by lengthening the interval between lamps.

In most cases the length of block or distance between street intersections should govern the spacing of the lamps. It is obvious that it is much more economical to place a lamp where it can light four directions than where it can light only two directions. This is not al-

together due to the waste of light when a lamp lights in two directions only, for that can be partly compensated for by prismatic glassware for refracting on the street the light that would otherwise be wasted. The investment per mile of street lighted is greatly increased by the use of lamps between street intersections because of the line and lamp investment, so that for the class of



FIG. 2—PLAN FOR CITIES WHERE THERE ARE ALLEYS

lighting where the covering of the greatest mileage of street at the smallest expense is required the placing of lamps at street intersections must usually be adhered to. The extra investment required to place lamps between street intersections of course always includes the cost of the lamps and their supports. Whether it includes more than this will depend upon the system of distribution and whether there is a pole line on the street anyway.

Spacing of lamps less than 500 ft. to 600 ft. (152.4 m. to 182.8 m.) is desirable. Assuming that lamps are now spaced at 500 ft. apart, as determined by block lengths, a spacing of 250 ft. (76.2 m.) would be the next most logical move rather than an increase in the candlepower of lamps at the 500-ft. spacing. Of course, should an increase of the number of lamps and shortening the intervals to 250 ft. prove too expensive, an increase of the candlepower at the 500-ft. intervals would be the next alternative. If lamps are spaced 250 ft. apart as against 500 ft. it is obvious that a reduction in the candlepower of each lamp can be made, but as to just how much reduction is permissible complete data are lacking. Considering the matter from a purely theoretical standpoint and leaving out of account the possible influence of the brighter street surface under the larger lamps on silhouette effect, as mentioned in the first article in this series,* the illumination midway between lamps is inversely proportional to one-half the spacing squared, so that reducing the spacing one-half would reduce the required candlepower to one-fourth, assuming, of course, the same form of distribution of candlepower from the lamps in all cases. With a 500-ft. spacing and with lamps suspended as low as they must be on residential streets in small towns to avoid the shade trees and keep within reasonable cost limits, it is not at all probable that the greater sil-

houette effect obtainable in certain positions with 400-cp. lamps at 500-ft. intervals would be enough to compensate for the advantages of the increased number of brightly lighted areas obtainable with 100-cp. lamps at 250-ft. intervals. It must be noted, however, that the 100-cp. lamp will cost considerably more than one-fourth as much as the 400-cp. lamp per year, on account of the greater investment and maintenance charges.

Lamp spacing as governed by sizes of blocks is complicated by the fact that many city blocks are greater in one dimension than in another. For example, in Fig. 9 is shown a typical block in a certain town which is representative of a large number the country over. It is considerably longer north and south than east and west. Now, as far as lighting Main Street (Fig. 9) with a lamp placed at each intersection and one midway between intersections is concerned, the power of each lamp should obviously be the same as regards that street only. However, the dimensions of the block measured east and west do not justify in many of these cases an intermediate lamp, so that the corner lamp must take care of the entire block on Fifth Avenue. This calls for a higher-power lamp at the corner, and this is good practice where mid-block lamps are used in cases of this kind. When street intersections are 350-ft. to 500 ft. (106.6 m. to 152.4 m.) apart it is not always an easy question to decide whether to put in mid-block lamps when the lighting is to be improved or to increase the power of lamps at intersections. Below 350 ft. the increase in power of the street corner lamps is better unless excessive shade-tree conditions, curves or desires for the ornamental effect of frequently spaced lamps are introduced.

SIDE AND CENTER LAMP LOCATIONS

The mounting of lamps on brackets from the regular poles on one side of the street is usually neater and

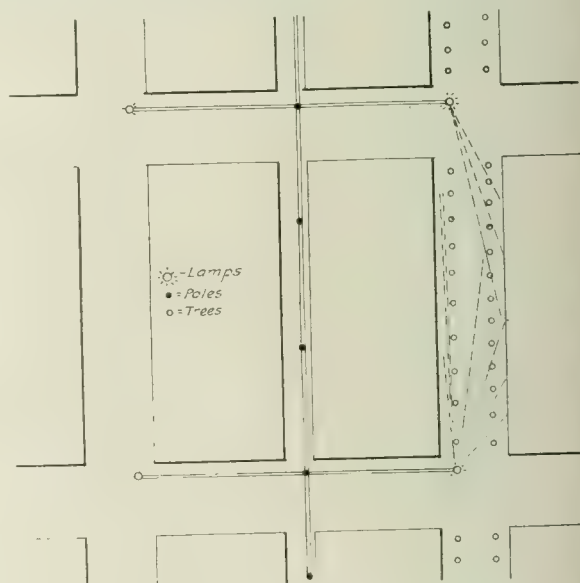


FIG. 3—PLAN FOR CROSS-STREET CIRCUITS

more sightly than center suspension, but in spite of this center suspension is to be preferred for a large number of locations on account of shade-tree conditions which make satisfactory lighting from the side of the street difficult. For example, on the streets shown in Figs. 4, 6 and 8 the trees are of such a size

*Sept 1 issue ELECTRICAL WORLD.



FIGS. 4 TO 8—A BAND REFRACTOR UNIT AND MEDIUM-HEIGHT LOW-TRIMMED TREES; HIGH TREES AND A FUTILE ATTEMPT TO GET ABOVE THEM; LOW TREES, LINES ABOVE; TYPICAL HIGH ARCHING TREES; MEDIUM AND LOW TREES, CENTER SUSPENSION

that they interfere considerably with lighting the sidewalk when a lamp is placed at the curb. On the other hand, streets shown in Figs. 1, 5 and 7 have trees of such a size that either center or side suspension would be good with proper tree trimming. It can, of course, be figured theoretically that center suspension allows a larger percentage of the light flux of the lamp to fall upon the street surface, but practically this is a minor consideration compared to tree shadows.

In Fig. 7, which is representative of another large class of streets, the trees are so high as to form a high arch over the street with plenty of room underneath. Such a street can be fairly well lighted by either center or side suspension, but where trees are as large as those on the left there is sometimes, with center suspension, considerable obstruction of sidewalk light by the tree trunk. Where the tree-trunk interference is likely to be great the location of the lamp at one side of the street and in line with the tree trunks, as in Fig. 2, may be preferable to center suspension. The tree trunks do not then shade the sidewalk on the side of the street on which the lamp is placed, while as regards the opposite side, the angle of the lamp with reference to the trees is such that a lesser percentage of the sidewalk is shaded than if the lamp were in the center of the street. It should be remembered, however, that the location of a lamp at the curb line on a street of this kind will cause very bad shadows on the side of the street on which the lamp is placed.

If located at the side of the street rather than center-suspended, lamps should usually be all upon one side of the street rather than staggered first on one side and then on the other. Both the illumination effect and appearances are in favor of the one-side arrangement. For spacing much longer than 150 ft. (45.7 m.) the lack of uniformity in illumination and the long intervals between lamps along any one side of the street cause a ragged appearance. Furthermore, it is easier to dodge the glare of one row of lamps than that of two rows, and this makes seeing better on the one-row street. Another argument in favor of the one row is that it costs less to install and involves less unsightly line work.

OVERHEAD CIRCUITS AND POLE HEIGHTS

There has been much misdirected effort and waste of money in an attempt to increase the height of pole lines faster than the rapidly growing trees under them gain in height. The ultimate result of most such attempts is shown in Fig. 5, where the trees have grown up completely around the wires in spite of high expensive poles. Of course, this applies to all kinds of pole lines, but especially to street-lighting lines which must run in the street even in towns where most of the other distribution is in the alleys. There are many streets where the trees are small and a high pole line offers the only relief from the continual trouble of tree trimming. About the only place where relief from tree trouble is obtainable by building of a high pole line is where the parkway is very narrow and the poles must pass up through the tree tops, the trees being always kept trimmed below a certain level. An inspection of the hopeless condition of the high lines shown in Fig. 5 and the possibilities for low pole lines in Fig. 7 should be convincing as to the advisability of planning to get lines below the trees at the earliest date possible. Where combination telephone and electric light poles are not required, so that the lighting lines are alone, the 25-ft.

(7.62-m.) pole is far more likely to keep the lines out of tree trouble in the future than a higher pole. At the same time, by encouraging the high trimming of trees better street-lighting conditions will be brought about.

In cities where there are alleys the usual rule is for blocks to be shorter at right angles to the alleys than parallel to the alleys. With lamps at street intersections only, the minimum number of poles will be necessary by branching out from the alley, as shown in Fig. 2, rather than by running the street circuits along the entire street. A somewhat greater number of poles but less wire will be required if street circuits are run straight through on cross streets as in Fig. 3. As poles cost more than street-circuit wires, the arrangement calling for the fewest poles involves the lowest investment and maintenance costs. Where lamps are placed

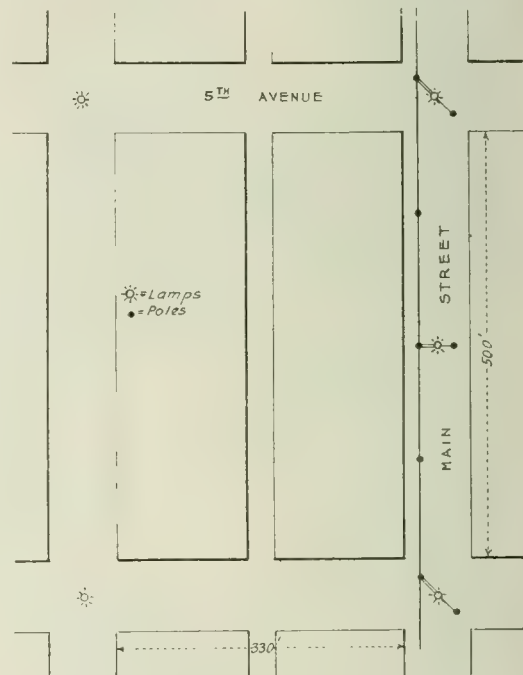


FIG. 9—PLAN FOR CITIES WHERE LAMPS ARE MID-BLOCK

mid-block and there are no alleys, the best pole-line arrangement is usually that shown in Fig. 9, which runs straight through from one lamp to another.

The efficiency of a street-lighting system in a residence district usually depends very much on the system of tree trimming.

Fig. 1 is an example of a street lamp almost obscured in one direction by a tree which is allowed to have its own way over the roadway. Fig. 5, already referred to, is an example where trimming out of low boughs should have begun long ago and the wires should have been run under the trees instead of through them.

Fig. 7 is an example of how large trees need not be an obstruction to good street lighting. It should be obvious that there is no way of satisfactorily lighting a street where tree branches are allowed to grow promiscuously over parkways in such locations as to hide the street lamp.

Where streets are curved lamps should not be placed at the curb on the inner side of the curve. This is because the glare from the lamp obscures the roadway beyond. This can best be avoided by putting the lamp on the outside of the curve. Another serious objection to putting a lamp on the inner curve on short curves is that trees are likely to obscure the illumination.

Systematizing the Changing of Transformers

How an Ohio Central Station Company Keeps Track of the Loads on Its Distribution Transformers to Prevent Overloading—
Other Uses for the Data Collected

THE Columbus (Ohio) Railway, Power & Light Company has a simple but effective system of recording data which pertain to the connected loads of its customers. These records are of value to several departments of the company, but this article aims to describe the system and its applications with particular reference to the value of the records to the distribution department.

To give an idea of the size of the record-keeping task, it may be stated that the data cover the installations of 26,500 customers and 705 banks of distribution transformers, which have an aggregate rating of 19,855 kw. These units are installed on twenty-eight separate primary circuits and nine tie lines. The records enable the distribution department to keep an accurate and continual check on the loading of all power transformers and a continual and approximate check on the loading of transformers furnishing residential service. To keep these records up to date requires a little less than the full time of one man.

The units of the system comprise: (1) a circuit book, (2) a customers' file, (3) a transformer-load book, (4) annual test data on transformer loading, (5) a numerical transformer envelope file, (6) a primary circuit handbook, and (7) a secondary circuit handbook.

The circuit book is a loose-leaf folder for mimeograph sheets that carry under the name of each circuit the location number, size in kilowatts, phase location and geographical location of each transformer bank on that particular circuit. To each circuit which is designated by name is allotted a group of transformer location numbers such as from 200 to 299. These numbers in turn are allotted to the banks or individual transformer units as they are placed in service. This book is, in fact, a condensed record of transformer data that are used for looking up transformer sizes or phase positions when the location number or circuit's name and geographical location is known.

CUSTOMERS' FILE—ITS USE

The customers' file consists of ninety-six 5-in. by 8-in. by 16-in. (12.7 by 20.3 by 40.6-cm.) drawers, containing data regarding every customer's installation, the information being listed by streets. For each meter there is an envelope in one of these drawers which contains: (1) the installation recount of connected load, (2) revised recounts that may have been made from time to time, (3) trouble complaint slips, (4) copies of records of all sales of repair parts, (5) records of lamp sales and renewals, and (6) any other data that pertain to the customer's installation. The outside of each envelope carries the customer's name and address and the number assigned him by the company's cashier, the location number of the transformer from which he is served and its geographical location, the name of the primary circuit, and the phase location of the transformer.

Data which are finally deposited in this file pass over

the desk of the service clerk and the superintendent of the meter and distribution department. Only those data which pertain to an installation recount or a revised recount are transferred from this file to the transformer load book, the purpose of which will be explained later. Other data, such as sales of repair parts, lamp renewals, etc., are merely noted in passing over these desks to observe large increases and to avoid placing too heavy loads on a transformer which is nearing the point at which it should be exchanged for a larger unit. The fact that both the service clerk and the superintendent of meter and distribution are familiar with the system makes this sort of check a sufficient one.

In ordinary practice this file is an information bureau for the service clerk in his dealings with the customer's



FIG. 1—DEPARTMENT WHERE TRANSFORMER RECORDS ARE FILED

trouble complaints. At times of electrical storms or other emergencies the file has another use in that it helps the service clerk to detect transformer failures or circuit failures by the grouping of geographical locations of calls coming from customers. Three calls from any neighborhood served from one transformer are taken as a sure indication of transformer failure. In this case the construction department is notified of the failure and the time for sending an individual troubleman to investigate is saved. This practice also reduces the time necessary to remedy the trouble.

The installation recount and revised recount data going to the customer's file are entered in the transformer load book. This book has a page for each transformer or transformer bank, the pages being arranged in the numerical order of the transformer location number. This arrangement naturally separates the transformers by circuits also. Each page carries: (1) the transformer size in kilowatts, (2) its phase position on the circuit, (3) name of the circuit, (4) location number, (5) geographical location, (6) date each customer is connected or disconnected, (7) each customer's load

in watts, and (8) total connected load on the transformer in watts and kilowatts. It will be observed at once that the important factors on each page are the transformer size in kilowatts and the total connected load, because from this information and a knowledge of the district served it is possible to determine approxi-

OAK ST. CIRCUIT			
3200 - 3299			
Location Number	Size	Phase	Location
3200	30	1	Grant Ave. 1st Pole N of Oak
3201	10	1	Oak St. & Young St.
3202	30	1	Washington & Al S. of Oak St
3203	30	3	Walnut W. of Washington Ave.
3204	40	2	Parsons Ave. & Oak St.
3205	30	3	Walnut W. of 18th St
3206	5	3	Walnut E. of 18th St
3207	20	2	Gustavus Lane & Monroe Ave.
3208	10	1	Oak & 6th Sts.
3209	25-20	1	Broad Oak
3210	10	3	Walnut E. of Grant Ave
3211	20	1	Grant Ave. & Alley S. of Oak

FIG. 2—SAMPLE OF CIRCUIT RECORD

mately when to replace the transformer with a unit of larger size.

Each power job involves a special study and does not depend upon this system for a transformer-load check. In the residential districts, however, a study of tests, amount of retail business on the lines, character of residences, etc., determines whether a transformer needs to be changed or not. There is no hard-and-fast rule governing this, but local conditions are considered. In making such changes it is necessary, of course, to take into consideration the probable future growth of the section in determining what size shall supersede the transformer taken out. The company has standardized upon the use of transformers of the following ratings for lighting: 2.5 kw., 5 kw., 7.5 kw., 10 kw., 15 kw., 20 kw., 30 kw. and 50 kw.

Some of the outlying transformers in purely residential sections are loaded up to 1200 per cent—that is, the ratio of the connected load to the size of the

To supplement this systematic watchfulness a test is made each fall on all lighting transformers which are loaded up to the point where there is doubt about their ability to carry the winter peak. These tests are made during the lighting peak, which occurs between the hours of 6 p. m. and 8 p. m. The tests are made by a crew of two men, one of whom is a lineman. Such a crew can make five or six tests during the evening with the aid of an automobile equipped with a searchlight to aid the lineman and a hand flashlamp to assist the driver. The current readings are taken at the secondary terminals of the transformer by means of a cable-testing instrument transformer with long cords. Potential readings are taken with long leads that terminate in clamps fitted with set screws which pierce the insulation of the transformer leads. When these tests are made a card is filled out in the office for each location with the following data from records: location number, geographical location and size of transformer, and kilowatts. These are then routed and given to the test crews, which make the tests and enter the amperes per side, volts per side, remarks on temperature of transformers, date and day of the week, approximate time, and character of the district served. After all tests have been made sheets are tabulated giving the

THE COLUMBUS RAILWAY, POWER & LIGHT COMPANY									
POWER AND LIGHT DEPT. TRANSFORMER RECORD									
SIZE		PHASE		L.S. IT		LOCATION		LOCATION NO.	
30kva		1		Oak St		Grant Ave. 1st Pole N of Oak St		3200	
DATE		CONNECTED		L.V.		CONNECTED		TOTAL LOAD	
5/24		56.872		44.0		6.50		71.874	
5/24		56.322		14.7		2.85		69.444	
6/14		57.322		15.2		15.00		77.644	
6/14		58.179		15.2		1.50		69.654	
6/14		60.179		7.117		3.75		66.679	
6/24		61.379		7.207		1.00		69.587	
6/24		61.279		13.52		9.00		61.879	
6/24		62.44		13.52		7.50		69.44	

FIG. 4—RECORD FROM TRANSFORMER LOAD BOOK

3200 Grant Ave. 1st Pole N. of Oak St.

Location No. 311

Location *Walnut St. & 1st St. N. of Oak St.*

Circuit *8th St.*

Phase *3*

R-571

5

5 L-10 #3108231 X-0 Sched. 1.

L. F. Matthews
- 1225 Wesley Ave.

FIG. 5—SAMPLES OF ENVELOPES IN WHICH RECORDS ARE FILED

above and, in addition, the connected load in kilovolt-amperes, actual load in kilovolt-amperes, percentage of the size to the connected load, and percentage of the load to the size.

The numerical transformer envelope file contains the same data as the circuit book, with the additional record of transformer changes up to date and a record of the name and telephone number of each important customer served from each transformer or bank of transformers. These envelopes also contain a record of transformer outages.

The circuit book is valuable in that it permits quick location of telephone numbers of customers served from any transformer when trouble has developed or is anticipated. On one occasion this record permitted the company to notify every power customer within a few hours of an emergency that made it necessary to shut down the power station at midnight. In this way the company was actually able to save its customers tens of thousands of dollars which otherwise would

FORM L-7

TRANSFORMER NOTICE 562

INSTALLED ~~RECORDED~~ DATE *May 26th* 1916

SIZE *30* KVA TAG NO *1163* SERIAL NO *1761140*

PRIMARY *2200/2300/2400* VOLTS SECONDARY *110 - 115 - 120* VOLTS

CIRCUIT *Oak Street* PHASE NO. *1*

LOCATION *Grant Ave. 1st Pole N of Oak St.*

LOCATION NO *3200* ESTIMATE NO *PL 1957-558*

O K *O. K. F. L. Baker* FOREMAN *Geo. Neff* CONSTRUCTION DEPT

FIG. 3—NOTICE OF TRANSFORMER INSTALLATION

transformer—while in other sections the connected load is not very much above the rating of the transformer. Where gas is cheap and is used to any extent for lighting it must be taken into consideration, as a shortage in the winter months will increase the transformer loading.

have added to their payroll. The book is also valuable in notifying customers of circuit changes that are to be made on Sundays.

In connection with this system a primary circuit handbook and a secondary circuit handbook are maintained. These books give circuit maps and complete circuit data arranged by circuits for the primary lines, and by transformer location numbers on the secondary

circuits. These records are considered of value to the service clerk in grouping trouble calls to determine transformer or circuit failures, and also give valuable information when circuit extensions are contemplated. They are assembled in loose-leaf blue-print form so that they may be easily kept up to date. H. G. Leavell is superintendent of the meter and distribution department.

Monthly Bills as an Advertising Medium

An Analysis of the Results That Can Readily Be Obtained from the Use of the Reverse Side of Bill for Advertising Purposes and of the Returns from Stuffers and Stickers

OPINION differs widely in regard to the value of the back of monthly lighting bills as a publicity medium. Some managers feel and are emphatic in stating that the space is valueless, and if used for certain forms of advertising is actually detrimental to the best interests of the utility. Others are just as firmly convinced of the efficacy of the space, and have no hesitation in using it in every way possible. Between these two extremes are found other points of view less decided in tone.

In order, therefore, to discover to what extent this space is of value, tangible or intangible, the ELECTRICAL WORLD has undertaken to analyze the experience and opinion of some of the more substantial and progressive companies in different parts of the country which have given thought to this subject.

Compared with other forms of advertising, there is no doubt that announcements on bills are the least expensive. This method combines a saving in both postage and stationery and entails no clerical expense in mailing. It is automatic. Practically the entire expense is in writing the advertisement and in the printing.

Furthermore, in spite of expressions to the contrary, it is undoubtedly true that the monthly bill offers an inexpensive medium of unquestionable worth for making certain kinds of announcements. Under this head would come announcements of a change in rates, a change in office location or a special sale of some appliance. It must not be understood, however, that the value of this advertising is such that it would warrant the use of bills solely. The fact is probably quite the contrary.

VALUE AS SUPPLEMENTARY ADVERTISING

The value of bill advertising will probably be greatest when it is used in conjunction with some advertising campaign as a further reminder. If used along with newspaper and circular advertising, printed announcements on bills have the added effect of bringing this notice to the consideration of the customer, particularly if at the foot of the bill there is a line directing the customer's attention to the reverse side of the bill.

Some companies find the reverse side of bills a very convenient place to list the location of offices where bills can be paid, others as a place for printing a schedule of rates. In each instance a footnote on the

front of the bill stating what may be found on the reverse side will probably increase the value of such publicity. Another somewhat common use of the reverse side of bills, and this is particularly true in the case of gas companies, is a brief explanation of how to read a meter and compute a bill. There seem good reasons to believe, however, that this kind of publicity receives very little attention. In fact, it is not unlikely, because of the brevity of the statement, that it may be injurious to the best interests of the company. Customers are very apt to become confused and think that they have followed instructions in reading the meter, whereas frequently they make errors. Naturally the bill is then questioned and the customer's faith in the company is shaken.

USE IN MAKING PUBLIC POLICY ANNOUNCEMENTS

In some instances lighting companies have used bills as a medium for explaining the public policy of the company to the customer. It has been a general policy to send a different announcement with each bill. Information, however, on this side of the question seems to indicate that there is no direct evidence of any value in the kind of publicity put out in this manner.

A number of objections have been voiced regarding the use of the reverse side of bills for publicity. An interesting comment from the Middle West is that the customer is liable, on opening the envelope, to mistake the bill for an advertisement and therefore pay no further attention to it. Some instances of this kind have undoubtedly occurred, but no evidence is offered as to whether the customer did not willfully throw the bill away in an attempt to delay payment, relying on the excuse that it was believed to be merely an advertisement. However, if the bills are of a distinctive color, as is the practice followed by most companies, it is hardly probable that any such confusion will arise, unless it is willful as stated.

Another comment is that the customer is not in the proper frame of mind on reading his bill to receive an advertisement from the lighting company. Of course, if the company is lax in its relation with customers it is easy to see why this would be the case. But since in general lighting companies maintain good relations with customers, this objection would probably not generally apply. At any rate the company making the objection finds that bill stickers produce results.

In all of the objections voiced, however, there does

run a common opinion, namely, that advertising on the back of bills does not pay because it is not read. In each case this kind of advertising was given a full and complete trial and the results were carefully gone over. There is no occasion to believe that in these cases the scheme failed for want of proper attention to the form of advertising, for each of the companies in question has a reputation for the quality of its efforts.

In each case, however, it is probably true that the scheme was abandoned because a better, though somewhat more expensive, means was found for placing the desired message before the customer. This other means is either by stickers attached to the face of the bill or by envelope stuffers.

Both of these methods have been found to bring results. Those who use them are of one opinion, namely, that they are a very desirable form of publicity.

For the stuffers either manufacturers' material or copy specially prepared by the lighting company is used, depending largely upon the subject matter.

That the monthly bill offers an excellent means for advertising to the customer none denies. The bill goes to every customer monthly and offers therefore certain advantages not found otherwise.

The investigation has shown that where a company is willing to spend a little bit more money in this form of advertising, or is not averse to using material prepared by the manufacturer, the use of stuffers and stickers is best. Otherwise the reverse side of a bill is of some value for special announcements, provided there is the proper footnote on the face of the bill.

CAMP ZACHARY TAYLOR RECEIVED QUICK SERVICE

Louisville Electric Company Put Eight Construction Gangs to Work on Cantonment Street-Lighting and Distribution System

The Louisville Gas & Electric Company, with 85 per cent of its construction and service force divided into eight gangs, made remarkably fast time in the installation of the electric street-lighting and distribution system at Camp Zachary Taylor, the National Army cantonment on the outskirts of Louisville. Temporary service was installed at the very outset of operations at the camp and a 13,200-volt transmission line was extended from a line passing near the camp entrance. A little later a second line of similar tension was constructed from the waterside plant of the Louisville Gas & Electric Company to provide dual service.

All of the work was done by the Louisville Gas & Electric Company with its own men, at cost without added percentage of profit. Energy will be metered at the substations and the estimated demand will be between 800 kw. and 900 kw. Forced operations were the rule, schedules calling for ten hours a day and Sunday work as well. Most of the difficulties were due to delays in receipt of materials, and the Louisville Gas & Electric Company had to draw heavily on its own store of supplies, which were replaced by the new materials as they were received. The inside wiring was done under contract by the Mason & Hanger Company, which had the general contract, Louisville contractors having pooled their interests and undertaken the job on a time, material and percentage basis.

This is a very large camp, similar in most respects to the others which the government is building. It will house up to 60,000 soldiers, with various appurtenances and divisions, including infantry, artillery, engineers and engineers' trains, division headquarters and headquarters trains, field signal battalions, Young Men's Christian Association establishments, auditoriums, bakery groups, hospital, twelve large warehouses, 20 miles of railroad sidings, etc. All told there are about 2000 structures of all descriptions, not to mention store buildings which are being erected outside of but adjacent to the reservation.

The plan of distribution is simple. The transmission wires lead to a step-down substation equipped with three 400-kw. transformers, which will reduce the 13,200-volt current to 2300 volts, three-phase, 60-cycle. From this substation three feeder lines will be run, the substation being completely equipped and using General Electric Company automatic oil switches. One feeder will supply energy for five 50-hp., 220-volt motors, driving centrifugal pumps which will raise water to the 1,000,000-gal. elevated storage, from which it will be



ERECTING POLES FOR CANTONMENT SERVICE

distributed around the camp. The second feeder will supply the street-lighting system and the third the buildings, both being lighting feeders. One is of No. 1 wire and the other No. 2, each carrying about one-half of the load.

From these feeders single-phase branches will be taken to feed the distributing transformers, of which there are to be eighty-one, ranging from 1 kva. to 20 kva. The street-lighting system, which will light streets, surroundings of lavatories, etc., calls for seven 5-kva. constant-current pole-type transformers, each provided with a weatherproof oil switch. From each there will be a series circuit feeding about forty-five 100-cp., 6.6-amp. Mazda, type C series lamps. These lamps will be hung from gooseneck fixtures carrying Wheeler reflectors; there are about 320 of these. Poles, mostly cedar, to the number of 1100, have been used, ranging in size from 35 ft. to 45 ft. (10.6 m. to 13.7 m.). Wire up to the distributing transformers is copper, that from those to the buildings is copper-clad, branches are all No. 6 and service connections No. 10.

Interior installation is plain, open construction without special features. All construction is in strict accordance with the N. E. L. A. specifications for overhead lines. The work was done under direction of Lewis S. Streng, general superintendent Louisville Gas & Electric Company, and G. M. Miller, superintendent of electric installation.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

POLE ARRANGEMENTS

FOR IRON-WIRE LINES

Advantage Taken of Hilltops and Greater Tensile Strength of Steel in Agricultural Districts—Suburban District Practice

In building iron-wire distribution lines in suburban districts it is ordinarily the practice of the San Diego (Cal.) Consolidated Gas & Electric Company to utilize pole spacings similar to those employed when copper is used. The pole spacings average 300 ft. (91.4 m.), 35-ft. (10.7-m.) poles being used in alleys and 40-ft. (12.2-m.) poles in streets.

In agricultural districts, however, advantage is taken of the greater tensile strength of steel and the poles are separated more widely. In such districts the standard spacing on tangents is 700 ft. (213.4 m.) With this spacing there is naturally considerable sag, and it has been found that 40-ft. (12.2-m.) poles are the shortest that can be used with safety along country roads. Across open fields, however, 35-ft. (10.7-m.) poles are sometimes used, particularly where it is possible to take advantage of the hilltops in rolling country and thus save in length of pole.

The conductors which are used consist of 1/4-in. (6.4-mm.), 5/16-in. (7.9-mm.) or 3/8-in. (9.5-mm.) double-galvanized standard steel strand. On spans in excess of 1000 ft. (304.8 m.), where required by slough or river-crossing conditions, high-strength steel is preferred by this company.

CLEANING BOILER TUBES

SAVES \$500 EVERY YEAR

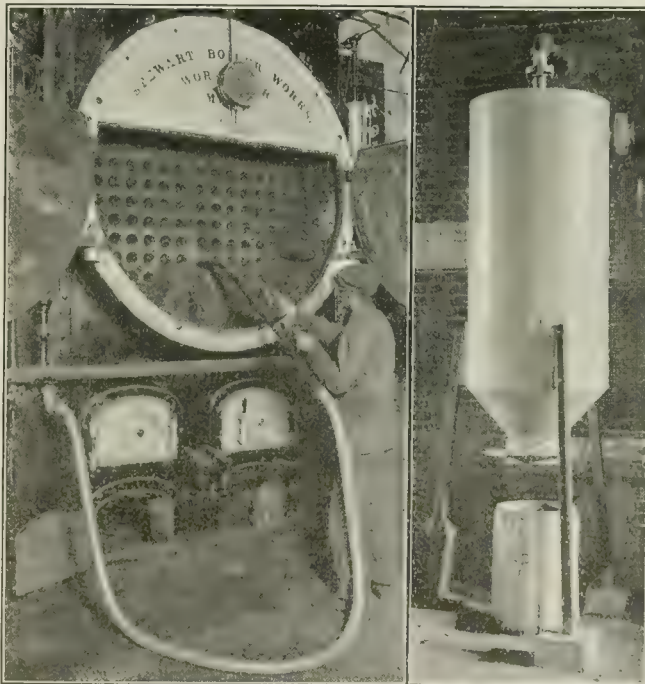
Vacuum System Used to Dispense with Necessity of High-Pressure Steam—Advantage Secured Through Adoption of System

At the Chase Court substation of the Worcester (Mass.) Electric Light Company four 150-hp. steam boilers are employed to supply steam heat to a large group of stores and offices in the immediate vicinity. The boiler plant formerly supplied high-pressure steam to the Denholm & McKay Company's isolated plant, but when the service was taken over by the lighting company the demands for high-pressure steam were virtually eliminated.

The photographs reproduced show an arrangement by which the tubes are cleaned by an electrically operated vacuum system which saves from \$45 to \$50 per month in fuel, as it is no longer necessary to run the steam pressure up to 150 lb. (10.5 kg. per sq. cm.) to blow out the tubes. The cleaner, which is of the Spencer turbine type rated at 7.5 hp., is owned by the Denholm & McKay Company, the lighting company having arranged to use the same equipment to avoid extra investment. Only about \$500 worth of addi-

tional piping, tank and mounting for outdoor removal of soot was required.

A 2-in. (5.1-cm.) pipe is run from the boilers to a vertical tank in an alley outside the substation, and all tube debris is delivered into this tank, provision being made for the removal of soot and dirt by ash barrel as shown. The withdrawal of soot from the tubes is effected by attaching a metal hose to a service outlet and inserting a special nozzle into the tube end. The nozzle is equipped with a flange, which covers the tube and insures a satisfactory vacuum. The nozzle consists of a piece of pipe about 4 ft. (1.2 m.) long, held by two brackets fitted with wooden handles to protect the fireman from the heat, which is too great to permit grasping the nozzle itself.



METHOD OF USING VACUUM CLEANER AND TANK IN WHICH DEBRIS IS COLLECTED

With this equipment cleaning of a boiler can be done inside of ten minutes with the fire banked or with the boiler cold. It is estimated that at least 500 lb. (226.8 kg.) of coal is saved daily in the plant. The tubes are given the "vacuum treatment" each morning about 4 o'clock, the boilers being banked from 11 p. m. to 5 a. m. The tube conditions are much improved, inspection showing them to be clean and bright instead of dull and dirty, as was the case after employing the old methods of cleaning. The fire room is much more comfortable, smoke is reduced, and the boiler insurance premium has been reduced \$15 per year on account of doing away with operations conducted under high-pressure conditions such as were necessary before the vacuum cleaner was introduced.

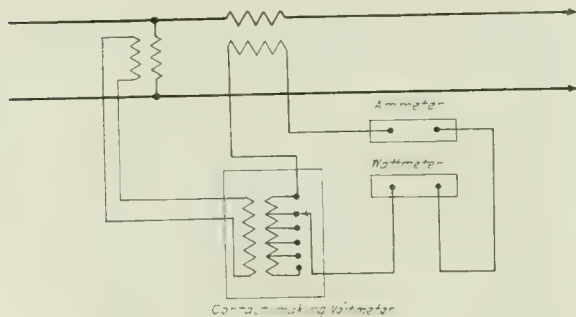
CONTACT-MAKING VOLTMETERS DESERVE MORE ATTENTION

Some Observations Made During Several Years'
Experience with Automatically Controlled
Circuit—Two Settings Inadvisable

BY J. C. RUTHERFORD

Since automatic control of voltage of distributing circuits has taken the place of the old-time hand control, it may not be exaggeration to say that the contact-making voltmeter is one of the most important though most abused instruments in use. Yet it is an instrument that may be used in numerous interesting and often ingenious ways for voltage regulation, power-factor compensation, etc.

Compensated-type, contact-making voltmeters are correct only for unity power factor or any one definite power factor, the compensation varying almost directly as the power factor, being a maximum not at unity power factor, but at a power factor corresponding to that of the contact-maker potential coil. Although only strictly accurate for compensating for line drop in a circuit without inductance or having unity power factor, the compensated type of contact maker is often



WATTMETER ERRORS MAY ARISE WITH THIS CONNECTION

used for circuits carrying mixed loads and varying power factors instead of the contact maker in conjunction with a line-drop compensator. This is done because of the saving in first cost and, more important still in some instances, the economy of station space.

To better the voltage regulation made possible with the compensated type of contact maker on low-power-factor circuits it is a rather common custom to use two settings, one for low and one for the higher power factor; for example, during the power and during the lighting load periods respectively. While this practice suffices it has the very great disadvantage of requiring the human element. To eliminate this much effort has been expended, making the maintenance of constant voltage no longer strictly automatic. If the operator forgets to change the contact-maker setting from that with low power factor to that corresponding to the higher power factor, the voltage will be in excess of the correct amount during the higher power-factor period by an amount approximately equal to the difference of the respective power factors. As the load with the higher power factor is usually a lighting load, lamp life is shortened and complaints come in of low voltage when the voltage reverts to its normal value, it being found that the public like high voltage, caring little for the more rapid burning out of their lamps so long as they are able to obtain free renewals.

There is another reason why the use of two settings

of the compensating coil for the two classes of load—lighting and power—is undesirable; namely, that the continual movement of the compensator arm tends to loosen it. When loose the arms may fall to other than the desired compensating points, raising the voltage at the load end of the line. Also, if the contact between arm and stud is not of the best, heating occurs and resistance is introduced, thereby causing an error in the ammeter indication. More important still, if an arc occurs it will damage the contact maker and may open the secondary of the current transformer. Cases have happened where an ammeter has indicated a far lighter load than really existed, causing heavy overloading of underground cables.

Still another danger of an open circuit in the current-transformer secondary is that where the circuit-breaker trip coil is in the same current-transformer circuit there is no longer any protection, and a short circuit occurring outside may open the transformer breakers in the station instead of only those connected with the circuit in trouble.

When using a compensating-type, contact-making voltmeter in the same current transformer secondary as a wattmeter an appreciable error may arise in the registration of the meter, because of the magnetic inter-linkage between the contact-maker current and potential coils. In other words, an electromotive force is induced by the potential coil in the current coil, the phase displacement and magnitude of which depends upon the load characteristics of the circuit. This electromotive force may lead to registration error of the wattmeter; hence where accurate metering is wanted a separate current transformer should be used.

CAUSES OF THE BALKING OF INDUCTION MOTORS

Among Them Are Impaired Conductivity of End Connections, Excessive Load, Low Voltage and Prolonged Sparking

BY E. C. PARHAM

Sometimes a rotor will start and sometimes it will not, even when the controller is moved to an advanced position. Rotors of the squirrel-cage type will be consistently unresponsive when starting under load if the conductivity of the end connections for any reason becomes impaired, and the maximum speed will be below normal. Assuming that there is no rubbing, balking of rotors of the wound type generally is due to conditions not within the motor itself. Excessive load to be started or failure of a brake to release will cause an rotor to "hang" until a fuse blows or a breaker opens or until the controller reaches an advanced position. The first trouble is common to motors that drive roll in which stock material becomes jammed. The second trouble may be due to low voltage, to want of proper adjustment of the brake clearance, or to baking of the brake coils.

Among the more commonplace causes of balking of wound rotors is bad and prolonged sparking due to overloads, to defective brush rigging or to rough or eccentric slip rings. This action will sometimes cause a non-conductive skin to form on the surface of the rings. A loose brush holder will prevent the brush from making certain contact, because with one direction

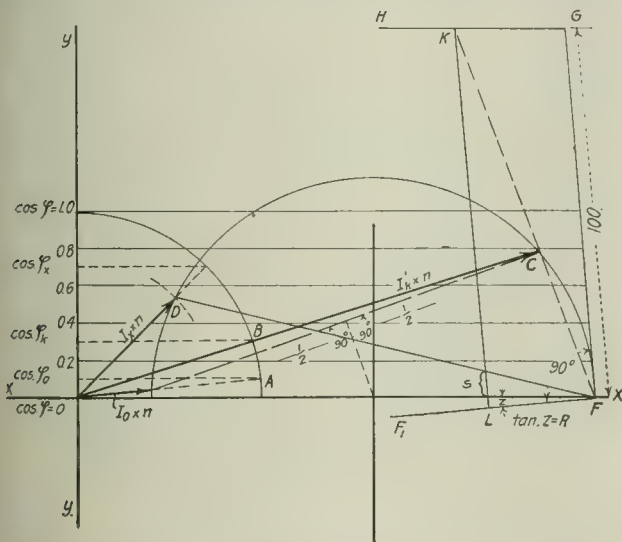
of rotation the contact may be bad while with the reverse direction of rotation it may be good. Sticking of a brush in a holder will cause action similar to that experienced under the same condition with direct-current motors. The starting becomes more and more erratic as the brush wears shorter and shorter, and finally one of the rotor circuits is opened by the brush failing to make any contact at all. Weak brush-tension springs and displaced tension fingers will cause irregular actions. Finally, disconnected, burnt-off or broken brush shunts have been known to affect seriously the promptness of starting and to cause brush-holder heating in normal operation.

SIMPLIFIED METHOD OF TESTING INDUCTION MOTORS

Practical Application of a Reduced Heyland Diagram Which Eliminates Necessity of Making Long Computations

BY GUSTAV E. JANSSON

Commercial testing of three-phase induction motors can be simplified to a large extent by a practical application of the reduced Heyland diagram as described below. Connecting up the motor for no-load test in



GRAPHICAL METHOD OF DETERMINING INDUCTION MOTOR CHARACTERISTICS

the usual way with the two-wattmeter method, values i_o , e_o , W_o can be obtained where i_o denotes current, e_o volts and W_o watts ($W_1 \pm W_2$). W_1 and W_2 represent the power in watts supplied through the two phases. Then, making the short-circuit test by reducing the impressed potential to a suitable value and keeping the motor at a standstill, values e_k , i_k , and $W_k = (W_{1k} \pm W_{2k})$ are determined. From these measurements $\cos \Phi_o$, which is equal to $W_o \div (\sqrt{3}e_o i_o)$ and $\cos \Phi_k$, which is equal to $W_k \div (3e_k I_k)$ can be computed, I_k equaling $e/e_k i_k$. The magnetic leakage factor is approximately equal to t when $t = i_o/I_k$ and the maximum value of $\cos \Phi$ equals $1 \div (1 + 2t)$.

After measuring the armature resistance per phase, the Heyland diagram can be constructed by laying off $\cos \Phi$ on the y axis as indicated and describing a quarter of a circle through it with a center at O . First, a line is drawn parallel to the x axis from $\cos \Phi_0$ until it cuts

the circle at A , joining O and A with a line, and on this with O as a starting point, laying off a distance equal to $n \times i_o$ (where n denotes any suitable scale length chosen to represent 1 amp.), the no-load vector ON is obtained in its proper magnitude and displacement.

Proceeding in the same manner, the short-circuit vector OC can be obtained. Having the points N and C , they are joined with a line from the middle of which a perpendicular is drawn until it cuts the x axis at M . With M as center a half circle is described through the points N and C , and the value of $\cos \Phi$ for any given load current is then found as follows:

Assuming a current I_x , its diagram length will be $I_x \times n$. With this value as a radius, arcs are drawn cutting the main circle at D . Then a line through the points $O-D$ is extended until it cuts the cosine circle at E . A line passing through E parallel to the x axis will intersect the y axis at $\cos \Phi_x$.

If the slip is desired, it can be found readily by drawing lines $F-F_1$ at an angle Z ($\tan Z = R$), $F-G$ at right angles to $F-F_1$ (making $F-G$ equal to 100 scale units) and $H-G$ parallel to the x axis. Then extend a line through the points $F-C$ until it cuts $H-G$ at K . $K-L$ is then drawn parallel to $F-G$ and point D cut off by the current on the main circle connected with F . The part S cut off on $K-L$ then represents the slip in per cent.

The reduced diagram can be drawn in a much shorter time than it takes to describe the operations and gives $\cos \Phi_x$ and the slip at any load with reasonable approximation.

The efficiency can be calculated from the diagram as follows:

$$\text{eff.} = \frac{3ei \cos \Phi \times 100}{3ei \cos \Phi \times (1 + S\%) + 3i^2 R} \text{ per cent,}$$

where e , i and R are the values per phase.

REPLACING POLE IN LINE IN A BRICK-PAVED ALLEY

Change Was Made Without Much Expense on Account of the Fact that No Pavement Was Removed in the Undertaking

Recently a 44-ft. (13.41-m.) white-cedar distribution pole had to be set in the exact location which had previously been occupied by another one which had failed. The pole carries one 2300-volt line, three 110-volt lines and two fifty-pair overload telephone cables, one entering the underground system at the pole which was to be changed. The alley in which the change was made is paved with brick. This fact was largely responsible for the desire to set the new pole in the hole occupied by the old one, because it was not desirable to tear up the pavement if it could be avoided.

To make the change the old pole was sawed off and kicked to a new position on the ground adjoining the alley. The wires and old pole were held in position by means of rope guys held taut by block and tackles. The stub was removed from the ground by means of heavy jacks attached to the stub with log chains. The new pole was then hoisted, using the old pole as a gin. When the new pole was raised to a vertical position it was lowered into the hole vacated by the old stub. The circuits were all transferred after the new pole had been set.

CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

DIRECTION THAT INCREASES IN RATES SHOULD FOLLOW

**Business Should Be Analyzed and Increases Placed
Upon Those Industries Profiting from Sched-
ules Made When Coal Costs Were Lower**

Along with the increase in operating cost comes naturally the subject of rates, although it has been recognized that the industry has been decidedly unwilling to increase the rate to the domestic consumer unless absolutely necessary. Rather have the rates been raised generally on that class of customers favored by a low rate, because of the certain load conditions.

Speaking before the recent convention of the Pennsylvania Electric Association, Joseph B. McCall, president of the Philadelphia Electric Company, made the following remarks as to the direction which he thought rate increases should take:

"It has been recognized by commissions, and also by managers of properties, especially of the largest companies throughout the country, that the small consumer is entitled to the benefit of as low a rate as possible, based upon the aggregate of all classes of customers in his community, in so far as local conditions make it practical. It is simply a communistic idea. If it is privilege, it is privilege; but I believe it should be a factor in the consideration of any increase, because the smaller consumer—and that reaches your resident class and your small retail man—who is facing to-day the hardships of the high cost of all the living necessities, in so far as it is practical, based upon local conditions, should not be disturbed. My recommendation, rather, would be that you analyze the classes of business and that any increases needed to meet present conditions be based upon those power and light consumers of the wholesale class who in many instances have not only been able to raise their prices to meet the changed conditions, but are profiting from schedules made when the coal cost was less than one-half the present price."

CHRISTMAS PRESENTS FOR FRENCH CHILDREN

**Indianapolis Central Station Company Is Helping
to Conduct a Campaign to Send 20,000
Packages to Them**

The Indianapolis unit of the American Fund for French Wounded has originated a plan to send 20,000 packages of toys from Indianapolis to the children of France. To assist in the movement the Merchants' Heat & Light Company has donated the use of one of its show windows and a portion of its store as the headquarters for collecting the packages.

A vigorous newspaper and direct-by-mail campaign is being waged to bring in the gifts. One of the cards

which is being mailed for this purpose says, "Will you share a part of your Christmas joy with a French father and his baby? Thousands of French soldiers—on beds of pain in the war hospitals—will see Christmas come and go with many heartaches, as they cannot remember the babies at home with even the smallest gift. Will you—in your pleasure—bring a glad smile to such a soldier by sending him a small token to be his gift to his little one? Such gifts left with the Merchants' Heat & Light Company will be forwarded by the local French Relief."

The effective window in the office of the Merchants' company is reproduced herewith. It shows two Christ-



CENTRAL STATION WINDOW DRESSED TO AID FRENCH RELIEF

mas trees. One is decorated with an American flag and is weighted down with presents. The other tree, by the French flag, bears merely a placard inscribed, "Somewhere in France—Will We Leave This Tree Bare?"

According to R. A. MacGregor, sales manager for the Merchants' company, the gifts are beginning to come in. As each gift arrives it is tagged with a Christmas card printed in French. Translated the French message is, "To a Noble Soldier of France—May this Christmas token bring joy to your heart and to that of your little child. This is the earnest prayer of a well wisher."

LABOR CONDITIONS AFFECT LAMP RENEWAL POLICY

Philadelphia Electric Company Forced to Discontinue Practice of Delivering Lamps to Customers' Premises

The former practice of the Philadelphia Electric Company of delivering lamps for renewal purposes to the premises of customers, and not only delivering the lamps but in thousands of cases removing the old lamps from their sockets and actually installing the renewal lamps, has, the company states, become so difficult and expensive with the increase of business that it has been necessary to discontinue it. This has primarily been brought about by the labor shortage resulting from the war.

In announcing the change to customers the company made the following statement embodying all the details of the change:

We have heretofore delivered lamps, for purposes of renewal, upon telephone or written request. Because of existing labor conditions this practice has become increasingly difficult and expensive. We are consequently forced to notify our commercial customers that on and after Sept. 15, no lamp deliveries for renewal purposes will be made, and on and after Sept. 15, or until further notice, no lamp renewals will be delivered to residence customers except during the month of October, during which month we will make deliveries in rotation as quickly as possible after we have received and filed the order blanks which have been furnished you with your monthly bills.

The lamps to be renewed will be delivered at your door and will not be placed in the sockets. It will be necessary for you to have the lamps to be renewed ready for delivery to our lamp men, who will at that time give you the new lamps in their place and make proper notations regarding the exchanges made, so that you may be properly billed if you are renewing lamps not on a free-renewal basis.

It should be understood that lamps may be renewed at any time, however, at your district office, and we would suggest for your own convenience that you purchase several additional lamps in order to take care of emergencies.

After Sept. 15, also, lamps that are subject to a renewal charge, as per our lamp schedule, when exchanged at the offices of the company, must be paid for in cash. No such lamps will be charged to the customer's account.

We would greatly appreciate your co-operation in this matter, and would request that you familiarize your household with the conditions surrounding lamp renewals in the future.

PUBLICITY ON APPLICATION FOR RATE INCREASES RECOMMENDED

President Lieb of the N. E. L. A. Believes that Public Should Be Properly Informed as to the Necessities of the Situation

It has been found that if the public is informed thoroughly on existing conditions there is no complaint when permission to introduce higher rates is asked from a public service commission. This was emphasized by John W. Lieb, president of the National Electric Light Association, before the recent convention of the Pennsylvania Electric Association. His remarks, in part, follow:

Our industry is facing not only enormously increased costs for labor, apparatus and supplies vitally necessary to its operation, but also a scarcity and often an impossibility of obtaining any or all of them.

As a result of these serious conditions our expenses are increasing much more rapidly than our revenues, and our

net returns are a diminishing quantity. Hence the appeals from utilities throughout the land for increased rates for their product to meet the increased expenses of construction and operation, and these appeals must now be directed to the regulatory bodies provided by the laws of nearly every state—the public service commissions.

These commissions, the creation of our state legislative bodies and to which they have largely delegated their functions in supervising the rates and standards of service of the utilities in behalf of the public, have been, as we can all testify, most active and efficient in regulating our rates continuously downward. They are now naturally loath to stay the reduction process, even temporarily, and enter upon the unpopular course of giving their sanction and approval to demands for increased rates.

We must assume, of course, that the public means to be fair and just in a matter which so directly and vitally affects its own interests, and we must therefore consider it a part of our problem, an important feature of our program in the movement toward obtaining increased rates, to see to it that the public also is properly informed as to the necessities of the situation.

We should, therefore, see to it that through proper avenues of expression the widest publicity is given to the facts and data placed before commissions as the basis of applications for increased rates for service. This is a matter of vital importance and should be brought home to every utility company in our industry, as the claims for increases in tariffs cannot be heard on behalf of groups of utilities, but the claims and supporting figures must be presented by the individual companies, and each company as its case is presented and its local situation unfolded before the commission should make it a definite part of its public policy to spread the facts before its local public. It is urged that the furnishing of this information to the people is a very necessary element in obtaining public approval for an increase of rates, which is in the present state of the public mind a thoroughly unpopular course, and our utilities must do their share in developing an enlightened and informed public opinion.

IMPORTANT POINTS IN CHANGING STREET LIGHTING

Changing Fixtures, Spans, Lowering Devices, Height and Size of Lamps, Bracket Fixture Wiring and Time Switches

BY M. M. SAMUELS

The introduction of the gas-filled incandescent lamp of small size and high candlepower has caused many municipalities and lighting companies to consider the advisability of changing their street series arc system either in total or in part into a series incandescent system. The writer recently had the opportunity to investigate a street-lighting system from which the following observations were drawn:

Before starting to make the change a map of the municipality should be prepared showing all existing fixtures, poles, manholes, overhead and underground circuits, also all poles available for new fixtures. In addition, an experienced engineer should investigate street conditions, the best time for this study being in the summer, when the effect of shade trees can be observed. This is especially necessary in the case of suburban roads where the illumination is primarily intended for vehicles.

Before proceeding to change old arc fixtures to accommodate incandescent lamps the material available on the market should be ascertained. It will be found in many cases that complete fixtures are available at a price not greater than that of making the change.

Except in extreme cases existing arc spans should not be used for incandescent fixtures. The only time

a span should be used is when it is impossible to illuminate a street or road crossing by bracket fixtures on account of shade trees. In all other cases bracket fixtures should be used, staggered on both sides of the street and in a diagonal direction at crossings. When installing incandescent lights in place of arcs the unsightly lowering device should be eliminated in each case, since the exchange of lamps does not occur often enough to make the installation of these devices necessary.

The height and size of units depend on each other. The placing of large units at a low level is not only poor engineering and economy, but a detriment to the public health. In some cases, however, it may become necessary to place large units at low levels to take care of special requirements. In such cases the lamp should either be frosted or surrounded by a diffusing globe.

In most cases the requirements for illumination vary with the hour of the night, so the circuits should be split up in such a way that part of the lamps can be cut out while the others are still burning. It will be found economical in most cases to install automatic time switches.

CHICAGO COMPANY SELLS 20,000 APPLIANCES IN SUMMER Crew of Fifty Men Conducting House-to-House Canvass Beats Last Year's Record by 8000 Pieces

For several years the Commonwealth Edison Company, Chicago, as a part of its summer program has hired a large number of college men and experienced solicitors to conduct a house-to-house canvass to sell heating devices on easy terms. The salesmen are usually hired on a drawing account plus commission basis, and they work in crews accompanied by a wagon and an experienced man who is in the regular employ of the company. This year the campaign extended from June 15 to Sept. 15, with an average of fifty men working from four wagons on the job. At the time of writing, when the campaign had yet four days to run, the total sales of the different devices were as follows: Egg cookers, 83; percolators, 1756; irons, 16,090; toasters, 1273; total, 19,202. The egg cookers, which were of the Hotpoint type, were sold for \$3.50; the percolators, which were Universal and Hotpoint equipment, were sold for \$4.75; the General Electric toasters were sold for \$3.95, and the irons, which were of many different makes, were sold for \$3.50.

In speaking of the success of this year's campaign, Oliver R. Hogue, head lighting agent, said it had been due to improved advertising and to the thriftiness of that class of housewives which was interviewed. The solicitors in their house-to-house work did not enter the city's high-class residential and apartment house districts, but strove rather to reach the home of the average wage earner, where it is easier to gain an entry and where thriftiness must needs be practised.

An interesting feature of the campaign is that it promoted rather than detracted from store sales. Mr. Hogue is of the opinion that if a census of total sales in the Edison company's shops and in all retail stores in the city were made, retail sales as a whole would show an increase due to the impetus given the business by this campaign.

RATES FOR RENTAL OF FACTORY LIGHTING GROW

Commonwealth Edison Company Increases Charge from 25 Cents to 40 Cents per Month to Meet Increasing Cost

The form reproduced herewith is the new contract under which the salesmen of the Commonwealth Edison Company, Chicago, are taking industrial lighting business on a rental basis. The contract differs from its predecessor in that the rental charge for the first twenty-four months has been increased from 25 cents to 40 cents.

The company also agrees to install without an

Form C 11

RIDER No. 8. TUNGSTEN FACTORY LIGHTS—METER BASIS

(Applicable to Rate "A" and "C"; not Altering or Changing Undersigned)

Rider to be attached to, and hereby made a part of, that certain contract or application (hereinafter referred to as the "contract"), dated _____, 191____, for electric service to be furnished by Commonwealth Edison Company (herein and in said contract called the Company) to the undersigned Customer.

Service requested. In consideration of the Customer's agreeing to pay the rental and maintenance charge hereinafter mentioned, the Company agrees, upon the conditions herein stated, (1) to furnish, install, erect and maintain upon the Customer's premises (being a factory or lot) at No. _____, Chicago, Illinois, _____ (not less than five) Tungsten factory lights of the Company's standard type and finish, each such factory light to consist of a single Mazda lamp of 100, 150, 250 watt capacity, as the Customer may designate, and a factory lighting fixture, to be suspended from the ceiling, and _____ (2 or a multiple of 2) drop lights (each such drop light to consist of _____ 60-watt Mazda lamp, and an aluminum steel reflector, to be suspended from the ceiling by a reinforced drop cord), two such drop lights to be considered for the purposes hereof as the equivalent of one factory light, (2) to furnish, for and during the life of said contract (at the rates mentioned therein and in accordance with the terms thereof), electricity for the lighting of said lamps, beginning as early as _____, 191____, and (3) to equip said premises with such wiring as may be necessary for lighting said lamps, with such equipment and lamps as may be required and installed, provided that the Company will install hereunder without extra charge not to exceed 35 feet of conduit per factory light requested, all conduit in excess of that amount to be installed by the Company at the Customer's expense.

Term of contract. In case said contract be under the Company's rate for "General Service" (Rate "A" the contract shall continue for a fixed term of _____ (not less than 2) years from the date when service begins hereunder, and after said fixed term until terminated upon notice in the manner provided in said contract.

Rental charge. The Customer agrees to pay to the Company for and during the life hereof, subject to the provisions hereinafter stated, a rental charge for the use of said wiring and other electrical equipment of _____ cents per month per factory light and _____ cents per month per drop light, to be paid by the Company's electricity for a period of 24 consecutive months, provided the Customer has then fully complied with all his obligations hereunder, the Customer's obligation hereunder to pay said rental charge shall thereafter cease, and said wiring and equipment, not including lamps, shall thereupon but not full then, become the property of the Customer.

Maintenance charge. In addition to said rental charge, the Customer agrees to pay to the Company for and during the life hereof, subject to the provisions hereinafter stated, a maintenance charge for the Company's care and maintenance of said equipment and lamps (including the furnishing and installing of renewals of said lamps) of 25 cents, net, per month per factory light installed, except that no maintenance charge shall be payable for the calendar months of June, July and August in each year. When and if said lights shall have been supplied with the Company's electricity for a period of 24 consecutive months, the Customer may, if he so elects, and upon giving the Company 10 days' written notice of such election, thereafter maintain said equipment at his own expense, and in such case his obligation hereunder to pay such maintenance charge shall thereupon cease, but unless and until the Company shall receive such days' notice, it will continue to maintain said equipment and lamps, and the Customer shall continue to pay such maintenance charge in accordance with the provisions hereof.

Electricity charge. In addition to said rental and maintenance charges, the Customer agrees to pay to the Company for all electricity consumed by said lamps at the rates specified in the contract to which this rider is to be attached.

Additional charge under Rate "C". In case said contract is for service under the Company's Rate "C" (if it is further agreed, irrespective of anything in so said contract contained, that the Customer, except as otherwise in this paragraph provided, shall pay to the Company for each month hereafter (in addition to the demand and energy charges specified in said contract, and in addition to said rental and maintenance charges, a sum equal to the cost net of each kilowatt-hour of electricity consumed in such month by the lamps installed hereunder). Such additional charge, however, will not be made where the Customer furnishes the necessary Mazda lamps hereunder, as he may do at his election upon signing the statement that effect printed on this rider.

Terms and Conditions. During such time as the Company is required to maintain the Mazda lamps furnished and installed hereunder, the Company will, at the request of the Customer, when said lamps are worn out, furnish and install renewals thereof without extra charge. All renewals of lamps furnished hereunder shall be of the same kind and wattage as the lamps originally supplied. The Customer shall in case remove from the fixtures, loosen, partially unscrew or in any way tamper with any of the Mazda lamps or renewals thereof. The Customer shall pay the Company, at the Company's regular prices, for the lamps and renewals thereof furnished by the Company and removed from the fixtures by the Customer, also for all lamps or renewals thereof broken or unaccounted for, and also for all unaccounted for broken or damaged shades furnished by the Company for said lamps. Should the Customer desire to change the fixed term of any of said factory lights after its first installation, such change will be made by the Company at the Customer's expense. All fees charged by the City for the inspection of the electrical equipment in said premises shall be paid by the Customer.

In case the Company shall discontinue service under said contract for failure by the Customer to comply with or perform any of the conditions or obligations thereof or of this rider, in addition to all obligations then due there shall immediately become due and payable to the Company, as liquidated damages, not as a penalty, a further sum equal to such proportion of the cost to the Company of furnishing and installing in and about the Customer's premises the electrical equipment required hereunder, as is then unexpired portion of said fixed term bears to the entire fixed term.

Nothing in this rider contained shall in any way affect the terms and provisions of said contract except to the extent that such terms and provisions are in conflict with, and therefore superseded by, the foregoing provisions of this rider.

This rider shall not be binding upon the Company until accepted in writing by the Company's General Contract Agent.

Accepted: _____, 191____, _____

COMMONWEALTH EDISON COMPANY, _____ CUSTOMER,

By _____ General Contract Agent _____ (Official Capacity)

The Customer agrees to furnish the necessary Mazda lamps hereunder.

_____ CUSTOMER,

By _____ (Official Capacity)

_____ (Official Capacity)

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ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

CYCLIC CANDLEPOWER CHANGE WITH ALTERNATING CURRENT

Measuring This Characteristic for Tungsten Filament Lamps—Comparing Lamps on Different Frequencies and Waves

BY D. L. MARKLE
Pennsylvania State College

IN CONNECTION with a series of tests conducted in the electrical engineering laboratories of the Pennsylvania State College to determine certain characteristics of tungsten-filament lamps a method was devised whereby the change in the candlepower of

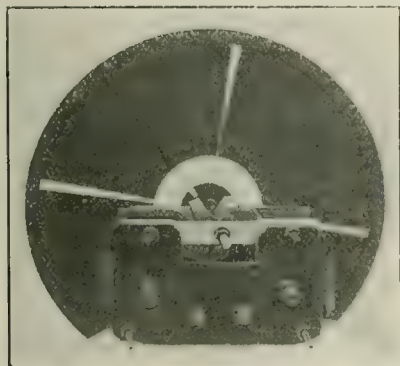


FIG. 1—SECTOR DISKS DRIVEN BY SYNCHRONOUS MOTOR

the filament during a cycle of alternating electromotive force could be measured.

This method does not make use of any new or original idea but is rather an adaptation of the step-by-step method of tracing alternating-current wave forms to photometric measurements. The only special apparatus used is a small synchronous motor to drive the sectored disks generally found among the accessories of any standard photometric equipment. The motor used in this test was built of spare material obtained in the laboratories.

The sectored disks were fastened to the shaft of the synchronous motor by means of a face plate and thumb nut. The pointer attached to the face plate is set opposite a circular scale concentric with the disks. This scale was laid off in divisions corresponding to ten electrical degrees on the voltage wave.

The apparatus, assembled as shown in Fig. 1, was mounted on the photometer bar directly in front of the lamp under test, and the motor was operated on the same alternating-current circuit to which the test lamp was connected. Then, with the pointer set to an arbitrarily chosen zero or starting point on the circular scale, the motor was brought up to speed and synchronized with the lamp circuit, and photometric readings were taken. It should be noted that the zero on the circular scale does not necessarily correspond to a zero point on the voltage wave. The motor was then stopped

and the disks were rotated on the motor shaft through an arc equivalent to ten electrical degrees on the voltage wave, after which the motor was again synchronized and photometric observations were made. This procedure was followed until the disks had made one complete turn on the shaft of the motor.

It is evident that the filament of the lamp will be exposed to the photometer screen during successive intervals of time whose length depends upon the disk opening. It is also evident that with the same number of disk openings as there are poles on the rotor the filament will be exposed to the screen during similar intervals and at similar positions on both positive and negative loops of the voltage wave. The values of candlepower measured in this manner are then multiplied by the constant for the disk opening used.

Thus far a 25-watt tungsten lamp is the only size that has been examined, the object being to test the method rather than the lamp. The results obtained on two frequencies (50 and 60 cycles) are shown in Fig. 2. The candlepower values were obtained with a disk opening of approximately one-thirty-sixth the total disk area and are therefore average values for portions of the voltage wave corresponding to ten electrical degrees. No attempt has been made up to the present time to obtain simultaneous values of voltage and candlepower to determine whether the maximum values of candlepower occur simultaneously with the maximum values of voltage.

The method has some disadvantages. For example, the motor had a tendency to hunt on frequencies lower than 40 cycles per second, while on higher frequencies its performance was all that could be desired. More

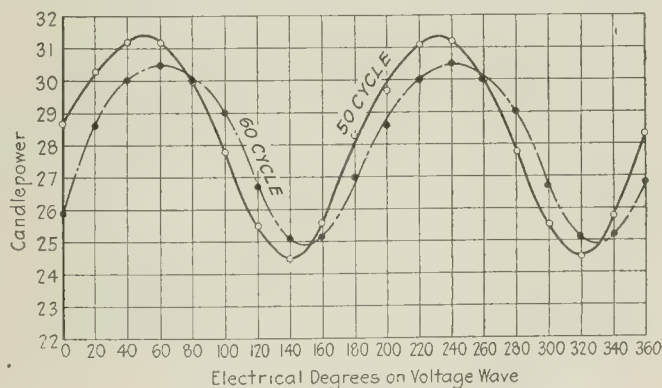


FIG. 2—VARIATION OF TUNGSTEN-LAMP CANDLEPOWER ON 50-CYCLE AND 60-CYCLE CIRCUITS

careful design would no doubt remove this difficulty to a great extent. Furthermore, it was necessary to stop the motor after each reading, change the position of the disks on the motor shaft, then bring the motor up to speed again for the next reading. This requires considerable time and is likely to introduce error if the disks are not securely clamped together. Also, on ac-

count of the low intensity of the light due to a very small disk opening, it was somewhat difficult at times to obtain an accurate photometric balance.

Qualitative results are to be expected rather than quantitative, and from the results obtained it would seem as if the method is a feasible one for comparing the performance of lamps of the same or different size on the same frequency or wave form. Further investigation along these lines is planned for the future.

The special apparatus used in this work was built by E. H. Mackey, L. E. Markle and E. D. Miller, who also assisted throughout the test.

Generators, Motors and Transformers

Design of Electromagnetic Machines.—STANLEY PARKER SMITH.—Part of an article started in the June 2, 1916, issue of the *London Electrician*. In this installment, which refers to alternating-current generators, the author discusses the distribution of mmf. due to three-phase windings, the reduction of armature to field ampere-turns, the characteristics of salient and non-salient pole rotors, the inductance of three-phase windings, the leakage flux and reactance of stator windings, and the calculation of the specific permeance. (To be continued.)—*London Electrician*, Aug. 17, 1917.

Lamps and Lighting

Some Features of Street-Lighting Specifications.—W. EDGAR REED.—The engineer having street lighting in charge should analyze thoroughly the whole situation with a view to obtaining the greater service for the available appropriation. Recognizing inability to forecast developments, the engineer should seek to include in specifications the essentials rather than the details. A comprehensive plan permitting gradual improvement is desirable. The specifications should limit the number of different sizes and kinds of lighting units; should include the kind of lamp supports and distribution system; should safeguard appearance, property and public; should determine the illumination intensity and provide for maintenance and penalize for deficiencies in illumination. In addition provision should be made for the following: Limited extension of lighting, relocations of lamps and equipment, changes in systems and kind and size of lighting units, limited discontinuance of lighting, right of city to use parts of distribution systems for signal wires, approvals by city or its electrician, and methods of verification.—*Trans. Ill. Eng'g Soc.*, Aug. 30, 1917.

Evolution of Light Projection.—C. A. B. HALVORSON and R. B. HUSSEY.—The authors trace the history and development of light projection or control from the time it was first alluded to in the Book of Job, where looking glasses or mirrors are mentioned, to the present time.—*Trans. Ill. Eng'g Soc.*, Aug. 30, 1917.

Generation, Transmission and Distribution

Electrical Interconnection in Lancashire and Cheshire.—There is sufficient in the second report of the committee for the interconnection of the Lancashire and Cheshire electricity supply systems to form a working basis for a practical scheme of electricity supply on a scale which accords with modern ideas—one which provides for the evolution of electricity supply along well-recognized lines, with the least possible disturbance

to financial and local interests. The report, which should be studied in detail, is in two sections, the first portion dealing with the constitution and powers of a proposed joint board, representative of both local authority and company interests, and its powers—which practically amount to the general control of the operation of the generating stations in the area, the formulation of tariffs for bulk, stand-by and reciprocal supplies, the allocation of financial charges incurred in giving such supplies, and the making of the necessary agreements between the various authorities. The board would also act in an advisory capacity, and to facilitate its work it would be divided into four district boards representing groups of undertakings, and these would elect a central executive, both the boards and the executive having various powers delegated to them. It is now proposed to invest the board with any powers to raise capital, the present arrangement being regarded as sufficient "under existing conditions" and in view of the proposed allocation of expenditure between participating authorities. Among other matters which we can only briefly mention are compulsory powers for wayleaves, and public road crossings; also powers to reimburse authorities who may be adversely affected financially through co-ordination. The committee records its opinion that no direct profits should be made on the class of supply dealt with in the report, except under special (and quite obvious) conditions; it further advocates the exemption from local taxation of interconnecting mains and plant, except where used for distribution purposes. This section of the report deals with matters arising from the interconnection of supply undertakings, but the committee recognizes that this is but a first step, and that at the present rate of increase in the maximum load of the area dealt with, i.e., 32,000 kw. per annum, the question of generating capacity must be considered, although not strictly within the terms of its reference. It therefore recommends in a supplementary section of the report that the joint board should have powers to erect new power stations and to acquire existing ones, considering it advantageous that the financial and controlling power in the area should be centered under one owning and operating authority. In the case of companies it is suggested that this would probably involve purchase of their entire undertakings, though it should be noted that the committee feels that the rights of statutory undertakings should be maintained as regards the distribution and sale of energy.—Editorial in *London Electrical Review*, Aug. 17, 1917.

Halifax Corporation Electricity Works.—Description of the 6000-kw. extension to the Halifax Corporation Electricity Works, which have had to enlarge the plant to cope with the rapidly increasing demand for electric energy in their territory.—*London Elec. Review*, Aug. 17, 1917.

Traction

Electrification of the Riksgrans Railway.—Outlines basis for design of the freight and passenger locomotives and contains description of layout and construction of operating equipment. Current is furnished the driving motor from the low-tension side of a transformer over a three-legged choke coil. Ordinarily the three legs of the choke coil are connected to the adjacent taps on the transformer; the connections are changed on one leg at a time. In this way is secured

the advantage that the current in the motor is divided in three parallel paths, with only one-third of the main current in each path, which makes the design of the contactors much easier and cheaper. The driving motors are compensated with commutating poles and designed to operate on an average voltage of 200 with a normal speed of 190 r.p.m. and a maximum speed of 300. The commutating poles are fed in shunt from a special winding on the main transformer, and in this circuit are also connected the field winding and a small ohmic charging resistance, all for the purpose of securing the proper phase displacement of the commutating field, which must compensate for both the reactance and the pulsation voltage. The motors are arranged for air-blast ventilation. The rear of the motor is in an airtight compartment and air is forced into this compartment by a 7-hp. fan under approximately 70 mm. pressure. The characteristic feature of the control system on the passenger locomotives is the use of choke coils with three terminals, which can be connected for boost or buck by double-throw contactors connected in certain sequence, by means of which a large number of running points are secured. Against thirty multiple-unit wires for the freight locomotives, of which twenty are for voltage variation only, there are only ten wires for the passenger locomotives, of which six are for voltage variation, and this in spite of the fact that the number of running points for the former is only eighteen against twenty-four for the latter. At the same time the entire system of interlocking of contactors is reduced to only a couple of wires.—*London Electrician*, Aug. 24, 1917.

Installations, Systems and Appliances

History and Progress of Electro Culture.—Account of the work of early investigators with descriptions of the latest apparatus, methods of application and results secured in different places.—*Canadian Electrical News*, Sept. 1, 1917.

Wires, Wiring and Conduits

Cable Breakdown in the Tropics.—D. M. W. HUTCHINSON.—In the writer's opinion vitrified bitumen cables are unsuitable for tropical countries. Lead-covered, paper-insulated cable is especially suitable for mining purposes where it may be necessary on occasions to overload plant and cables to cope with an emergency. For special positions, such as shafts in a mine where acid water is encountered, a double-wire-armored cable protected by a bitumen sheath over all, and with solid strand filling, should meet every requirement and should give no trouble once properly installed. The possibility of the lead parting under the strain of its own weight might be avoided by specially careful manufacture and by the use of fairly short lengths looped in to horizontal joint boxes in chambers excavated in the sides of the mine shaft. Cables with varnished-cambric insulation might also solve the problems, as this class of insulation is said to be non-hygroscopic and is mechanically strong.—*London Elec. Review*, Aug. 24, 1917.

Electrochemistry and Batteries

Electrochemistry and Electrometallurgy in France.—C. O. MAILLOUX.—(Extracts from report of American Industrial Commission to France.) In the case of metallurgical or chemical processes involving the use of electric furnaces or depending upon the heating

effects produced by electric currents the cost of electric energy ought to be brought down to about \$12 per electrical horsepower per year (which is equivalent to about \$16 per kilowatt-year), and it is highly desirable that the cost should be as much below that figure as possible. It is said that in the case of some of the large water powers in Norway, where the cost of development per horsepower is very low, the cost of power at the power station is as low as about \$5 or \$6 per horsepower-year. These are exceptionally favorable cases. A power cost of \$10 to \$12 per horsepower-year would be considered low; above that price it becomes less satisfactory, and it may be too high for many purposes. A cost of \$16 per kilowatt-year (8760 hours) corresponds to less than 2 cents per kilowatt-hour. The applications which have been made of electrochemical processes in France include the production of calcium carbide, nitrogen products, chlorine and its compounds and miscellaneous products. Electric energy is used in two ways for making nitrogenous products: first, by processes of "direct fixation" of nitrogen from the air; second, by processes of "indirect fixation," which involve the prior production of substances that are chemically adapted and can be made suitable for absorbing nitrogen. The largest plants for producing nitric acid and nitrates by direct fixation are in Norway, the Norwegian Nitrogen Company being one of the principal ones. A French company, known as the Nitrogen Company, has been operating since 1909 a direct-fixation nitrogen plant near Briançon, with nine double furnaces, each of 450-kw. to 600-kw. capacity, oxidizing nitrogen from the air and producing a product which is then transformed into nitric acid of 36 deg. The power capacity of the plant is to be increased from 8000 to 20,000 hp., with a corresponding increase in the output of nitric acid. The great objection to all direct-fixation processes thus far developed is the comparatively large amount of electrical energy required per unit of product obtained. For this reason attention has of late been given to other processes, including the cyanamide process of producing nitrogenous substances. The electrolytic chlorine-and-soda process is the only process that produces pure chlorine gas directly. The difficulty is that the market for the alkali (soda) portion of the output is at present many times (possibly eight or more times) greater than the market for chlorine and its compounds. One of the largest "electro-siderurgical" plants in France is equipped for making electric steel castings up to 25 tons (22.5 t.). The six furnaces that were in operation have an aggregate charge capacity of 35 tons (31.5 t.). Two more furnaces are under construction, one of 2 tons (1.8 t.) and one of 12 tons (10.8 t.), which will make the aggregate charge capacity 47 tons (42.3 t.). Each furnace can be used for making at least three heats per day, and each heat requires about six and a half hours. With the six furnaces already in use there was no difficulty in making 3000 tons (2700 t.) of electric steel per month, or an average of 100 tons (90 t.) per day. There is, perhaps, no application of the electric furnace which has been more successful than the manufacture of "ferro-alloys." The total production of ferro-alloys in France in 1910 was 64,000 tons (57,600 t.), of which a little less than half was made in electric furnaces. Since then the production by the electric furnace has been enormously increased.

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

INDUSTRIAL RESEARCH TO BE DISCUSSED IN PHILADELPHIA

American Institute of Electrical Engineers Will
Devote Its First Fall Session to Consideration
of That Subject

The three hundred and thirty-third meeting of the American Institute of Electrical Engineers will be held in Philadelphia, Oct. 8, 1917. The general subject of the meeting will be industrial research. A discussion of industrial research should prove highly profitable and practical just at this time, when every energy is being focused on problems connected with the progress of a war which, above everything else, is making use of every scientific advance.

Papers will be read by C. E. Skinner and Dr. F. B. Jewett on the influence of industrial research on the development of electrical industries, and by Dr. A. E. Kennelly on the contribution of universities to industrial research. It is hoped to have a member of the National Research Council present to read a paper on the organizing of engineers and engineering research in the prosecution of the war.

Afternoon and evening sessions will be held, and an informal dinner will take place between the sessions. The sessions will be held at the Bellevue-Stratford Hotel. There will be no New York meeting of the Institute in October.

CO-OPERATIVE ELECTRICAL AND INDUSTRIAL COURSE AT "TECH."

General Electric Company and Massachusetts Institute of Technology Arrange for Three Years of
Joint Instruction in Theory and Practice

To train leaders for the engineering and administrative branches of the electrical industry a new course has been inaugurated at the Massachusetts Institute of Technology with the co-operation of the General Electric Company. The course covers three years' work, and the entrance requirements are the completion of work equivalent to the first two years of the regular electrical engineering course at the institute. The three years of co-operative instruction will be equally divided between courses under the faculty at Cambridge and employment under special foremen instructors at the Lynn works of the company. Continuity of work will be secured by dividing each group of students into two sections working in alternate four-month periods at Lynn and Cambridge. At Lynn the students will receive compensation as regular employees.

The first two years' instruction at Cambridge will correspond to the work of the last two years of the regular electrical engineering course at the institute, and also give important factory experience in machine work, insulating, drafting, designing and administra-

tion. The last year of the co-operative course is given up to special research problems at the works and advanced instruction in the courses leading to the master's degree. Completion of the course is recognized by the conferring of the latter degree. The course is especially designed to be useful in the reconstruction period to follow the war.

ELECTRIC SIGNS USED TO HELP SAVE FOOD

Electric Light and Advertising Companies Engage in
National Outdoor Advertising Campaign
for Food Administration

The Food Administration has issued the following statement from headquarters at Washington:

Through the co-operation of advertising companies, the Treasury Department, municipal authorities and electric light companies, the United States Food Administration is, without cost, putting on a national outdoor advertising campaign that is probably the biggest thing of the sort ever undertaken. The slogan, "Food will win the war—don't waste it," is being blazoned in every large city in the country on immense signs on public buildings. These signs are uniform in general design, in paint for daytime display and illuminated by electric light for night.

Advertising companies have patriotically contributed their resources without charge to install the signs.

Trenton, N. J., was the first city to furnish a space on the front of the Municipal Building. It was also at Trenton that the first sign was placed on the post office premises. Since then many cities have followed, including Philadelphia, where spectacular electric signs on the north and south sides of the City Hall are being installed. In Philadelphia also four large bulletins are being placed on the post office. Plans have been perfected for the same in New York City, Norfolk, Richmond and many other cities.

So far as we can learn the work is being pushed by Mr. Maxwell, the head of a large billboard advertising company of Trenton, N. J., who is serving as chairman of the board designated for that purpose by Food Administrator Hoover.

CENTRAL STATION ASKS EMPLOYEES' EXEMPTION

New England Company Asks That Two Men Be
Excused from Military Service to
Serve Public Interest

Exemption of two employees on the ground that their duties render their draft for military service outside the public interest is sought by the Edison Electric Illuminating Company of Brockton, Mass., a central station managed by Stone & Webster.

In one case the employee whom the company desires to retain is engaged in inspecting industrial motor installations with the object of enabling customers to secure the most efficient use of energy in terms of production rates, and in the other the employee concerned

is in charge of the maintenance of the underground system. Factories in the Brockton district are heavy users of central station energy and many war orders are being filled at present.

In response to an inquiry by a representative of the ELECTRICAL WORLD, A. F. Nelson, local manager, stated that the city press had exaggerated the company's viewpoint in regard to claims for exemption, and that thus far only two employees have been suggested by the company as desirable for exemption. The company will probably be required to file affidavits with the district exemption board at Taunton, Mass., in the cases cited.

WAR CONTRIBUTION OF THE ELECTRICAL INDUSTRY

Additional Data on Liberty Loan and Red Cross Subscriptions and Concerning Men Registered in the Selective Draft

Additional data have come in showing the electrical industry's contributions to the Liberty Loan and the Red Cross and men registered for national service as follows:

Company	Liberty Loan	Red Cross	Registered in Draft
Nashville (Tenn.) Railway, Light & Power Company.....	\$193,000	\$1,440	246
The States Company.....	550	.....	...
Malone (N. Y.) Light & Power Company	1,600	55	5
H. L. Doherty & Company Organization, New York, N. Y.....	1,000,000	250,000	...

Data previously received will be found in the ELECTRICAL WORLD for Sept. 1 and Sept. 8.

MERGER OF PENNSYLVANIA UTILITIES IS ANNOUNCED

Metropolitan Edison Company Formed to Take Over Properties Supplying Reading, Lebanon and Surrounding Territory

Announcement has been made by W. S. Barstow & Company, Inc., of the merging of public utility companies in Pennsylvania controlled by the Eastern Power & Light Company.

By merger of the Metropolitan Electric Company of Reading, Pa., the Edison Electric Illuminating Company of Lebanon, Pa., and the Lebanon Valley Electric Light Company, a new company known as the Metropolitan Edison Company was formed, which now owns all of the properties of the above companies, comprising the electric light and power, generating and distribution systems which supply virtually the entire electric light and power service in the cities of Reading, Lebanon and surrounding territory. The Metropolitan Edison Company also acquired the entire outstanding common stock of the Pennsylvania Utilities Company, which does virtually all the gas and electric light and power business in Easton, Pa., Phillipsburg, N. J., Nazareth and Stroudsburg, Pa. The Guaranty Trust Company of New York and Messrs. Reilly, Brock & Company of Philadelphia have purchased \$3,250,000 first and refunding 5 per cent five-year bonds of the Metropolitan Edison Company and they have also purchased \$950,000 one-year 6 per cent notes of the Metropolitan Edison Company.

The Reading Transit & Light Company, the United Traction Company and the Front and Fifth Streets Railway Company, all of Reading, Pa., the Boyertown & Pottstown Railway Company, Birdsboro Street Railway Company and Reading & Womelsdorf Railway Company, all of which are connecting lines of the Reading street railway system, were merged in a new company to be known as the Reading Transit & Light Company. This will operate, through ownership or lease, the street railway system in and about the cities of Lebanon and Reading and extending from the latter to Philadelphia. The Reading Transit & Light Company acquired the stock of the Oley Valley Railway Company and Never-sink Mountain Railway Company and the entire outstanding common stock of the Metropolitan Edison Company.

POWER PLANT ECONOMY URGED IN NEW ENGLAND

Public Utility and Other Users Urge the Patriotic and Protective Necessity of Coal Conservation—Investigations at Cost

In a statement urging fuel conservation in power plants the New England coal committee offers to send a representative inspector to investigate and report upon any power plant at cost as a contribution to national defense and a means of promoting offensive measures abroad through the release of fuel and carriers which would otherwise be required under less efficient operation.

The statement of the committee was framed by a sub-committee on power-plant economy, of which the following are members: Chairman, Albert Greene Duncan of the Harmony Mills, Cohoes, N. Y.; Matthew C. Brush, president Boston Elevated Railway; Charles L. Edgar, president Edison Electric Illuminating Company of Boston; Howard Coonley, president Walworth Manufacturing Company, Boston; H. W. Mason of S. D. Warren & Company, Boston; J. F. McNamara of the International Brotherhood of Stationary Firemen. The statement follows:

Owing to war conditions a most serious situation confronts the coal users of New England during the coming winter. In previous years two-thirds of New England's coal supply was shipped by water in large steamers and barges towed by tugs. Our government requires every possible ship capable of crossing the ocean and every possible tug for mine sweeping and submarine spotting. Our railroads cannot possibly do this extra work—we must help the government by saving coal. It is not only an absolute necessity for our own protection, but a patriotic duty. In view of this emergency it is absolutely essential that the utmost economy be used in the burning of coal for power, light and heat, and the New England coal committee would urgently call this matter to your attention.

We do not advocate costly expenditure to make your boiler plants more economical, for, owing to the probable delay in furnishing all material requisite for such improvements, the work could not be completed in time to be of use the coming winter. We do urge, however, that stricter attention than ever be paid to the upkeep and maintenance of existing plants so that greater efficiency may be obtained therefrom.

The greatest enemies of efficiency in boiler plants come under two general heads—lack of cleanliness by allowing soot or scale to accumulate on boiler tubes and lack of repairs in allowing leaky brickwork of boiler settings and leaky baffles, and without the expenditure of any great sum of money marked increase in efficiency may be obtained by giving attention to these simple points. In addition to

this, increased economy may also be practised by closer attention being given to the firing of coal and the number of boilers kept in operation for a given load. It is better economy in general to run fewer boilers at their full capacity than it is to keep in operation a larger number of boilers running underloaded.

We would urge upon all plants, both large and small, that accurate daily records be kept of the amount of coal burned and other operating conditions and that these records come under the direct attention of the responsible managers of the plants, who should urge upon their engineers the absolute necessity of the most economical use of coal as a patriotic service.

We would also urge the hearty co-operation of the men who actually fire the coal. If unable to serve their country by enlisting in its military or naval forces, a few pounds of coal saved by each one every day during the coming winter will in the aggregate amount to enough to send many a ship loaded with supplies for our boys at the front.

Upon request the New England coal committee will gladly send an inspector to investigate and report on conditions in any plant, charging only a fair price to cover the bare cost of services.

FINAL RECOMMENDATIONS OF NITRATE SUPPLY COMMITTEE

**Under Existing Conditions, Committee Says, Most
Suitable Fixation Process Is One Requiring
Least Amount of Power**

In the *ELECTRICAL WORLD* of July 21 was published the statement of the Secretary of War regarding the construction of plants for the production of nitrates from atmospheric nitrogen.

The fixation of atmospheric nitrogen for the purpose of national defense has been the subject of extended and extensive official investigations during the past year. Section 124 ("nitrate supply") of the national defense act of Congress of June 3, 1916, authorized an investigation into the best, cheapest and most available means for the production of nitrates by water power or any other power that may be best and cheapest. To permit rapid action in backing up the conclusions reached in this investigation, Congress appropriated \$20,000,000. The scientific investigation was in the hands of technical committees appointed for this purpose; the collection of all possible further information was in the hands of the special agents.

The first committee of scientists and engineers was appointed at the request of the Secretary of War by the president of the National Academy of Science in co-operation with the American Chemical Society, and consisted of Arthur A. Noyes, chairman; L. H. Baekeland, Gano Dunn, Charles H. Herty, W. K. Lewis, M. I. Pupin, Theo. W. Richards, Elihu Thompson and W. R. Whitney.

This committee was succeeded and its work continued by a new committee—the "nitrate supply committee"—appointed by the Secretary of War, and constituted as follows: Chief of Ordnance William Crozier, U. S. A.; Chief of Ordnance Ralph Earle, U. S. N.; Chief of Engineers William M. Black, U. S. A.; F. W. Brown, L. H. Baekeland, Gano Dunn, Charles H. Herty, William F. Hillebrand, Arthur A. Noyes, Charles L. Parsons and W. R. Whitney.

Of the progress of the investigation very little was heard during the past year, until it became known that the final decision reached was to put to immediate use less than \$4,000,000 out of the total of the twenty-million-dollar "nitrate supply appropriation" of Con-

gress until further information was given out by the Secretary of War at the end of last month. He first gave the details of the conditions as to the work to be undertaken at once by the government, and second, published several reports in abstract written by Dr. Charles L. Parsons, chief chemist of the Bureau of Mines, as special agent.

The principal feature of the final recommendations of the committee, as indicated by this statement, is the manifest conviction that under the conditions now existing in this country those nitrogen-fixation processes are most suitable which require the least amount of power. For this reason the committee does not favor those processes which have assumed greatest commercial importance in Europe in connection with immense hydroelectric developments. This explains at once why less than one-fifth of the total \$20,000,000 appropriation of Congress is to be used up—there will be no large expensive water-power developments.

One of the reports, dated Jan. 27, 1917, which Dr. Parsons prepared for General Crozier gives interesting data on the arc process, the Haber process, the cyanamide process, and by-product coke-oven ammonia.

Concerning the arc process, which is operated on a very large scale in Norway, it is said that in spite of the very low efficiency of the process, yet on account of the very cheap horsepower available in Norway and the fact that the raw materials cost nothing and are always at hand, nitric acid can there be produced by the arc process at a cost less than by any other commercial process.

The report said:

The cost of horsepower used for the production of nitric acid in Norway is less than \$5 per horsepower-year. The best estimates in my possession indicate that with horsepower at \$10 per horsepower-year the cost of finished strong nitric acid at the plant would be as cheap as by any other process now in operation. However, the low cost of producing nitric acid by the arc process is outweighed by so many disadvantages that, in my opinion, the process is entirely inapplicable to the uses of the United States government, and this opinion appears to be shared by all who have given careful thought to the subject. The cost of installing the arc process is high and it involves the use of an amount of horsepower that seemingly is not available on the American continent within reach of the points where the nitric acid would have to be used.

Nitric acid is not economically transportable. As strong nitric acid it can be transported only if tank cars made of aluminum can be obtained, and aluminum is a metal that for this purpose has many disadvantages besides cost. The nitric acid might be transported mixed with sulphuric acid in iron tank cars, but this involves the erection of large sulphuric acid factories near to the nitric acid plant and a large addition in freight rates. Freight rates on such nitric acid as is transported are very high and must always remain high on account of the dangers involved.

The great difficulty that has faced the Norwegian plants from the beginning—namely, a market for their products—would in peace times be a serious obstacle to the operation of a large arc plant in the United States. An arc plant at its best involves the use of 2.33 hp.-year per ton of weak nitric acid. This means that a water-power development of at least 50,000 hp. would be necessary for the peace requirements of the government, and a development of 440,000 hp. would be required for war purposes. These figures are minimum figures on the basis of the relatively high efficiency reached in Norway. No installation should be considered by the government of less than 75,000 hp. for peace requirements or 550,000 hp. for war requirements. If the arc process is to be used it would also be advisable to arrange for the production of explosives at the point where the arc plant was situated. This would of course involve the trans-

portation of all other raw materials needed, such as benzol, toluol, alcohol, acetone, glycerine, sulphuric acid, cotton, and other materials too numerous to mention, to the plant and the transportation of the finished explosives therefrom to the place of consumption. As these materials are highly combustible and for the most part carry high freight rates, it has been found necessary the world over to locate the plants intended for the production of munitions near to the point where the munitions are likely to be consumed.

The construction of a hydroelectric plant is recommended only if the arc or cyanamide process is used. The report continues:

I seriously doubt whether hydroelectric power will be necessary or desirable three years from now for the most efficient process of fixing nitrogen, and accordingly I deem it unwise to install such hydroelectric power at great cost with the sole purpose of producing nitrogen. If, however, such water power can be utilized by the government in the production of certain ferro alloys absolutely essential for ordnance and other munitions, can be sold to commercial companies which will take upon themselves the financial risk involved in the erection of plants for nitrogen fixation, under guarantee of cheap ammonia to the government, or can be sold during peace times to companies requiring power for purposes which would allow instant requisition of the power by the government in time of war without handicapping the supplies of other needed war material, the development of such hydroelectric power would be highly desirable.

EARNINGS AFFECTED BY INCREASED COST

American Public Utilities Company Directors, However, Find Satisfaction in Proportion of Hydroelectric Energy in Operations

In the report of directors of the American Public Utilities Company for the year ended June 30, 1917, conditions of business and cost are dealt with in part as follows:

The abnormal prices of materials for construction purposes has led the management of the company to limit the plant extension of its subsidiaries to absolute necessities rather than to permit a great amount of forward development. This program has resulted in the attainment of a greater density of business in the communities already served, rather than an enlargement of its volume from extensions. Such additions to plant as have been made have fallen within two classifications, the one making provision for greater density of business in existing plants, the other being extensions and betterments the prospective income and economies from which justify investments in additional property even at the present unusual costs of the same.

The experiences of the last fiscal year bear out the suggestion made in the last annual report that the Wisconsin-Minnesota Light & Power Company would take its place as the most important of the properties owned and operated by the company. While this is true, the condition and earning power of the other companies continue to be extremely favorable. New possibilities of marketing power have developed in the territory of this company to an important degree. Among these are the demand created by the abnormal prices of coal supply for existing industries, which promises to result in the conversion of many steam-driven industries into electrically operated plants. A considerable contribution to the demand has grown out of the operations of the industrial department of this company, which has concerned itself with the bringing of new industries into the company's territory and with the development and continuance of those already established.

The situation of the company with regard to earnings for the current year must necessarily be affected to some extent by the increased costs of raw materials and labor. While adjustments of rates to meet these conditions are under way, it is not anticipated that the whole burden entailed by them can be shifted to the consumer during the

period that must elapse until conditions become normal. However, so great an amount of the income of the company is derived from the hydroelectric operations of its principal subsidiary, which are not affected by changing market and labor conditions, that the likelihood of diminished returns from the operations of the company in the aggregate must be considered remote. Whatever difficulties may accrue, if any there be, are most likely to come from conditions which may temporarily deny access to the money market for the sale of securities whose proceeds must be invested in necessary extensions and betterments, although to offset this possibility the stockholders have as their dependence the policy of the directors to go cautiously in the way of plant enlargement and the friendly connections with strong financial houses which have been established and maintained for the company's benefit by its managers.

PLAN TO APPORTION AVAILABLE COAL SUPPLY

United States Fuel Administration Announces It Is Absolutely Essential that Domestic Consumers Have Coal

The United States Fuel Administration realizes the acute need of making immediate arrangements to apportion coal supply and regulate retail sales. To this end the following plan has been adopted:

The Fuel Administrator is to choose a representative in each state and territory. He will also appoint in each state a committee of citizens who, with the representative, will assume direction of the regulation of the sale of coal in that state. No person will be appointed, either as a state representative or on any of these committees, or any of the committees mentioned below, who is connected with the local coal industry.

Each state representative will choose a committee of citizens to represent the Fuel Administration in each county and in each city having more than 2500 population.

The state representative and state committee will be chosen directly by the Fuel Administrator with the approval of the President.

County and city committees will be chosen directly by the state representative.

The state committee will ascertain the amount of coal in the state available for use during the coming winter and the amount needed to meet any deficiency in the supply, based on last year's consumption.

It will be the duty of the various committees to report to the Fuel Administration the reasonable retail margin (viz., the cost of local distribution and a reasonable dealers' profit to be allowed). This margin, when duly fixed by order, together with the cost at the mine named by the President, the transportation charge and the jobbers' commission, when sold to a jobber, will constitute the price to the consumer. The Fuel Administration will make public from its local committees in each community sufficient data to enable the individual consumer to ascertain for himself the established price.

These figures will be compiled with relation to local needs in order that the Fuel Administration may, if necessary, apportion coal with careful regard to the greatest existing needs. There are many communities in which there is no supply available at retail prices.

A very large proportion of the coal supply available for the coming winter is under contract. These contracts, which are allowed to stand for the present, were made prior to the President's proclamation and very

largely limit the amount which may be placed on sale at retail prices based on the President's order.

It is absolutely essential, however, that a sufficient amount of coal be put on the market at once at these prices to meet needs of domestic consumers. The Fuel Administration believes that this supply of coal can be made available, and will be made available, by voluntary arrangement between operators and those with whom they have contracts, and thus make it unnecessary for the Fuel Administration to exercise or recommend the powers of the Lever act.

INDUSTRIAL CONFERENCE BOARD REPORTS ON LABOR

Recommendations of Means for Preventing Interruption by Labor Disputes of Necessary War Production Made to Defense Council

At the invitation of Howard Coffin, the National Industrial Conference Board's advisory committee, of which L. A. Osborne of the Westinghouse Electric & Manufacturing Company is chairman, has presented its recommendations on the labor situation and the economics of industry to the Council of National Defense. The Electrical Manufacturers' Club is a member of the National Industrial Conference Board, and among the indorsers of the report is the Associated Manufacturers of Electrical Supplies.

The committee epitomizes its conclusions and recommendations as follows:

We urge:

1. That as a basis of mutual understanding employer and employee recognize and agree that now and for the period that the war continues efficient production can alone equip and sustain our military forces. Every dispute, whatever its motive, which interrupts production furthers the ends and operates to the advantage of the public enemy.

2. The nation needs the service of every citizen. Its industrial workers are as indispensable to victory as the soldier on the firing line. The non-union man is as necessary in the factory as he is in the army. On economic as well as indisputable moral grounds the government can therefore neither permit nor tolerate the exclusion of any laborer from productive employment. We, therefore, urge the Council to adopt and reassert as its guiding principle the fundamental American doctrine authoritatively stated by the Anthracite Coal Strike Commission, with the approval of representatives of both employers and unions included in its membership, and commended as the basis of industrial adjustments by Presidents Roosevelt, Taft and Wilson:

"That no person shall be refused employment or in any way discriminated against on account of membership or non-membership in any labor organization; that there shall be no discrimination against or interference with any employee who is not a member of any labor organization by members of such organization."

3. The Council's reiterated recommendation that "employers and employees in private industries should not attempt to take advantage of the existing abnormal conditions to change the standards which they were unable to change under normal conditions" should now receive an unambiguous interpretation to assure its practical application as a working principle. To this end we propose:

(a) That, applied to existing statutory regulations intended to promote safety and health, it shall be agreed that for the period of the war there shall be no suspension or modification of such provisions, except upon recommendation of the Council of National Defense after due investigation by its agencies and when, in its judgment, required by the exigencies of war;

(b) Applied to wages, demands shall be tested by the prevailing local standard of the establishment in effect at the beginning of the war with such modification as may be

shown to be necessary to meet any demonstrated advance in the cost of living.

(c) Applied to hours, the standards shall be those established by statute or prevailing in the establishment at the beginning of the war, subject to change only when in the opinion of the Council of Defense it is necessary to meet the requirements of the government.

(d) Applied to what are commonly known as "open" or "closed" shop conditions, it shall be understood and agreed that every employer entering the period of the war with a union shop shall not by a lock-out or other means undertake to alter such conditions for the duration of the war, nor shall any combination of workmen undertake during the like period to "close" an "open" shop.

4. Adopting these standards as the basis of its operation, we recommend the creation of a federal board to adjust labor disputes for the duration of the war, the activities of this board to be confined to disputes growing out of employment on the subject matter of war production for the government. To such board shall be primarily referred for final settlement all major disputes of the nature suggested, with full power to create all machinery necessary to execute its functions. Its decisions must bind all parties to the dispute. It should be constituted equally of representatives of employees, employers and the government, representatives of the latter to hold the deciding voice in the event of an equal division of opinion. It is to be further understood and agreed that there shall be no interruption of production by strike, lock-out or other means within the control of employer or employee.

5. We pledge to the country, through you, the acceptance of such a program by the great body of representative associations and individual manufacturers we are authorized to represent. We do not seek to be regarded as the exclusive spokesmen of all industry and will co-operate in any helpful capacity with any and every manufacturer whether members of our association or not.

6. To secure in the public interest a mutual understanding and agreement predicated upon the proposals set forth we suggest: That the Council of National Defense call, at the earliest convenient date, a conference of representative national and international officers of American trade unions that they may be requested to join in the pledge here made on behalf of employers. Their loyal co-operation for the duration of the war will assure a known standard of conduct to govern these vital industrial relations. The national safety will then no longer be imperiled by disputes, halting vital production and necessarily operating to give aid and assistance to the public enemy.

We reiterate in conclusion the pressing necessity for recognizing one vital and primary principle. A government which cannot itself discriminate between its citizens cannot tolerate a condition which encourages private organizations to compel such discrimination. Politically and economically such a policy spells disaster. It destroys the responsibility of management which is vital to successful production and denies in our own democracy the basic principles of individual liberty and opportunity for which its citizens since the foundation of the Republic have shed freely of their blood and for which to-day they are prepared to die on alien soil.

PROMPT ELECTRICAL WORK AT CAMP MEADE, MARYLAND

Extension of Transmission Lines to the Cantonment and Installation of 1000-Kw. Transformer Quickly Carried Out

J. J. Doyle, vice-president and general manager Washington, Baltimore & Annapolis Electric Railroad, which supplies electrical energy to Camp Meade, Admiral, Md., wrote recently to the ELECTRICAL WORLD:

Immediately upon being advised of the decision of the United States camp site board regarding the location of Camp Meade on our line at Admiral, Md., we promptly arranged for the construction of a three-phase, 33,000-volt transmission line from Naval Academy Junction to the can-

tonment site, as well as the purchase of a 1000-kw. transformer which has just been installed. This transmission line was constructed for the purpose of furnishing electric energy for power and lighting purposes within the camp.

We also found it necessary to increase our substation capacity and orders have been placed for three 800-kw. transformers to be located in the substation adjacent to Bennings power station, one 1000-kw. rotary with necessary transformers to be installed in the Baltimore substation, and one 750-kw. rotary with necessary transformers to be installed at Naval Academy Junction.

The expenditure for electrical equipment and construction of transmission lines incident to the location of the cantonment on our property will be in the neighborhood of \$50,000. This applies only to such equipment as is necessary for the furnishing of electric energy, and does not take into consideration expenditure necessary for additional car equipment, construction of double tracks and grading, etc., which will run to approximately \$250,000 or more.

NORTHWEST ELECTRIC LIGHT CONVENTION AT SPOKANE

Discussions on Range Situation and on How Engineers and Salesmen Can Co-operate—Contractors Hold Simultaneous Convention

The tenth annual convention of the Northwest Electric Light and Power Association and the annual convention of the Washington Association of Electrical Contractors and Dealers were held jointly last week at Spokane, Wash., with representative men present from all the coast centers. The idea of holding the two conventions together, with one joint session and entertainment features in common, worked out well and was pronounced a long stride toward better relations between the two branches of the industry.

President M. C. Osborne, Washington Water Power Company, Spokane, planned a patriotic opening which was most effective. George B. Muldaur, field secretary of the National Electric Light Association, brought greetings from New York headquarters. J. E. Woodbridge, Sierra & San Francisco Power Company, San Francisco, was present as representative of the Pacific Coast Section, National Electric Light Association.

The afternoon session of the first day was devoted to a discussion of a paper on "Practical Central Station Salesmanship," by Lewis A. McArthur, Pacific Power & Light Company, Portland, Ore. Comment came in abundance from all quarters, indicating the general interest in this subject. Central stations were warned to consider the probable service or repair charges as well as load-building characteristics of new appliances. It was suggested that in the company office in small towns the usual clerk in charge could profitably be replaced by a high-class salesman because the difference in sales on the floor would warrant it.

A. C. McMicken, Portland Railway, Light & Power Company, said his office salesmen, unlike the outside men, have their yearly salary fixed at 7 per cent of sales. This he thought fair for inside men, giving them both opportunity and incentive. Mr. McMicken has arranged for the metermen, who visit an average of 100 homes daily, to inquire if any socket appliances are out of order and to make repairs or take the appliance to the shop. This has put a considerable appliance load back on the lines. Previous speakers had spoken both for and against circulars sent out with bills, but Mr. McMicken cited his success in selling 800 vacuum cleaners by this method.

Manufacturers were criticised for advertising thirty days' free trial of socket appliances. Demonstrations in the homes of selected prospective customers were approved, but unless the sales were closed the devices were taken back to the office. Sales of most appliances on installments were advocated, but this has not been a success on fans, because customers bring them back after summer is over and ask for exchange. G. C. Sawyer, Portland Power & Light Company, North Yakima, found it better not to give lists of wiring prospects to contractors, but now has company salesmen close the contracts and then turn the work over to contractors. He found that the fostering of pride and competition among salesmen through sales announcements in the company bulletin did more than cash prizes to stimulate their work.

EDUCATION OF SALESMEN

A. H. Richardson, Hotpoint Electric Heating Company, Ontario, Cal., emphasized the need for more general educational effort on the part of salesmen. Some appliances can be sold easily for work which they are not well adapted for, and these seriously harm the business. The salesman should use his knowledge to safeguard the customer on this score. Mr. Richardson said that progress was being made in the work of standardizing socket plugs, and he expected soon to see the same plug standard for both ends of the socket appliance cord. C. R. Young, Portland Power & Light Company, said that attention to merchandising methods, plus good times, had increased the company's annual merchandise sales from \$50,000 to \$250,000. The company plans to make 15 per cent on the gross price.

S. M. Kennedy, Southern California Edison Company, Los Angeles, was introduced as the man who has sold more appliances than any other man on the Pacific Coast. For selling appliances, he said, the central station has obligations of three kinds, *i.e.*, to stockholders, to customers and to competitive dealers. The first requires that maximum earning be secured on investment; the second that since the company is in a position to know, it shall help its customers to see how they can make the most of opportunities to buy and use appliances; the third, that the company protect and co-operate with dealers, recognizing their right to a share of the business and the value of having them satisfied and prosperous. With 140,000 customers on the lines at the first of the year, his company had 200,000 socket appliances on the system. The average revenue from each appliance is now 1 cent a day, or a total of \$730,000 per year. The operating cost for this appliance load is about half the charge against other business or, say, 25 per cent of gross. On this basis the operating profit on such a load would pay 5 per cent interest on \$11,000,000 in bonds. On his system it is now easier to sell appliances for doing some new operation electrically than it was to give them away before the people were educated to the idea.

SUGGESTIONS FOR CHRISTMAS DISPLAY

W. R. Putnam, Utah Light & Power Company, Salt Lake City, urged the use of a "kids' corner" in the salesroom. The children will bring their parents in to see the electrical toys they want for Christmas, and while in the store parents will look over other merchandise displays. Vacuum cleaners and washing machines are good appliances to sell, he believes, in spite

of low-load return, because customers need and appreciate them. By means of a bake oven demonstrated daily for a week in his display window a local baker had no difficulty in selling on the spot all the bread and cookies that could be turned out.

DEPARTMENTAL CO-OPERATION

Thursday morning a paper on "How the Engineers Can Assist the Commercial Department" was read by D. H. Henderson, Washington Water Power Company. Mr. Woodbridge pointed out that, under present war conditions, transformers and construction materials generally should only be used after joint consideration by engineering and commercial departments. Results would be much better, he said, if the engineer could always be promptly notified of prospective business. Other speakers pointed out the need of departmental co-operation in recommending motor voltages to customers, how this would eliminate unnecessary transformers, how comparing notes would prevent broken promises to customers, and what profitable returns would accrue from close and continual touch between these departments. Participants in the discussion were H. H. Schoolfield, S. J. Lisberger, J. H. Siegfried, G. E. Quinan, W. H. Putnam, J. C. Martin, S. M. Kennedy, O. B. Coldwell, J. B. Fiske and Lewis A. McArthur.

Thursday afternoon a paper on "Co-operation in Modern Home and Apartment House-Wiring Practice" was read by Mr. McMicken, and a written discussion was presented by F. H. Murphy, Portland Railway, Light & Power Company, and Foster Russell, Washington Water Power Company. Mr. Murphy stated the three principles which underlie all successful campaigns as educating the public, securing their confidence and giving them service.

Co-operative methods in Seattle, Portland and Spokane were outlined respectively by J. H. Agutter, J. H. Sroufe and W. E. Chase, all electrical contractors. E. B. Price, representing the Spokane architects, asked electrical men to help keep architects informed on up-to-date methods and devices. Others who participated in discussions were T. E. Bibbins, Pacific States Electric Company, San Francisco; E. J. Mundy, contractor, Vancouver, B. C.; Albert H. Elliot, secretary Pacific Coast Electrical Supply Jobbers' Association, and E. D. Walker, British Columbia Electric Company, Vancouver. A resolution was passed authorizing the appointment of a committee of one to meet with like appointees from manufacturers', jobbers' and contractors' associations for the purpose of fostering closer relations among these three branches of the industry, particularly on modern wiring problems.

THE ELECTRIC RANGE AND WATER-HEATING PROBLEMS

On Friday the entire day was devoted to a discussion of electric range and water-heating problems. The day was begun by reading in extract a report on the subject prepared by a joint committee of which W. S. Putnam was chairman. Different angles of the matter were presented by manufacturers and by commercial engineering departments. In Salt Lake City, Mr. Putnam said, the average heating element replacements on 1600 ranges amounted to 15 per cent per year, the equivalent of 50 cents per range per month. E. H. Richardson, Hotpoint Electric Heating Company, said a rate of renewals not exceeding 5 per cent per annum could be expected in the near future, and when this condition was

reached consumers would probably be willing to bear renewal costs.

Mr. Kennedy suggested care in avoiding making rates too low at the start; he thought that 3½ cents for cooking and 2 cents for water heating were fair enough while pioneering is still required. J. F. Roche, Montana Power Company, Butte, Mont., pointed out that the personal solicitation method brings best results in range selling. All employees should be enthusiasts on the electrification of the home. As an example of the good results of this he cited the sale of twelve ranges in one day to prospective customers whose names were turned in by street railway platform men. Another point is to get the departments to work together. "Have the boys think of our company, not our department," he said.

J. D. A. Cross, General Electric Company, Schenectady, N. Y., cited results of cooking-school and other demonstration methods in Milwaukee and points further east. Mr. Richardson said progress was being made in speeding up surface heating elements and that the speed of gas burners is being approached. The leakage of smoke and moisture from ovens is serious only because of the bad impression it creates. This should be taken care of by suitable vents.

Three purposes are now paramount in electric-range manufacturing, he said, (1) to do everything possible to increase the efficiency of the range, (2) to reduce its maintenance charges, and (3) to reduce first cost. Endeavor in the latter direction is being handicapped by war prices on materials, but this is partly compensated for by the increasing price of other fuels. Others who spoke were Milton Herrock, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; Edmund B. Walker, British Columbia Electric Company, Vancouver, B. C.; George Hughes, Hughes Electric Heating Company; C. R. Young, Pacific Power & Light Company, Portland, Ore.; R. W. Clark, Puget Sound Traction, Light & Power Company; A. C. McMicken, Portland Railway, Light & Power Company, and Y. M. White, Washington Water Power Company, Spokane.

At this session there was also presented the paper on "Cooking Tests by Fuel and Electricity," by B. L. Steele, professor of physics at the State College of Washington.

A motion was adopted unanimously which urged upon manufacturers the abolition of present discriminatory rates on ranges and the use of a discount scale which would be the same for all purchasers of equal quantities.

ELECTION OF OFFICERS

The election of officers for the coming year resulted as follows: President, Guy W. Talbot, Pacific Power & Light Company, Portland; vice-president for Washington, J. S. Thornton, Willapa Electric Company, Raymond; vice-president for Oregon, W. E. Coman, Northwestern Electric Company, Portland; vice-president for Montana, J. F. Roche, Montana Power Company, Butte; vice-president for Idaho, W. T. Wallace, Idaho Power Company, Boise; executive committee, L. B. Faulkner, George D. Brown, P. A. Bertrand, L. A. McArthur and H. L. Walther.

ELECTRICAL DEALERS AND CONTRACTORS

The Washington Association of Electrical Dealers and Contractors held the opening session of its meeting

Thursday morning and joined with the central station men for the afternoon session. On Friday the dealers and contractors held only an afternoon session, at which were presented papers on co-operation, from the central station point of view by O. B. Coldwell, Portland Railway, Light & Power Company, and from the jobbers' point of view by W. S. Berry, Western Electric Company, San Francisco. Papers by Spokane men were: "The Electrical Contractor," by Hugh L. Tinling, and "The Inspector's Viewpoint," by W. A. Davis, city electrical inspector.

Much of the discussion in the contractors' meeting was on the subject of central station competition in the sale of lamps and other appliances. Strong protest was voiced particularly against the central station practice of cut prices on lamps.

CONTRACTORS' OFFICERS FOR COMING YEAR

The election of officers for the ensuing year resulted as follows: President, V. S. McKenny, NePage-McKenny Company, Seattle; secretary-treasurer, H. D. Allison, Seattle; delegate to Pacific Coast conference, W. E. Chase, Spokane. As usual, vice-presidents were elected from each district, three from Seattle, two from Spokane, and one each from Bellingham, Yakima and Tacoma.

The two associations joined for the entertainment features, which included, in addition to automobile rides and teas for the ladies, a banquet on Friday night and an all-day trip on Saturday to the electrified mine of the Bunker Hill-Sullivan Mining & Concentrating Company at Kellogg, Idaho. The trip was made by special train and boat, and at noontime near the mines a barbecue luncheon was served.

INCREASES IN RATES OF THE DOHERTY COMPANIES

**Danbury & Bethel Gas & Electric Light Company to
Raise Schedules on Lighting and Power
Service—Gas Rates Up**

Certain Doherty properties have taken definite steps to meet the high cost of living which confronts public utilities. The rate engineer of the Doherty organization has announced that two companies have already prepared to make higher charges for electric and gas service, and it is expected that other properties will follow shortly. The two companies are the Pueblo (Col.) Gas & Fuel Company and the Danbury & Bethel (Conn.) Gas & Electric Light Company.

At Danbury arrangements have been completed for increasing both electric and gas rates. The increase in electric rates covers lighting and power service and, according to estimates, will increase total electric operating revenues about 10 per cent. It is estimated that the increase in total gas revenues will be about 15 per cent. A service charge is added to the former consumption charge. This is 50 cents gross per electric customer and 25 cents per gas customer per month.

The Pueblo Gas & Fuel Company has filed a petition with the Colorado Public Utilities Commission for rate increases based on a different system from that used by the Danbury company. The existing maximum rates are \$1.35 per 1000 cu. ft. (145.2 cu. m.) net for gas for illuminating purposes and \$1 net for fuel purposes.

The company asks that it be allowed to abandon the "dual" meter system and charge one rate (\$1.10) for gas for illuminating or fuel purposes. The petition also contemplates increases of 5 cents per 1000 cu. ft. (145.2 cu. m.) in gas for industrial purposes, and from \$1 to \$1.20 net for gas sold through prepayment meters. If granted, the new rates will increase the company gross revenues about 8 per cent, and also reduce operating expenses materially through abandonment of the dual meter system.

PUBLIC UTILITY SECURITIES UNDER PRESENT CONDITIONS

**Prospect That Utility Companies Will Be in Fully
as Strong Financial Position This Fall
as in Fall of 1916**

Present conditions of the security market from the standpoint of the investor in public utilities in view of government control plans now taking form are analyzed by L. P. Hammond of Bonbright & Company, New York, as follows:

Present conditions in the investment market are puzzling to insiders. The United States is holding more gold than any other country is known to have held in the history of the world, bank clearings are at an unheard-of rate, steel companies' orders are far in excess of any estimated possibility in that direction, and all other usual barometrics point to unheard-of prosperity. It is evident that there is plenty of money in the country and that the stagnation must be due to psychological causes. In plain words, the investor is apprehensive.

It is reasoned that this apprehension must be due to uncertainty of the effect of governmental regulation of business as a war measure.

Public utility securities have acted in sympathy with the market, and many exceptionally well-secured investments are available at unusually high rates of return. The critical investor should be appealed to by the fact that public utility corporations are practically assured of very little disturbance through regulation, because the industry as a whole has now been under governmental regulation by the individual states for some years, and it has adjusted itself to such regulation. In this industry practically all of the complicated and serious problems necessary to establish proof that earnings constitute a fair return upon a fair value have been worked out. Where the result did not fit in with earnings the necessary adjustments have been made.

The industry, therefore, will not only be exempt from adjustment of earnings, but also from the evils of ill-advised or uninformed efforts of newly created regulatory bodies.

However, governmental regulation of industry may in another way be a factor in public utility operation, because if the government regulates the price of coal and other commodities which are used to a large extent in public utility operations, public utilities will be directly affected, but obviously in a favorable way.

It is suggestive of the capacity of the companies to meet the war situation that the majority of the public utility corporations reporting their earnings show gratifying increases in net for May, June and July. These comparative increases of recent months are much higher than those shown on the twelve months' basis and indicate that the utilities have adjusted their earnings and expenses to the new condition of affairs, and that the remarkable increase in gross earnings already generally noted is now being properly reflected into the net.

Despite the fluctuations in prices of securities of public utilities, from the investment standpoint the supporting conditions are in fact most gratifying, and there is a fair prospect, therefore, that the utility companies will find themselves in fully as strong a financial position this fall as that in which they were in the corresponding period of last year.

CHAMBER OF COMMERCE RECOGNIZES UTILITIES' NEEDS

War Convention of American Business Men at Atlantic City Hears of the Value of Central Station Service to the Nation

American business men at Atlantic City this week, in a convention called by the National Chamber of Commerce of the United States, discussed their responsibilities in the war, looking to a more definite organization between government and business.

Speaker after speaker, Cabinet officer and small-town business man, expressed the key thought that this was the time, not for lip service, but for definite sacrifice of property, money and personal ambition, if the war is to be won. Harry Wheeler, Chicago banker, epitomized business patriotism in these words: "Until the principles we have at stake in this war are closer to us than our business we will never be right with our government." He said the business man's attitude should be, "How can I have this unprecedented task done?"—not that the thing is impossible.

DISCUSSION OF THE TRANSPORTATION PROBLEM

On Tuesday Secretary Baker and Secretary Lane addressed enthusiastic audiences. In the evening the Russian ambassador, Hon. Boris Bakhmeteff, called attention to Russia's need, in common with the United States and the Allies, for more effective transportation.

Harry A. Wheeler, in discussing the transportation problem as chairman of the transportation committee of the Chamber of Commerce of the United States, pointed out the peculiar needs of the public utilities at this time. Speaking of the general situation he said: "Every business man must realize that business will never be the same again. The war has shattered precedents. Old ideas must change. Business men must shape their policies, not on the basis of former economics, but on a new set of conditions. They must gage the future, not the past. Capital conditions are different; labor conditions are different; raw-material conditions are different."

Mr. Wheeler called attention particularly to the fact that transportation and light and power must be furnished and that the business of the country must expect to pay more for services of this sort. The same thought was brought out by business men in different sections, particularly by a representative from the wheat belt, who said that if the central station plants in his territory did not get coal the grain elevators would be without power and the food stream would be blocked.

Waddil Catchings, chairman of the National Chamber committee of co-operation with the Council of National Defense, pointed out, in a concise summary of conditions at Washington, that the various purchasing activities of the government must be grouped under one board which would establish standard methods of purchasing. Time is now lost, in spite of willingness to co-operate, because the machinery of purchasing in different departments is not co-ordinated and one department competes with another on prices and on deliveries.

Representative electrical men at the convention included John W. Lieb, president of the National Electric Light Association; John R. Galloway, representing the National Electrical Contractors' Association; Willis H. Booth of the Hotpoint Company and vice-president for the Western States of the National Chamber; William

N. Pelouze, Illinois Manufacturers' Association; Russell E. Sard of the Rathbone-Sard Company, and P. H. Gadsden, American Electric Railway Association.

PROPOSED INCREASE IN THE MILWAUKEE RATES

Immediate Adjustments Sought Before Wisconsin Railroad Commission to Compensate in Part for Increased Coal Cost

The Milwaukee Electric Railway & Light Company and the Milwaukee Light, Heat & Traction Company have filed petitions with the Wisconsin Railroad Commission asking for immediate adjustments in electric and heating rates to compensate in part for the increased cost of coal. These petitions are filed under the emergency clause of the public utility law, and the commission announced a hearing on them for Sept. 19 at Madison.

A statement sent to customers says that the applications limit the relief to be obtained to but a portion of the added expenses due to the increased price of coal, and ask no relief to cover increased costs of other material or increased costs of labor. The companies have had heavy increases in operating costs for many months past, and hoped that some relief would be obtained by national control of fuel supply or otherwise. It is now apparent that no relief may be expected during the present season because, first, the companies have been compelled to contract for their supply of coal until the spring of 1918 in order to safeguard against fuel shortage, and second, because the market price of coal was fixed on July 1 by agreement with the coal operators, and again this month by an executive order of the President. As compared with the prices so fixed, the coal contracts of the companies are favorable but they nevertheless represent heavy increases in cost as compared with the cost in former years, upon which rates have been based. The companies' statement says:

The relief we ask for is just and reasonable. You as business men will readily understand the necessity of our meeting at least a portion of the present greatly increased operating costs by increased rates. We propose:

1. An increase in the price per kilowatt-hour for that part of the energy taken in any month in excess of 1000 kw.-hr. this increase to be figured on the cost to us of our coal. This will vary with changes in the price of coal.

2. All existing flat rates for steam to be discontinued so that customers will purchase their steam on a meter basis enabling them to profit by economical use. The placing of this service on a meter basis will conserve the greatly restricted supply of coal available for use in this community.

3. The rate charged for steam on a meter basis to be increased to cover increased cost of coal. This will vary with changes in the price of coal.

The increases which we are asking for are not large. For example: A customer whose present electric bill is, say, \$75 per month for 3000 kw.-hr. per month would under the proposed increase be asked to pay an increased rate on only 2000 kw.-hr. out of 3000 kw.-hr. used. With the present price of coal the increased rate on this part of the bill would be about 4 mills per kilowatt-hour, or \$8. The cost of this energy would therefore be a little less than 2.8 cents per kilowatt-hour instead of 2.5 cents per kilowatt-hour.

Since the cost of coal is a bigger factor in steam service than in electric service, the increases we are asking in steam rates are larger than in electric rates. For example, a customer taking 50,000 lb. of live steam would have his bill increased by about 26 per cent, and a customer taking 50,000 lb. of exhaust steam would have his bill increased by about 24 per cent, as a result of the actual doubling of coal costs.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Liability for Failure to Light Street Lamp.—In an action against a city to recover for personal injuries received in a collision caused by the defective condition of a street, where the city, which owned the electric light plant, had failed on the night of the accident to light a lamp at the crossing of two much-traveled streets, the jury might reasonably infer that city had been negligent, the Supreme Court of South Carolina held (93 S. E. 180). The negligent failure constitutes a "defect in the street" and a "mismanagement" of the lamp, so as to render the city liable to one who suffers personal injuries in a collision between his bicycle and an automobile, caused by such neglect.

Indemnity Between Tort-Feasors.—Where a telephone lineman has recovered judgment against his employer and an electric company as joint tort-feasors, judgment in electric company's cross-action against the telephone company for indemnity may be rendered by the Court of Civil Appeals by law, provided that such court may proceed to render such judgment as the court should have rendered, and that the matter was actually litigated in the trial court, the Court of Civil Appeals of Texas held in the City of Weatherford Water, Light & Ice Company versus Veit (196 S. W. 986). A lineman who got damages against an electric company for injuries resulting from coming in contact with high-tension wires could not complain on rehearing of judgment of indemnity against his employer in favor of the electric light company where his own rights were unaffected, unless for reasons entirely outside the record.

Duty to Discover Uninsulated Wire.—A telephone lineman working on a pole adjacent to that of an electric company was not required to discover the fact that high-tension electric wires were uninsulated, where he had no knowledge of their dangerous character, according to the Court of Civil Appeals of Texas in the case of the City of Weatherford Water, Light & Ice Company versus Veit (196 S. W. 986). A telephone lineman could assume that his employer had provided him with a safe place to work and also that defendant's high-voltage wires were fixed to its cross-bars in the usual and customary manner to indicate the dangerous or the harmless nature of the wires. Knowledge of danger from high-tension wires in close proximity to telephone wires will be imputed to the telephone company where such condition had long continued, and because as matter of law it was the telephone company's duty to know of such condition.

Power of City Regarding Electrical Inspection.—In determining whether a city council's delegation of duties and powers as to electrical equipment was warranted, the controlling consideration is not that the power may be unreasonably or oppressively exercised, since every presumption is that it will be honestly and reasonably exercised, according to the Supreme Court of California (166 P. 348). A Pasadena ordinance requiring repairs to electrical equipment in private houses on written notice of the city electrician, if he determines that the equipment is dangerous to life or property, without specifying the tests by which he shall determine such question, is not void as unwarrantedly conferring upon the city electrician judicial or legislative powers, nor because its terms are indefinite, arbitrary or oppressive. Although in equity the court in making its decree adapts its relief to the state of facts existing at the close of the litigation, where an ordinance the enforcement of which it is sought to enjoin is amended so as to confer a right of appeal from the city electrician to the council, the plaintiff's mere failure to appeal does not foreclose his right to resort to the courts to restrain enforcement of the ordinance on the ground that it is void.

Authority of Commission in Regard to Depreciation Accounting.—The requirements of a uniform system of keeping accounts for all gas corporations, prescribed by the Public Service Commission under authority of the Public Service Commissions law have the force of law, it was held by the Appellate Division of the New York Supreme Court (166 N. Y. S. 196). Although the commission has no authority to dictate as to how the money in the treasury of a public service corporation shall be disbursed, and whether such corporation is actually entitled to issue bonds, the commission having no power to affix as a condition some act that it has no jurisdiction to compel, it does have power, in any order granting consent, to impose a condition based upon facts which justify the order with the condition, and has authority to require a gas company to apply to reserve from a bond issue the amount of an expenditure made from its depreciation fund, since to permit the company to issue bonds to reimburse it for expenditure from a depreciation fund would be in effect to permit it to capitalize its depreciation fund and create an obligation of the company to that amount. As a gas company was entitled under the law to fix its own rule or rate of depreciation, and fixed it at 8 cents, the Public Service Commission, without taking an independent proceeding against the relator, could not make an order requiring it to change its whole system of accounting and put its depreciation charges on another basis, requiring a greater percentage of contribution thereto than that adopted by the company under the law and earlier order of the commission, as a condition precedent to its consent to a bond issue.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Value of Water-Power Rights Affected by Competitive Plants.—A decision of the Wisconsin Railroad Commission affecting the city of River Falls holds that "a value placed upon the water-power rights of a municipal utility for rate making, somewhat in excess of the amount paid therefor, was not too low in view of the presence of transmission lines of large hydroelectric plants in the vicinity, tending to diminish the value of the water powers owned by the city."

Sierra & San Francisco Power Company Buys La Grange Plant.—The California Railroad Commission has authorized the Yosemite Power Company to sell to the Sierra & San Francisco Power Company of San Francisco for \$450,000, plus the cost of additions and betterments from Dec. 1, 1916, its electric production, transmission and distribution property and utility business known as the La Grange division. The property sold consists of a water right on the Tuolumne River near Indian Bar, a water conduit 17 miles (27.37 km.) long and a 900-kw. hydroelectric plant at La Grange, a transmission and distribution system and the electric lighting and industrial power business in Stanislaus County, east of the San Joaquin River, south of the Tuolumne River and north of the Merced River, including the towns of Turlock, Denair, Ceres, Hughson, Hickman, Waterford and La Grange. The Yosemite Power Company is selling this property because of difficulties in obtaining funds to extend its line and develop new business. The commission says that the public will be benefited by the transfer of the property as the Sierra company will be able to extend its line more freely and to make effective the rates for general power and lighting service that it enforces at the present time in the San Joaquin Valley, these rates being considerably lower than those of the Yosemite company. The Sierra company can also effect economies, the commission believes, and the output of the plant can be increased 50 per cent or more. The Yosemite Power Company has \$1,640,300 common stock and \$410,000 preferred stock outstanding, with a bonded indebtedness of \$1,708,000 and a current indebtedness of \$172,000. The holders of all bonds, except \$8,000, have deposited them under an agreement providing that the proceeds from the sale of the properties shall be applied first to the current indebtedness and second to the pro rata reduction of the bonded debt and maintenance of the property retained by the Yosemite company.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Municipal Plant at Columbus May Compete with Private Corporations.—The proposed amendment to the city charter of Columbus, Ohio, giving the municipal light plant the rights of a private corporation to adjust rates and charges in a manner that will allow it to compete for business was approved by the voters by a ballot of 9864 for and 4286 against the proposition.

Customer Ownership at Ottumwa, Iowa.—An issue of \$118,900 of 7 per cent cumulative preferred stock is being offered to customers and employees by the Ottumwa Railway & Light Company, which has supplied electric power and light, street railway and steam-heating service under Byllesby management in Ottumwa, Iowa, for more than eleven years. The stock is issued to pay in part for improvements and extensions necessary to serve increasing demands for power and lighting.

Municipal Plant in Kansas City, Mo., Deferred.—A project for the issuance of \$1,000,000 bonds to build the first unit of a municipal electric plant in Kansas City, Mo., has been set aside temporarily. The most pressing reason for postponement is the necessity for immediate attention to the gas supply. The city probably will vote bonds or otherwise find means to maintain its own gas supply. It has also been realized that, even if bonds were voted now, the equipment for a light plant could not be secured for two or three years, and that \$1,000,000 would not go far toward a plant that would adequately care for the city's needs.

Hydroelectric Construction in Barcelona, Spain.—Clinton Kearney, engineer, who was formerly a member of the City Commission of San Antonio, Tex., is now in charge of the erection of a dam and hydroelectric plant situated near Barcelona, Spain. The dam will be the largest in Europe. Mr. Kearney in a letter to a friend in San Antonio says that the industrial troubles which have been disturbing Spain have not been felt so far in the Barcelona district, or at least have not affected construction work upon this project. The dam is of concrete and is 700 ft. in length and 330 ft. in height. It is 230 ft. at the base and 14 ft. at the top. The reservoir will be 15½ miles long and 3¼ miles wide. The first unit, which has now been installed, has a rating of 20,000 hp. The total rating will be 40,000 hp. when the plant is finished. It is stated by Mr. Kearney that enormous quantities of American construction materials are being used in the work. The engineering force and many of the skilled laborers are Americans.

Higher Electric Rates in Amsterdam.—United States Consul Frank W. Mahin, Amsterdam, Holland, reports that the high cost of coal has made it necessary to increase the prices of gas and electricity served by the Amsterdam municipal works. Electrical energy has been furnished, according to the quantity used, at 12 to 15 Dutch cents for light and 8 to 10 for power (4.8 to 6 and 3.2 to 4 American, respectively) per kilowatt-hour. These charges it is now proposed to increase by 5 Dutch cents for light and 1½ cents for power (2 and 0.6 American cents, respectively). This increase, it is stated, is due less to the higher cost of production than to the fact that consumers of gas would be induced by its increased cost to change to electricity if its price were not also increased. The objection to such a change is that the materials for extending electric service are now almost unobtainable.

Storage Battery Locomotives in Coal Mines.—The Electric Vehicle Section, National Electric Light Association, has collected interesting data showing the actual saving of the miniature electric locomotives over mule haulage in mines. The Madison Coal Corporation, one of the largest coal-mining corporations of the Middle West, which strongly advocates the use of the electric locomotive in coal mines, based on actual operating experience, states that in addition to the money saving in ton haulage there is a remarkable financial economy in the prevention of injuries, for while the mule drivers form only 5 per cent of the entire working forces of the company, their accidents amount to 26 per cent of the whole number, and the cost in connection with them amounts to 34 per cent of the total liability cost. Some comparative monthly operating costs from the Madison Coal Corporation follow: Cost to gather with mules, per ton, \$0.04096; cost to gather with storage-battery locomotive, per ton, \$0.02099; difference in favor of storage-battery locomotive, \$0.01997. The Pocahontas Smokeless Coal Company of West Virginia is also operating storage-battery locomotives successfully. At its mine four cars, each weighing 1300 lb. empty and 4100 lb. loaded, are hauled on each trip by one electric-storage battery locomotive, on main entry, a distance of about 2500 ft., including 1200 ft. against 3 per cent grade, 400 ft. against 2½ per cent grade, and short grades of 5 and 7 per cent, all against the loads. To secure the 400 tons a day that this mine should produce, the mule haulage would cost \$735 a month and battery haulage \$306 a month, making the very substantial saving of \$429 a month in favor of the "electrics." Furthermore, the maximum number of mules and cars allowed by the track conditions could not handle 400 tons a day. The upkeep on ties and track was considerable with the mule haulage and is greatly reduced with the locomotives. It is estimated that in one year the "electrics" will save the cost of the whole installation and at the same time increase the coal output two-thirds.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Synchronous Club, Los Angeles, Cal.—At a meeting of the Synchronous Club held at Los Angeles Sept. 6 H. LaV. Twining spoke on "Determination of Electrical Units."

Louisiana Engineering Society.—On Sept. 10 the Louisiana Engineering Society held a meeting under the auspices of the New Orleans Section of the American Society of Mechanical Engineers at which a paper entitled "Notes on Shipbuilding" was presented by F. J. French.

Empire State Gas and Electric Association.—The annual meeting of the Empire State Gas and Electric Association will be held in New York City on Oct. 5. The topics selected for consideration at the meeting are "Depreciation" and "Bonus Systems." Among those who will talk on these subjects are W. J. Meyers, secretary United Electric Light & Power Company; W. C. Wishart, statistician of the New York Central Lines, and F. H. Patterson, assistant auditor of the Rochester Railway & Light Company.

Illuminating Engineering Society, New York Section.—At the Sept. 13 meeting of the New York Section of the Illuminating Engineering Society two subjects were presented, "Economies in the Operation of Large Lighting Installations," by C. L. Law and J. E. Buckley, and "General Level of Illumination Intensity in Large Department Stores in New York City," by W. F. Little and J. F. Dick. The first paper contained a description of a method followed in securing data and making recommendations for lighting installations in office buildings, loft buildings, club houses, hotels, etc. The second paper is well described by the title.

Electric Distribution Committee, Empire State Gas and Electric Association.—The electric distribution committee of the Empire State Gas and Electric Association held an open meeting at Albany, N. Y., on Sept. 14, at which a report was presented on "Methods for Selecting Size of Transformers to Prevent Overtransforming and Undertransforming on Alternating-Current Lighting and Power Systems and the Testing of Transformers for Overload, Defective Oil, etc." The following subjects were also considered: The use of vertical racks for secondary distribution, the relative advantages and disadvantages of three-phase delta and three-phase Y for primary distribution, advantages and disadvantages of steel poles and cross-arms over wooden poles and arms, and the relative advantages and disadvantages of wooden insulator pins and metal pins of a type which clamp around the cross-arm.

Hubert C. Blackwell, who has been vice-president and general manager of the People's Light Company at Davenport, Iowa, has resigned and on about Oct. 1 will accept an executive position with the Kansas City (Mo.) Light & Power Company. Mr. Blackwell graduated as a mechanical engineer from Purdue University in 1902 and has spent the greater portion of his time since graduation in public utility work in Iowa.

Elbert F. Norton, sales engineer with the Standard Underground Cable Company's Chicago office, has received a commission as major in the Engineers' Reserve Corps, U. S. A., and has left for three months' training at Fort Leavenworth, Kan. Mr. Norton is a graduate of Purdue University in electrical engineering. He has been with the Standard Company about five years and previous to this employment was an erecting engineer of electric and steam power plants.

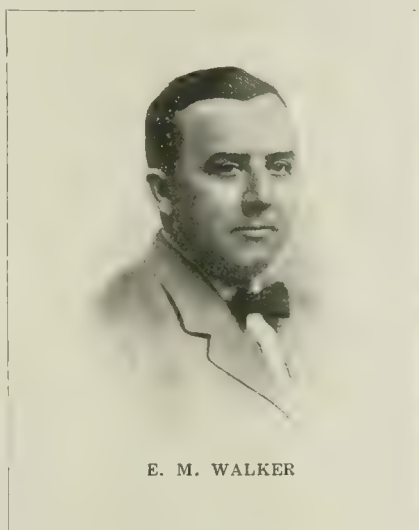
J. N. Cadby, who for nearly ten years has been actively connected with the engineering work of the Railroad Commission of Wisconsin, has severed his connection with the commission and opened a consulting engineering office in Madison, Wis. Mr. Cadby is a graduate of the University of Wisconsin, receiving his bachelor's degree in 1903 and the degree of electrical engineer in 1907. His principal experience in engineering work before joining the Railroad Commission was with the Milwaukee Electric Railway & Light Company as superintendent of the meter-testing department. For the last five years Mr. Cadby has been in charge of the testing division of the Railroad Commission, having to do with the quality of service furnished by gas, electric and telephone utilities, operating matters, electric safety, interference between power and telephone lines, illuminating engineering, and other similar matters. Since the organizing of the State Engineering Department at Wisconsin a few years ago, Mr. Cadby has also had charge of the electrical installation work for many of the State institutions. He will be retained by the State Engineering Department for handling special matters before the commission and other State departments, but will devote the majority of his time to consulting engineering work along the lines he has formerly handled for the State.

E. M. Walker has resigned the position of general manager of the Dubuque Electric Company, which he has held for the last five years. During the first four years of this period the company was known as the Union Electric Company, and then upon its purchase by interests represented by Elston & Company, Chicago, it was re-incorporated under the name of the Dubuque Electric Company. Under Mr. Walker's management the gross earnings of the company, including both the light and railway properties, increased approximately 50 per cent. The number of lighting and power customers was nearly trebled, one of Mr. Walker's recent achievements in this

Men of the Industry

Changes in Personnel
and Position —
Biographical Notes

respect having been the winning of a bronze and silver cup for selling more Liberty bonds than any other individual in the city. His individual sales totaled \$85,000 and included 291 different subscriptions. In railway and lighting work Mr. Walker is well known for his activity in association work, having served the year before last as president of the Iowa Section, N. E. L. A., and now being a member of the board of directors. Mr. Walker began his work in the utility field immediately after his graduation in 1897



E. M. WALKER

from Williams College. He served thereafter one year with the Lockport Gas & Electric Company. In 1898 he became connected with the Hyde Park (Mass.) Gas Company as secretary and assistant superintendent. He served in this position for three years and then became general manager of the company and continued in this position for two years. For four years, beginning in 1893, he was general manager of the Bristol (Tenn.) Gas & Electric Company, which operated electric railway as well as gas and electric properties. Subsequent to this employment Mr. Walker became general manager of the Muscatine (Ia.) City Railway & Light Company, which supplies the gas, electric and street railway service for this city. This connection was followed by his appointment as general manager of the Union Electric Company in Dubuque, which position he has retained to date. He was born in England in 1875.

O. H. Simonds, general manager and purchasing agent for the Vicksburg (Miss.) Light & Traction Company, has been appointed general manager of the Dubuque (Iowa) Electric Company to

succeed E. M. Walker, resigned. Both the Vicksburg and the Dubuque properties are controlled by Elston & Company of Chicago.

Obituary

Lloyd B. Mathes, general superintendent electric division of the Norfolk Southern Railroad since 1911, died at his home in Norfolk, Va., Sept. 5. Mr. Mathes was general manager of the Dubuque (Iowa) Electric Company from 1903 to 1911. He was a native of Memphis, Tenn., and was forty-six years old. He leaves a widow and four children.

Francis B. H. Paine, a member of the consulting engineering firm of Paine, McClellan & Campion of New York and Philadelphia and a fellow of the American Institute of Electrical Engineers, died at his home in New York City on Sept. 13, at the age of forty-eight. Mr. Paine entered the electrical industry in 1886 with the Westinghouse laboratories at Pittsburgh. Three years later he became a salesman and engineer, establishing electric lighting companies in municipalities. From 1891 to 1893 he was in the employ of the Edison General Electric Company and the Siemens & Halske Company in an engineering and commercial capacity. He then returned to the Westinghouse interests, spending most of his time at the New England office, of which he later became manager. In 1899 he left for a two years' tour of Japan, eastern Siberia, China, the Philippines, Siam and India, to study foreign trade conditions. On his return in 1901 he established an export department. He became general manager of construction work for the Ontario Power Company in 1905 and later took charge of the development of the Niagara, Lockport & Ontario Power Company, of which he finally was elected vice-president and general manager. In 1911 he made a trip to Europe to study utilities and on his return opened an office as consulting engineer and public utility counselor. During this time the New York Telephone Company called him to become chairman of the committee of appraisal in connection with the New York rate case before the Public Service Commission. This committee was made up of a number of the most prominent utility men in the country and acted in an advisory capacity to the legal and executive departments of the company in connection with the appraisal and valuation of approximately \$100,000,000 worth of property. Mr. Paine was a member of the National Electric Light Association and the American Electric Railway Association. He represented the American Institute of Electrical Engineers on the joint national committee of overhead and underground line construction. He had frequently been a member of other important engineering committees. In 1891 he was the delegate of the A. I. E. E. to the engineering convention held in connection with the exposition at Frankfurt on the Main.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

EXPORTS FOR FISCAL YEAR ARE MORE THAN \$52,000,000

Twelve Months Ended June 30 Last Show Greatest Value for Any Year in Exports of Electrical Goods in the History of the Industry

During the twelve months ended June 30 last, the fiscal year of the Department of Commerce, there were exported from the United States electrical goods to the value of \$52,158,773, which is the greatest value that electrical exports have reached in any single year in the history of the industry. This sum is to be compared with \$30,256,778 in 1916, \$19,771,757 in 1915, and slightly over \$25,000,000 in 1914. Most of this amount was made up by miscellaneous equipment, which amounted to \$24,529,375. This is a greater percentage of the total than in former years. Batteries and insulated wiring and cable showed the greatest relative growth, but it is probably true that a considerable portion

COMPARATIVE FIGURES FOR EXPORTS OF ELECTRICAL GOODS FOR THE YEARS 1917, 1916 AND 1915

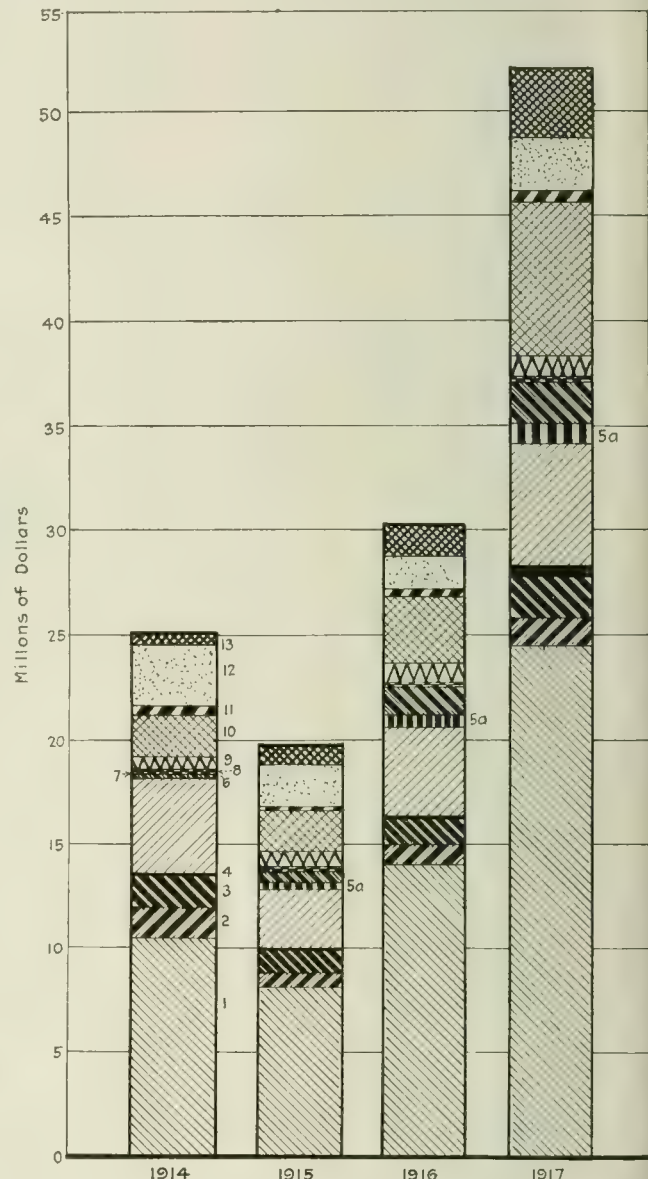
Articles	JUNE		TWELVE MONTHS ENDED JUNE		
	1916	1917	1915	1916	1917
Batteries.....	\$159,876	\$699,844	\$967,146	\$1,569,836	\$3,266,674
Dynamos or generators.....	145,965	277,575	2,013,130	1,468,961	2,554,504
Fans.....	24,831	79,580	258,309	356,729	482,652
Insulated wire and cable.....	290,151	633,115	1,911,850	3,157,239	7,191,684
Interior wiring supplies, etc., including fixtures.....	36,835	102,695	753,351	818,985	1,123,628
Arc lamps.....	156	1,061	30,984	18,693	15,752
Carbon-filament lamps.....	4,188	21,725	101,923	144,872	158,271
Metal-filament lamps.....	133,683	357,385	473,149	1,282,039	2,143,136
Meters and other measuring instruments.....	72,540	84,072	440,916	776,381	1,039,049
Motors.....	321,147	649,788	2,818,743	4,218,974	5,895,696
Telegraph instruments (including wireless apparatus).....	8,564	19,915	76,271	148,536	539,389
Telephones.....	183,965	283,152	1,149,361	1,329,346	1,953,504
Transformers.....	55,847	162,180	624,483	993,193	1,265,459
All other.....	1,715,154	2,464,969	8,152,141	13,972,994	24,529,375
Total.....	\$3,152,902	\$5,837,056	\$19,771,757	\$30,256,778	\$52,158,773

of this can be accounted for by higher prices, particularly for wire and cable. The increase in the exports of incandescent lamps, while almost double in value, was about 50 per cent greater in quantity. It may also be pointed out that the exports of carbon lamps have increased, 1,341,444 lamps having been exported in 1917, as against 1,197,751 lamps in 1916 and 838,002 in 1915. The increase in quantity of tungsten lamps is shown by the following data: 1917, 10,707,014 lamps; 1916, 7,670,968 lamps; 1915, 2,509,849 lamps.

The exports of motors increased from a little less than \$3,000,000 in 1915 to almost \$6,000,000 in 1917. While not of so great value as some other items, the export of telegraph instruments nevertheless showed a large growth. It amounted to somewhat more than \$500,000 in 1917, as against less than \$150,000 in 1916 and but \$76,000 in 1915. The only item that showed a decrease over previous years was arc lamps, the total number of which was the same in

1917 and 1915, although the value had dropped from more than \$30,000 in 1915 to but slightly more than \$15,000 in 1917.

The exports during June last were the largest for any month yet reported, amounting to \$5,837,056. The significant features of the June trading were batteries, insulated wiring cable and motors, each of which amounted to more



ELECTRICAL EXPORTS BY ARTICLES FOR THE YEARS 1914, 1915, 1916 AND 1917

(1) Miscellaneous, (2) transformers, (3) telephones, (4) telegraph instruments, (5) motors, (5a) meters, (6) tungsten lamps, (7) carbon lamps, (8) arc lamps, (9) interior wiring supplies, (10) insulated wire, (11) fans, (12) generators, (13) batteries.

than \$600,000, with batteries leading at but a few dollars under \$700,000.

June figures bring the total for the first half of 1917 up to \$28,805,118, or at the annual rate of almost \$60,000,000.

The detailed figures shown here are supplied by the Bureau of Foreign and Domestic Commerce, and from these and other figures was drawn the accompanying chart giving detailed comparisons for the last four years.

METAL ZONES INCREASE
MARKET FOR CONDUIT

This Practice Has Now Become Well Established
in Seventy-one Cities in the United
States and Canada

The market for metallic conduit is continually enlarging. To no small amount has this been due to the establishment in different cities in the United States and Canada of metal zones. An investigation has been made into the extent of this practice and the reasons therefor, and the results were presented in a paper read before the recent convention of municipal electricians by C. E. Corrigan, National Metal Molding Company, Pittsburgh. The reasons for this practice he stated to be as follows:

- 1. The trend of modern construction is constantly toward a metal basis. This is evidenced in all new office and similar buildings being erected.
 - 2. The installing of electric wiring in at least business districts of cities in metallic protection—either rigid conduit, armored conductors or metal molding—conforms to this modern construction tendency and gives the needed and desirable mechanical, chemical and atmospherical protection to the inclosed wires.
 - 3. Experience has demonstrated that the insulation of wires inclosed in metal protection has doubled the life of the insulation on such wires, as compared with knob and tube or wooden molding installations. Instances have been cited where wiring done in wooden molding and subject to water leakage on adjacent plaster walls has resulted in chemical action on the insulation of the wires and surrounding wooden molding, disintegrating them very rapidly and causing the resulting damage of fires through short circuits.
 - 4. In knob and tube construction or open wiring the difficulty of protecting the same against mechanical injury in the multitude of installations, such as where adjacent to sliding doors, is a problem which is solved by the use of metal protection.
- In the United States and Canada there have been reported seventy-one cities that are now on this basis, but there are a large number of cities which apparently have not yet taken action in this regard.

METAL MARKET CONDITIONS
Stagnation Once More Plainly Evident in Almost
Every Direction

When by the end of last week no report came from Washington announcing the government prices for metals, the market once more became stagnant. All of the nervousness of last week has disappeared. Both buyers and sellers have now practically determined to sit tight and await some definite action in Washington. As soon as the price situation is settled there are prospects of a large volume of business in metals.

Nominal quotations for electrolytic copper were as follows on Monday: September, 26.56¼ cents; October, 26.37½ cents; November, 26.12½ cents; December, 25.87½ cents.

NEW YORK METAL MARKET PRICES					
	Sept. 10		Sept. 17		
	£	s d	£	s d	
Copper:					
London, standard spot....	120	0 0	120	0 0	
Prime Lake	27.00	to 28.00*	27.00	to 27.75*	
Electrolytic	26.37½	to 26.62½*	26.37½	to 26.75*	
Casting	26.25	to 26.50*	26.25	to 26.62½*	
Wire base	32.00	to 33.00*	32.00	to 33.00*	
Lead, trust price	10.00		9.00		
Nickel, ingot	50.00		50.00		
Sheet zinc, f.o.b. smelter....	19.00		19.00		
Spelter, spot	8.05	to 8.17½	8.30		
Tin, Straits	61.50		62.50		
Aluminum, 98 to 99 per cent....	41.50	to 42.50*	39.00	to 40.00	
<hr/>					
OLD METALS					
Heavy copper and wire.....	24.00	to 25.00	25.00	to 25.50	
Brass, heavy	15.50	to 16.50	15.50	to 16.50	
Brass, light	12.00	to 12.50	11.50	to 12.00	
Lead, heavy	8.25	to 8.50	7.50	to 8.00	
Zinc, old scrap	5.50	to 5.75	6.00	to 6.25	

*Nominal.

THE WEEK IN TRADE

FEWER changes occurred this week probably in the market for electrical supplies than in any previous week in the past two years. The volume of business is being maintained, with seasonable trade strong. Building operations show no inclination to increase except in localities where an unusual amount of labor is being employed. Labor is very uneasy, particularly in the Far West, and is delaying a lot of construction work of one form or another. The first half of the drafted army is now in camp, and while the number of men is not very large the withdrawal of them from business is expected to have an added effect on an already strained labor situation.

NEW YORK

Conditions of the last few weeks mark the market of to-day. Aside from a few advances there have been no changes in price. Wire has stiffened somewhat under the stronger condition of the copper market. This was brought about through the sale of a large tonnage of copper to the Allies at 25 cents, thereby giving the impression that the government price would not fall below this level. There is, however, some doubt on this matter, and nothing definite has come from Washington at this writing.

The building situation is awaiting the outcome of the meeting of the different interests. Bricks showed a tendency to soar once more, thereby further halting new construction. Now that winter is coming on with increased transportation difficulties and low local stocks of building materials, it is doubtful if any impetus will come much before spring even if prices soften somewhat.

Labor is becoming more scarce every day, particularly office help. Wages for this form of help have advanced considerably in the last few months.

The government was in the market again this week for a long list of electrical supplies. While most of the government's purchases have been made direct from the manufacturers, the Mohawk Electrical Supply Company, Syracuse, reports that it furnished all of the electrical equipment for the Syracuse concentration camp. This order included, in addition to miscellaneous equipment, 1800 cedar poles.

SOCKETS.—There is practically no demand in this field. The government went into the open market this week for a supply of a number of different kinds of electrical material, including a large supply of sockets.

FUSES.—The demand both for inclosed fuses and for re-fillable is particularly good. Prices are steady and deliveries fairly good.

MOTORS.—Owing to the inability to get stocks local agents are finding business rather dull. Inquiries, however, show that there is a large unsatisfied demand for both alternating and direct-current motors in fractional horsepower sizes and up to 10 hp. The shortage of direct-current motors, it is understood, is particularly acute. Announcements came out this week of an increase in prices on Emerson products, as of Sept. 1. Motors were advanced around 5 to 6½ per cent. It is not believed, however, that other manufacturers will follow suit as generally as was done in the fall of 1915 and the winter of 1916.

VENTILATING FANS.—The Emerson Electric Manufacturing Company has announced as of Sept. 1 higher prices on ventilating-fan motors as well as on Davidson & Parker blade exhaust fans. The advance on ventilating-fan motors amounts to practically 20 per cent.

INCANDESCENT LAMPS.—Fall and winter demand has opened up well, and so far is ahead of last year with prospects bright for a large winter trade. It has been noticed that a number of the local trade are placing their orders earlier this year than is customary.

REFLECTORS.—On Sept. 15 Hubbell reflectors listed under schedule C advanced approximately 10 per cent.

HEATING APPLIANCES.—Damp and chilly weather has produced some early inquiries for radiators and heaters. An order for one of the largest electric kitchens in existence was recently received by the National Electric Utilities Company for the new Ancon Hospital at Panama.

WIRE AND CABLE.—The Navy Department is in the market for a supply of wire and cable of different kinds. The details of requirements and delivery places are as follows:

	Amount	Delivery Place
Cable, conductor, leaded and armored	200 ft.	Portsmouth, N. H.
Cable, four-conductor, marker, buoy	4,150 ft.	Portsmouth, N. H.
Cable, portable, three-conductor	800 ft.	Portsmouth, N. H.
Cable, interior communication, 14-22-26 conductor	18,500 ft.	Brooklyn, N. Y.
Cable, interior communication, leaded and armored	Misc.	Portsmouth, N. H.
Cable, telephone, leaded and armored	39,700 ft.	Brooklyn, N. Y.
Cord, lamp, twin, new code	15,000 ft.	Brooklyn, N. Y.
Wire, double-conductor, lighting and power, portable	8,150 ft.	Portsmouth, N. H.
Wire, double-conductor, plain, flexible	1,600,000 ft.	Brooklyn, N. Y.
Wire, single-conductor, plain	18,000 ft.	Brooklyn, N. Y.
Wire, lighting and power, twin, leaded and armored	Misc.	Portsmouth, N. H.
Wire, lighting and power, single, plain	1,500 ft.	Portsmouth, N. H.
Wire, lighting and power, single, leaded and armored	Misc.	Portsmouth, N. H.
Wire, rubber-covered, for 600 volts and less	16,000 ft.	Brooklyn, N. Y.
Wire, weatherproof, on reels	8,800 lb.	Brooklyn, N. Y.

CHICAGO

The feeling with regard to the market in basic materials has become more crystallized within the last week with the belief that fundamentally prices have passed the peak. It is expected that the government price fixed for copper will be about 21 cents. The difference between the price of lead and the price of spelter is believed to be too great, and lead is expected to go down and spelter up. Lumber is one item in which little relief is seen from the present high prices. Cotton is thought to be too high, and some leading buyers are holding on for a better market. There is no general belief that prices will break abruptly. On the contrary, it is the belief in some quarters that the price of copper, for instance, will not go below 20 cents for the next five years.

ELECTRIC RANGES.—Manufacturers are instructing sales forces to continue to exploit the electric range, particularly as a conservator of fuel and food and a means of increasing the efficiency or reducing the amount of home labor. Sales are falling off, as is expected at this season.

STEEL.—Large industrial purchasers who have had observers in the Pittsburgh district recently are confident that there will be no higher steel prices. The fact that one mill has recently quoted under the market is taken as an indication that lower prices are coming.

ELECTRIC CONSTRUCTION.—Data obtained from V. H. Tously, chief electrical inspector for the city of Chicago, afford an excellent barometer of electrical construction business in Chicago. For the seven months ending July 31 the number of permits issued was 18 per cent less than those issued for the same period in 1916. The number of permits issued in July itself was 34 per cent less than for July, 1916. The amount of fees for inspection decreased 10 per cent in the first seven months of the year. Figures for the first four months of the year showed a decrease in the applications for installation of electric lamps and an increase in the application of electric motors. The percentage of decrease in applications to install lamps for the first four months was: January, 22.4 per cent; February, 38 per cent; March, 30 per cent; April, 6 per cent; average, 24 per cent. The gain in applications to install motors was: January, 69 per cent; February, 24 per cent; March, 28 per cent; April, 51 per cent; average, 42 per cent. These figures for the city of Chicago indicate clearly that business for the electrical contractor in the lighting field is not nearly as prosperous as it is in the industrial power field.

SECOND-HAND MACHINERY.—Some second-hand electrical machinery merchants, believing that higher prices of new equipment will prevail, have been making especially

liberal offers for second-hand equipment. One merchant states that he has on hand more direct-current motors of 20 hp. and larger than he has had in the last two years, and during the last thirty days he has been able to get to his plant or get in transit more good alternating-current motors than he was able to pick up in the last six months.

SHIPBUILDING.—The Chicago Shipbuilding Company has just closed a contract with the Commonwealth Edison Company for about 2500 hp. additional service. The company formerly had a load of about 500 hp. The Electric Machine Company of Minneapolis has sold a large order of synchronous motors of another shipyard. These instances are merely typical of the activity in the shipbuilding field in the Middle West.

TURBINES.—The Kansas City (Mo.) Light & Power Company has contracted with the General Electric Company for two 25,000-kw. turbo-generators as the first unit for installation in a new power house designed for an ultimate capacity of 240,000 kw. Delivery on the first of these two machines is expected in January, 1919, and the other in August of the same year.

BOSTON

Jobbers report a steady volume of trade, prices remaining even, with the exception of various electric heating appliances which were advanced about Sept. 15. Collections in Maine are reported as rather poor, but at Boston the credit situation is on the whole favorable. Summer business continued later than usual this year, possibly owing to the peak of seaside and other resort patronage noted in August, July having been an unusually quiet month along the coast. In some quarters a new start appears in house-wiring work, and it is reported confidentially that in one town no less than 500 new houses are to be built this fall, provided present arrangements for financing are successful. Contractors continue busy on industrial work, and a large amount of replacement business is being handled by supply dealers. Owing to the failure of many central stations to claim exemption for their employees, the draft is beginning to be felt somewhat more in these circles, with a resulting tendency to slow down enterprise. The iron conduit situation fails to improve as to deliveries and an analysis of price conditions gives little ground to expect any early break in prices, although the opinion is advanced in some quarters that prices may soften somewhat before long. It seems doubtful if any reduction is likely to be experienced so long as war activities put a premium on raw materials, which would ordinarily permit deliveries of two or three weeks compared with several months at present. Jobbers' conduit stocks are far from large. The general labor situation continues about the same, except that the increasing flow of drafted men to the national service exerts more and more pressure upon executives to adopt labor-saving methods and co-ordinate existing resources to the best advantage. Completion of the major work at Camp Devens, the Ayer (Mass.) cantonment, is marked this week by the release of a large force of men hitherto occupied in construction operations.

IRON CONDUIT.—Very hard to obtain, prices showing no positive change downward, and deliveries still most unsatisfactory except on government demands.

PORCELAIN KNOBS AND TUBES.—Heavy demand for this material is noted, with great difficulty in filling orders. Prices continue at high levels and government use of this equipment is unquestionably affecting the market seriously. Despite these handicaps, considerable new house wiring is in prospect here and there, although no sweeping developments are in sight, taking New England as a whole.

LUMINOUS RADIATORS.—The recent cold snap, which was a serious blow to local agriculturists, has stimulated the demand for this class of equipment, and with continued high prices for household coal in prospect, it appears that a large volume of business will be handled in this class of appliances. Stable prices, however, are greatly needed.

WASHING MACHINES.—Interest appears to be increasing in these units, and the prospects are excellent for a substantial fall trade.

MOTORS.—Deliveries appear to be very satisfactory on fractional horsepower sizes, but there is still much to be desired with respect to the prompt supply of units above 5 hp. No price changes have come to hand, and the industrial demand continues brisk. Important motor applications have recently been made in shipbuilding service in southern Maine, in connection with the work of the Federal Shipping Board.

FIXTURES.—Trade is rather dull in this line, but the prospects of at least a moderate increase in sales as the fall advances are good.

TEXTILE MOTORS.—Trade continues in substantial volume, with no recent changes in price or intimations of further advances.

FANS.—Trade continues quiet, with little prospect of more than momentary spurts before October.

POWER PLANT COAL-HANDLING MACHINERY.—Inquiries are very numerous in this field, and some manufacturers are in an excellent position to handle this business.

ATLANTA

Business conditions in general have changed very little since last week. Manufacturers, however, report an increased volume of orders in all lines, exclusive of any government business, indicating that there is a considerable industrial demand being filled. The cold wave which visited the Southeast this week has tended to stimulate activity in certain lines that for the past few months have been almost dormant. Jobbing business continues good, with a slight increase in the number of orders secured. The amount per order, however, shows a falling off.

The reduction from 200 to 150 men per company, following out the new method of army divisional numbering, will require extensions to the present barracks or the erection of new ones at each National Army cantonment. These changes will call for an additional \$1,000,000 for each camp and probably carry construction work into the latter part of November. Sufficient material to complete the electrical work is on hand or in transit.

Reports on general crop conditions are good and a feeling of optimism prevails.

Collections through jobbers and contractors are holding up well. Manufacturers' collections for the first week of September show a marked improvement over the last two weeks in August. Apparently very little attention is being paid to the price-fixing program, with the possible exception of coal prices.

LAMPS.—This line is becoming more active and the volume of sales transacted is growing daily. Stocks are in excellent shape to date.

TRANSFORMERS.—The demand for capacities up to 50-kva. distributing types is increasing. Although industrial extensions have slowed up temporarily, a number of substantial orders are being placed for the larger power types.

BATTERY-CHARGING RECTIFIERS.—A very active market has opened up during the past week for these, and deliveries are fairly prompt.

HEATING APPLIANCES.—Jobbers report a brisk buying movement in this line previous to the price advance. On the other hand, the manufacturers in this section have not felt any marked change in their business.

SEATTLE

Save for labor troubles, authorities state that business conditions and business outlook were never more promising locally. A sympathetic strike ordered in the hope of forcing the adoption of an eight-hour working day has finally developed from strikes in logging camps and mills. Unofficial figures show that approximately 5000 employees in wooden shipbuilding plants are on strike, the main reason being the refusal to use lumber produced in ten-hour mills. On Sept. 14 2000 union carpenters, representing seven locals in Seattle, struck for the same reason, absolutely tying up all building. It is believed that the government will not permit work incident to war preparedness to be re-

tarded and that it will take over the yards if the situation assumes serious proportions. The strike has not seriously affected steel shipyards as yet, although the present outlook is far from satisfying. A strike of telephone construction men in the Seattle district is rumored, although the date set for the walkout cannot be ascertained.

Sales of electrical equipment and wiring devices to the building industry are at a standstill owing to strikes. This condition will obtain until strikes are over. There is a slight decrease in sales of equipment and machinery to shipyards, probably due to the fact that new plants under construction are practically completed. Sales of materials, wiring devices, lamps, motors and the like for new ship construction is normal.

Some few mill owners are taking the opportunity afforded by the strike to make needed extensions and betterments to plants. Alaska shipments of electrical machinery equipment and fixtures to interior points will be over this week owing to the closing of navigation. Shipments to Alaska open ports remain about the same, which is satisfactory. Most of the interior business was with the government railroad power plants under construction and for the maintenance of plants in operation during the past Alaska season at interior points about four months. Business with the government exceeded last year's trade considerably. Business with mines, fisheries and power companies increased noticeably, and that with electrical dealers was about the same as last year.

Tacoma is asserted to be the busiest city in the Northwest at the present time owing to construction of the Todd shipbuilding plant, new buildings to house increased population resulting from the construction of the American Lake cantonment, and the construction of Camp Lewis. One Seattle firm reports a large order from the cantonment for wire sockets, lamps and fixtures for the Y. M. C. A. building under construction; also several orders from Portland district for electric ranges for apartment houses totaling nearly \$10,000.

LAMPS.—A scarcity is being experienced. Demand is increasing and shipments are exceedingly hard to obtain, while the situation is growing worse daily.

WIRE.—Wire is scarce and shipments are hard to obtain. Demand is normal.

PROJECTORS.—Floodlamps are moving well under increased demands for shipyard and business lighting. Shipments are fairly easy to obtain and prices are steady.

HOUSEHOLD APPLIANCES.—Electric heaters are beginning to move and jobbers are laying in a large supply of lamp-socket types. Shipments are coming through nicely. Washing and sewing machines are selling satisfactorily, particularly the latter. Prices are steady and stocks ample. Electric range sales are dropping off with the close of the summer season. Electric iron sales are decreasing slowly. The market for irons in the Northwest is always good. The electric fan season is over.

LIGHTING OUTFITS.—A campaign on farm lighting systems is being waged in the Northwest at carnivals and fairs, bringing excellent results. Inquiries are pouring in. Stocks are ample and shipments are satisfactory.

CONDUIT.—Demands are firm and prices are about the same, with shipments hard to obtain.

MOTORS.—The demand for smaller sizes is about the same as last week; larger sizes show a decrease.

SAN FRANCISCO

Trade conditions in general remain about the same. The strike of metal trades called on Sept. 17, which involves workers in shipyards, factories and machine shops, including employees of the Union Iron Works and the Moore & Scott Iron Works will probably slow up business in industrial lines. Large government orders have been received for wire sockets and receptacles. Lamp stocks are good, and the volume of business is large. Deliveries, however, are rather slow, owing to labor shortage. Condition of stocks in the more staple lines is fair. Demand is improving. Prices remain unchanged. Collections continue to be good.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor	
B. & S. Size	List, per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor	
No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE PER 1000 FT.—NEW YORK

Single-Conductor	
No. 14 solid:	
Less than coil.....	\$54.90 to \$61.00
Coil to 1000 ft.....	48.80 to 59.17
No. 12 solid:	
Less than coil.....	63.90 to 71.00
Coil to 1000 ft.....	56.80 to 68.87

Twin-Conductor	
No. 14 solid:	
Less than coil.....	\$78.00 to \$104.00
Coil to 1000 ft.....	75.00 to 80.00
No. 12 solid:	
Less than coil.....	121.50 to 135.00
Coil to 1000 ft.....	108.00 to 130.95

DISCOUNT—CHICAGO

Single-Conductor	
Less than coil.....	+10%
Coil to 1000 ft.....	—10%

Twin-Conductor

Less than coil.....	+10%
Coil to 1000 ft.....	—10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	—10% to 12%
1/5 to std. pkg.....	10% to 20%
Std. pkg.....	34% to 44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+20% to 12%
1/5 to std. pkg.....	Net to 20%
Std. pkg.....	30% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28	.29

BATTERIES, DRY—Continued

CHICAGO		
Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 30.....	.35	.35
50 to barrel.....	.3175	.3275
Barrel lots .....	.2875	.2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less than Coil	Coil to 1000 Ft.
3/8-in. single strip.....	\$67.50 to \$75.00 \$60.00 to \$69.75
3/8-in. double strip.....	71.75 to 75.00 63.75 to 72.00
1/2-in. single strip.....	90.00 to 100.00 80.00 to 93.00
1/2-in. double strip.....	95.00 to 100.00 85.00 to 96.00

NET PER 1000 FT.—CHICAGO

Less than Coil	Coil to 1000 Ft.
3/8-in. single strip.....	\$75.00 \$63.75
3/8-in. double strip.....	78.75 71.25
1/2-in. single strip.....	100.00 85.00
1/2-in. double strip.....	105.00 85.00-95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
5/8.....	.15	2.....	.55
3/4.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$55.00 \$24.50-\$25.50	\$21.50-\$24.75
1/4-in.—	\$40.00-\$60.00 \$27.00-\$30.00	\$23.50-\$27.00

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$36.65 to \$55.00 \$27.50	\$23.10-\$24.75
1/4-in.—	\$40.00 to \$60.00 \$30.00	\$25.20-\$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List	Elbows, List
1/4.....	\$0.05 \$0.19
3/8.....	.06 .19
1/2.....	.07 .19
3/4.....	.10 .25
1.....	.13 .37
1 1/4.....	.17 .45
1 1/2.....	.21 .60
2.....	.28 1.10
2 1/2.....	.40 1.80
3.....	.60 4.80

DISCOUNT—NEW YORK

Less than 2500 lb.....	3.8% to 8%	5.8% to 10%
2500 to 5000 lb.....	6.8% to 11%	8.8% to 13%
(For galvanized deduct six points from above discounts.)		

DISCOUNT—CHICAGO

Less than 2500 lb.....	3.8% to 8%	5.8% to 10%
2500-5000 lb.....	6.8% to 11%	8.8% to 13%
(For galvanized deduct six points from above discounts.)		

FLATIRONS NEW YORK

Net.....	\$3.50
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CHICAGO

Net.....	\$3.50 to \$4.50
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FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.75 to \$6.30
1/5 to std. pkg.	4.50 to 5.25
Standard package, 500.	List, each, \$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500.	List, each, \$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B.	100	\$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00

Round bulbs, 3 1/4 in., frosted:		
15-watt—G 25	50	.50
25-watt—G 25	50	.50
40-watt—G 25	50	.50
Round bulbs, 3 3/4 in., frosted:		
60-watt—G 30	24	.72
Round bulbs, 4 1/4 in., frosted:		
100-watt—G 35	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$30.00 to \$34.88
Coil to 1000 ft.	21.00 to 26.52

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$37.20
Coil to 1000 ft.	27.90

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	\$15.00 to \$29.00
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CHICAGO

Net per 100	\$14.58 to \$34.00
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OUTLET BOXES

Nos.	List, per 100
101—A, A1 1/2, 4 S.C., 6200, 320.	\$30.00
102—B.A., 6200 S.E., 300, A.X. 1 1/2,	
4 S.	30.00
103—C.A., 9, 4R. B 1 1/2	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list	List to 33%	List to 27%
\$10.00 to \$50.00 list	List to 42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list	40%	35%
\$10.00 to \$50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$14.00 to \$20.00
1/5 to std. pkg.	13.00 to 15.00
Standard package, 2200.	List per 1000, \$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80 to \$20.54
1/5 to std. pkg.	14.80 to 19.24
Standard package, 2200.	List per 1000, \$20.

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net	Std. Pkg. 3500.	Std. Pkg. 4000
		5 1/2 N.C.—Solid Nail-It—N.C.	
Less than 1/5 std. pkg.	\$10.50 to \$18.00		\$28.00
1/5 to std. pkg.	9.75 to 11.10		21.50

CHICAGO

	Per 1000 Net	Std. Pkg. 3500.	Std. Pkg. 4000
		5 1/2 N.C.—Solid Nail-It—N.C.	
Less than 1/5 std. pkg.	\$11.85	\$30.75	
1/5 std. pkg.	11.10	24.20	

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/8-in. cap key and push sockets	500	\$0.33
1/8-in. cap keyless socket	500	.30
1/8-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No. Fuse

High Grade:	List
30-amp. S. P. S. T.	\$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

High Grade:	
Less than \$10 list	List to —5%
\$10 to \$25 list	11% to 16%
\$25 to \$50 list	14% to 24%
Low Grade:	
Less than \$10.00 list	5% to —5%
\$10.00 to \$25.00 list	11% to 16%
\$25.00 to \$50.00 list	14% to 24%

DISCOUNT—CHICAGO

Less than \$10 list	+5% to 5%
\$10 to \$25 list	11% to 16%
\$25 to \$50 list	14% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap

Switches

	Std. Pkg.	List.
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp., three-point	100	.54
10-amp., three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to Net
1/5 to std. pkg.	Net to 15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

	List, Each
Union and Similar	
No. 155	\$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list	List to 23%	18%
\$2.00 to \$10.00 list	20% to 23%	18%
\$10.00 to \$50.00 list	23% to 30%	18%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list	25% to 50%	20% to 40%
\$2.00 to \$10.00 list	25% to 50%	20% to 40%
\$10.00 to \$50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

Net price	\$3.10 to \$3.50
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CHICAGO

Net price	\$3.38 to \$3.75
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WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

No. 18, less than full spools.	\$0.52
No. 18, full spools.	0.48

CHICAGO

	Per Lb. Net
No. 18, less than full spools	\$0.065 to \$0.6885
No. 18, full spools.	0.5285 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14....	\$15.00-18.00	\$12.00-14.50	\$11.50-12.50
12....	21.06-28.35	18.96-24.30	18.01-20.25
10....	29.60-39.83	26.64-34.14	25.31-28.46
8....	42.40-56.49	38.16-48.42	36.25-40.35
6....	72.19-89.39	64.98-76.62	61.73-63.85

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14....	\$18.00	\$16.00	\$14.00
12....	25.99-28.63	21.96-24.54	20.13-22.50
10....	36.49-40.28	30.84-34.44	28.27-31.57
8....	48.84-51.83	43.80-44.77	40.15-44.77
6....	70.24-81.93	63.85-69.24	56.54-57.47

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$40.25 to \$45.00
25 to 50 lb.	39.25 to 42.00
50 to 100 lb.	38.00 to 38.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	\$42.35 to \$42.50
25 to 50 lb.	41.35 to 41.50
50 to 100 lb.	40.35 to 40.50

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Lighting Unit

A self-contained lighting unit which, it is claimed, utilizes every ray of light produced by the electric bulb, carrying its own diffusing reflector, is made by the Americolite Company, 523 West Fifty-second Street, New York City. This unit projects a soft, cheerful light downward where it is needed, it is claimed. Attention is called to the fact that the unit shows the true colors in fabrics, and also enables the matching of delicate colors perfectly. This unit is available for both the direct and indirect lighting methods.

Compression Fuse Switch

The compression fuse, together with its holder, supports and inclosing box, described here, is made by the Electrical Development & Machine Company of Philadelphia. The fuse consists essentially of three parts, an aluminum melting strip, the contact member and the gas chamber. The gas chamber is a specially treated soft-steel sherardized container sealed by a small phosphor-bronze tube which is provided at its extremity with a special fusing tip. The chamber is filled with carbon dioxide gas under pressure, which, when released by the melting of the fusing tip, discharges through the phosphor-bronze tube. The contact member is separate from the gas chamber but is fastened to the fuse forming one of its terminals. The melting strip is of



BOX OPEN WITH FUSE DISCONNECTED FROM CIRCUIT

aluminum and so designed that it will melt on an overload.

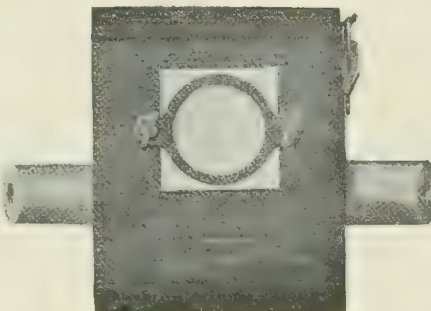
The fuse box shown herewith consists of a combination skeleton metal frame and asbestos lumber sides. The knife-switch blades to which the line terminals are connected are mounted on composition insulators which are in

turn fastened to the body and door of the box. The arrangement is such as to allow the fuse to be withdrawn by the mere opening of the lid. An additional feature pointed out is one which permits the inspection of the fuse or interior of the box without opening the circuit.

Outdoor Fuse Box

The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has recently placed on the market its type OD safety-first fuse box, in which those parts to be handled are separated from all live parts, this being accomplished automatically by opening the door.

The fuse tube is open at the bottom and is provided with a closed expulsion chamber at the top. Upon the blowing of a fuse the gases are therefore expelled from the bottom of the tube through a porcelain bushing in the bot-



BOTTOM VIEW OF FUSE BOX

tom of the box. The bushing is close to and directly beneath the open end of the tube. Upon a fuse blowing, the gases expelled from the fuse tube puncture a piece of paper clamped under the box. The puncture can be seen from the ground by day or by night.

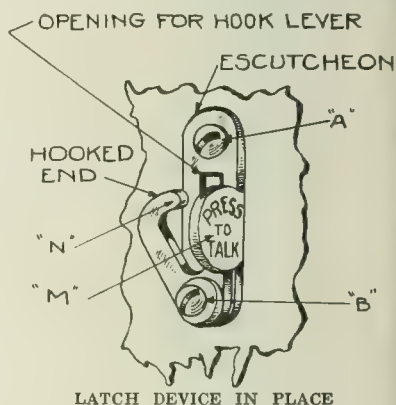
No hook stick, tongs or other tools are necessary to re-fuse this box, except a screwdriver for clamping the fuse in the tube. When the door of the box is opened the fuse tube—the only part requiring handling—is disconnected from the line and can therefore be disengaged from its clips.

The fuse tube is held in spring clips mounted on 7500-volt insulators on the door of the box. The clips are made light, as they carry no current but merely hold the tube in place. Heavy spring fingers with hollow contact tips are mounted on 7500-volt insulators on the rear of the box in such a way that contact is made between the fingers and brass ferrules on the fuse tube when the door of the box is closed.

Contact far above the rated capacity of the box is insured by the toggle locking catch.

Device That Saves Telephone Dry Batteries

A "battery saver" which, it is claimed, eliminates waste by permitting subscribers to use their telephones for listening purposes without connecting the dry cells to the transmitter cir-



cuit, and is arranged so that by pushing a button the telephone is immediately put in transmitting condition for talking purposes, has been developed by the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y. It consists of a latch device which is made to attach to the hook-switch escutcheon plate on the left side of the instrument. When the receiver is removed from the hook the lever springs up, but is caught half way by the bent finger of the latch device. In this position the circuits of the telephone are connected so that the user may hear but not talk; the transmitter is not connected to the battery and no energy is consumed. If the person using the telephone wishes to talk he presses the latch back. This disengages the hook-switch lever and allows it to resume its upward movement to the full operating position. When the lever is in this position the battery is connected to the transmitter and the telephone may then be used for talking purposes. When the receiver is replaced the device is automatically forced to its normal position.

Automatic Lighting Plant

The Mathews Engineering Company of Sandusky, Ohio, announces the addition of a 5-kw. set to its present 1918 1-kw. and 2-kw. automatic lighting plants. This new unit performs all the functions of the smaller plants,

starting and stopping automatically. It furnishes energy for light and power, requiring no attention beyond replenishing the supply of fuel and oil. The engine is four-cylinder, four-stroke cycle, and develops 20 hp., giving it a reserve capacity for nearly 100 per cent overload. This, together with the fact that the set runs at the slow speed of 900 r.p.m., the manufacturer points out, insures smooth, easy running and long life. The generator is especially designed for the work and is of General Electric make. It is directly connected to the engine through a flexible coupling. The entire power plant is mounted on a substantial base. The engine is water-cooled, the pump forcing water from a tank of large capacity through the cylinder jackets. This heated water is then returned to the water tank after being cooled by passing through an automobile type radiator, through which a fan forces a stream of air. The vacuum feed gasoline system provides a constant supply of fuel to the engine from the main gasoline tank, which may be installed underground outside the building. Thus there are never more than a few pints of gasoline inside the building.

Instantaneous Electric Water Heater

The K.D. Manufacturing & Sales Company, 74 New Montgomery Street, San Francisco, Cal., has developed an instantaneous electric water heater made of nickel-plated brass, 5.5 in. (14 cm.) high. It weighs 4 lbs. (1.8 kg.) and is rated at 33 amp., 110 volts., or 25 amp., 220 volts. This heater will heat 1 gal. to 2 gal. (3.7 l. to 7.6 l.) a minute, according to the amperage of the heater used and the number of degrees the temperature of the water is to be raised. It is claimed that this heater gives boiling water in ten seconds and water enough for a bath in from ten to twenty minutes.

The electricity and water are controlled by the same operation, and the user may draw the quantity required at any temperature desired, from cold to boiling. When cold water is drawn there is no consumption of energy.

Iron Box Bell

The Electric Sales Company of Boston, Mass., is placing on the market a line of iron box bells made by the Schwarze Electric Company. The construction is especially designed for signal transformer service, but is equally efficient on battery circuits of 3 volts, it is claimed. Attention is called to the fact that it is necessary to carry only one line in stock for both fixtures.

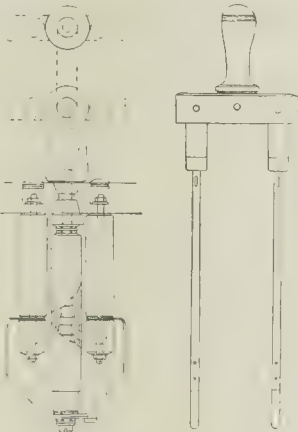
The base and cover are of steel, the latter fitting under the plunger hammer in a manner which excludes dust and all other undesirable material. The line comprises 2½-in. by 3-in. (6.4-cm. by 7.6-cm.) round, tea-dome and cow-gong bells, a 3-in. (7.6-cm.) monitor type and a buzzer.

Lighting Manholes with Storage Batteries

Electric portable lighting outfits for lighting manholes have been developed by the Edison Storage Battery Company of Orange, N. J. The set includes an Edison storage battery of five cells and two guarded 12-cp. lamps with reflectors and 11-ft. (3.3 m.) leads. One of these lamps can be used constantly for twenty hours on a completely charged battery, and both of them will burn for ten hours. The Edison storage battery is particularly adapted to this service because it can be allowed to stand idle indefinitely in any condition of charge or discharge without injury, it is claimed. The complete outfit weighs 40 lb. (18 kg.). The ampere-hour capacity is 37.5, and the normal charging rate for seven hours is 7.9 amp. at 9 volts.

Dead-Front Plug Switches

Current leads of dead-front plug switches made by the General Electric Company of Schenectady, N. Y., are attached to the outer ends of the receptacle and the parts accessible from the front of the panel are dead when



PLUG SWITCH FOR SERIES LIGHTING CIRCUITS

the plug is not in place. The single-plug switch has been provided with greater insulation and the plug with a larger handle. The present plug is much safer than the older type and in conjunction with the new method of making connections is extremely satisfactory from the viewpoint of safety, it is claimed.

The double-plug switch follows the design of the single-pole element in the use of tube insulation, porcelain and brass supports, etc., but each complete switch consists of two tubular receptacles and a two-plug double-break switch per pole.

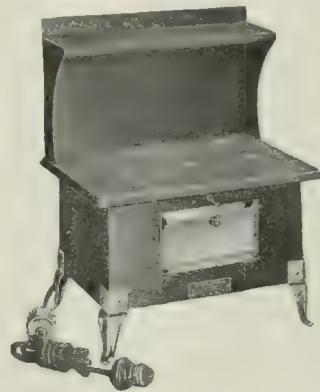
Until the switch has opened sufficiently to break the circuit there is slight chance of touching the live parts of the switch.

The entrance bushings for receptacles are of molded material and extra large in size. The two-plug switches have thick, wide cross bars which constitute a guard and an additional protection.

Receptacles and plugs are identical for both open and short circuiting, but the arrangement of receptacles is such that there can be no confusion in operation.

Portable Toy Range

The Hughes Electric Heating Company of Chicago announces a small toy range for children. With this range the child does not make believe, but actually cooks. The range is rated for



CHILDREN CAN ACTUALLY COOK ON THIS RANGE

440 watts and can be attached to any electric light socket. The range has six burners and is furnished with attachment plug, cord and switch placed close to the range for the convenience of the child. It is finished in black enamel with nickel-plated legs and oven door.

Washing Machine That Occupies Little Floor Space

The Puffer-Hubbard Manufacturing Company of Minneapolis, Minn., is offering a variety of types of family washing machines designed to meet various requirements. These machines embody a mechanism designed on a different principle from that of other washing machines, it is claimed. A series of disk cones is mounted concentrically on a vertical shaft which enters the washing tub from the top and causes the cones to operate vertically as plungers through the water. The shaft carrying the washing cones is clamped to a tubular-steel arch bar. Levers below the tub impart a rising and falling motion to the arch bar during operation.

Each cone contains openings which, it is stated, allow air to escape and enter at each upward or downward stroke of the shaft in such a manner as to cause pressure or suction on the clothes, which are thus thoroughly cleaned with rubbing or rotary motion. These machines have frames of angle steel, riveted and occupying small floor space. All metal parts are galvanized; frames are equipped with movable casters. Emerson Electric Manufacturing Company motors of ¼ hp. are employed with these machines, power being transmitted to the crank shaft through an endless belt and cut gears.

Trade Notes

ETNA KUHLMAN, president of the Kuhlman Electric Company, Bay City, Mich., died at his home on Sept. 14 after a lingering illness.

J. B. LAIRD, until recently connected with the Moore Steam Turbine Corporation, Wellsville, N. Y., has resigned his position with that corporation to go into the machine-tool business.

THE MANHATTAN ELECTRICAL SUPPLY COMPANY, 17 Park Place, New York, is planning for extensions and improvements in its plant at 45 Morris Street, Jersey City, N. J., at a cost of approximately \$18,000.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., has had plans prepared for the construction of a new five-story reinforced-concrete factory at Fourth Avenue and Twelfth Street, Newark, about 100 ft. by 200 ft., to cost about \$163,000.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., is building an extensive addition to its plant in order to take care of requirements. The addition will be ready some time before the first of the year, contract for erection having been awarded.

SLOAN, HUDDLE, FEUSTEL & FREEMAN, consulting engineers of Chicago and Boston, announce that their general offices in Madison, Wis., and their Chicago office in the People's Gas Building have been removed to the Conway Building, Chicago. William F. Sloan has assumed personal charge of the Eastern office at 14 Kilby Street, Boston, as resident partner in that city.

THE PARKER RUST-PROOF COMPANY OF AMERICA, which in its two years of existence has grown to be a \$2,300,000 concern with plants established at Detroit and Cleveland, now has plans under way for establishing similar plants in New York City, Chicago, Philadelphia, Pittsburgh, Boston and St. Louis. This company owns patent rights on a rust-proofing process used in coating metal parts for electrical machines and automobiles with ferrous and ferric phosphates insoluble and stable in atmosphere.

THE SANGAMO ELECTRIC COMPANY announces the opening of a Chicago district office in the Old Colony Building, in charge of C. H. Hurtt as district manager. In the past the Sangamo company has had a Chicago representative with the Electric Appliance Company, which for many years has been selling agent for the Sangamo Electric Company throughout the Middle West. In establishing this new office the Sangamo company has made no change in its selling arrangements with the Electric Appliance Company and the Federal Sign System (Electric) of Chicago, which will continue to handle Sangamo products exactly as in the past. The new office has been established with a view to giving a more complete service on Sangamo meters and other products than has heretofore been possible in Chicago and surrounding territory, this being necessary on account of the greatly increased demand for Sangamo products. A completely equipped repair department will be maintained as heretofore, under the management of the Chicago office.

THE ROBBINS & MYERS COMPANY, Springfield, Ohio, believing that the maximum degree of efficiency can be obtained through the spirit of co-operation, and desiring to offer an incentive to all employees to put forth their best efforts and take more personal interest in their work, made its employees two bonus propositions. Both plans have become effective as of Aug. 1. Under the plans perfect attendance for thirty-day periods will bring bonuses ranging from 3 to 5 per cent of the monthly wage or salary, while length of continuous service of employees will bring bonuses of from 1½ to 10 per cent, the percentage being based upon the number of years of service. The two plans are entirely separate and yet operate together. Plan No. 1 is known as the "perfect attendance" bonus plan. Plan No. 2 is known as the "service" bonus. Under Plan No. 1 any employee with a record of thirty consecutive and perfect days for attendance and time punched in and out will be given a bonus amounting to 3 per cent of his straight-time earnings for that period. If any employee has a second successive thirty-day period, the bonus will be increased to 4 per cent, while 5 per cent will be given for a third successive thirty-day period of perfect attendance. Thereafter if the record is continued, the bonus will continue at 5 per cent. Un-

der Plan No. 2, known as the "service" bonus plan, employees will be given bonuses for faithful service in the company's employ, the amount of bonus to be determined by the length of a continuous service. Following is the bonus schedule based upon length of service: Six months' continuous service, 1½ per cent of earnings; one year's continuous service, 2 per cent of earnings; two years' continuous service, 4 per cent of earnings; three years' continuous service, 6 per cent of earnings; four years' continuous service, 8 per cent of earnings; five years' continuous service, 10 per cent of earnings, and thereafter, 10 per cent of earnings.

Trade Publications

VOLTAGE REGULATORS.—The General Electric Company of Schenectady, N. Y., has prepared bulletin No. 45,505, descriptive of its induction voltage regulators of the outdoor type.

TELEPHONE ATTACHMENT.—The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., is distributing bulletin No. 1020, descriptive of its "Battery-Saver" attachment.

EXHAUST FAN OUTFITS.—Motor-driven exhaust-fan outfits for direct and alternating current are illustrated and described in bulletin No. 41,801, prepared by the General Electric Company of Schenectady, N. Y.

WIRING DEVICES.—The Bryant Electric Company of Bridgeport, Conn., has prepared leaflets descriptive of its bayonet sockets, sockets for candle fixtures, current taps, "New Wrinkle" canopy taps, and flush heater control combinations.

PANELBOARDS.—The Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, has issued catalog No. S-2, showing an entirely new line of residential panels and numerous innovations in dead-front panelboard construction.

ENGINES.—The "New Way" Motor Company of Lansing, Mich., has prepared catalog M-16, descriptive of special features of the "New Way" engines. The engines operate on gas, gasoline, motor spirits, benzene, engine distillate, alcohol, naphtha and petrol.

HEATERS.—The "Hotpoint Hedlite" heaters are illustrated and described in a folder now being distributed by the Hotpoint Electric Heating Company of Ontario, Cal. This folder gives sales help and copies of "ads" that are appearing in various magazines.

ELECTRIC WARE.—Electric heating and cooking appliances, such as flatirons, toaster stoves, percolators, milk warmers, radiators, immersion heaters and solder pots, are described in catalog 8-C, just issued by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. The "sew-motor" for sewing machines is also described.

STORAGE BATTERIES.—A handbook descriptive of the "Exide" battery for automobile starting, lighting and ignition service has been prepared by the Electric Storage Battery Company of Philadelphia, Pa. This company has also prepared bulletin No. 167, descriptive of the chloride accumulator for telephone service. A bulletin descriptive of the "Exide" battery for miscellaneous types for automobile starting and lighting service has also been prepared.

PUBLICATIONS OF BUREAU OF MINES.—The following bulletins have been prepared by the Bureau of Mines, Washington, D. C.: Bulletin 133, on the wet Thioegen process for recovering sulphur dioxide in smelter gases, by A. E. Wells; bulletin 142, on the mining industry in the Territory of Alaska during the calendar year 1915, by S. S. Smith; bulletin 147, abstracts of current decisions on mines and mining, reported from September to December, 1916, by J. W. Thompson. The following technical papers are ready for distribution: Technical paper 103, on organizing and conducting safety work in mines, by H. M. Wilson and J. R. Fleming; technical paper 153, on the occurrence and mitigation of injurious dusts in steel works, by J. A. Watkins; technical paper 177, on the preparation of ferro-uranium, by H. W. Gillett and E. L. Mack, 1917. Miners' circular 23, on elementary first aid for the miner, by W. A. Lynott and D. Harrington, is also ready. Three editions, one in Italian, one in Polish and one in Slovak, with English translations on opposite page, have been prepared. Those asking for this publication are requested to say which edition is required.

FLASHLIGHTS.—The Usona Manufacturing Company, Inc., 1 Hudson Street, New York City, has prepared a leaflet descriptive of new models and developments of "Kwik-lite" flashlights.

CHOKE COILS.—Choke coils for alternating-current circuits are illustrated and described in bulletin No. 45,606, recently prepared by the General Electric Company of Schenectady, N. Y.

STARTING SWITCHES.—The Krantz Manufacturing Company, 160 Seventh Street, Brooklyn, N. Y., is distributing bulletin 70, descriptive of its shock-proof safety motor-starting switches.

LIGHTING DATA.—The George Cutter Company of South Bend, Ind., has prepared bulletins Nos. 3310 and 3313. The former, which is descriptive of Cutter "Arcadian" and "Suburban" ornamental posts, also contains considerable engineering data in connection with the installation of street-lighting equipment. This booklet should be of aid to those who are in charge of the installation of municipal lighting systems. Bulletin No. 3313 is on handy wiring tables and illuminating data. It has been prepared for the purpose of giving useful information to electrical contractors, shop electricians, wiremen, etc., and should be especially valuable to those planning new or modernizing old lighting systems.

New Incorporations

THE HARLEM CITIZENS' ELECTRIC COMPANY, Harlem, Mont., has been incorporated with a capital stock of \$25,000 to operate an electric light plant.

THE ADVANCE ELECTRIC COMPANY, Chicago, Ill., has been incorporated with a capital stock of \$10,000. The incorporators are William B. Ward, Thornton M. Pratt and B. Hand.

THE VINCENNES ELECTRIC SUPPLY COMPANY, Vincennes, Ind., has been organized by A. J. Heitz and others with a capital stock of \$10,000 to buy and sell electrical supplies.

THE JOHN CUTHBERT COMPANY, Dover, Del., has been organized by C. M. Egner, C. L. Rimlinger and M. L. Rogers of Wilmington. The company is capitalized at \$500,000.

THE COLE STORAGE BATTERY COMPANY, Chicago, Ill., has been incorporated by Bernard J. Brown, Samuel Goldfarb and Harry A. Silverstein. The capital stock of the company is \$5,000.

THE MAHONING & SHENANGO RAILWAY & LIGHT COMPANY, Youngstown, Ohio, has been incorporated with a capital stock of \$1,000,000 by R. P. Stevens, A. E. Dedrick and W. M. Coleman.

THE ELECTRIC SERVICE COMPANY, Joplin, Mo., has been incorporated with a capital stock of \$5,000. The incorporators are Anton Voegtli, R. L. Carson, N. H. Carson, J. J. Gross and H. C. Mills.

THE O. K. ELECTRIC COMPANY, Miami, Okla., has been organized with a capital stock of \$5,000. The incorporators are L. M. Torbett and H. W. Harriman, Miami, and W. J. Smiley, Joplin, Mo.

THE AMBOY LIGHTING COMPANY, Perth Amboy, N. J., has been organized to carry on a local electrical business. The capital stock of the company is \$15,000, and the incorporators are S. and E. Hyman and Morris Weinstein.

THE SILENT VACUUM CLEANER COMPANY, Cleveland, Ohio, has been incorporated with a capital stock of \$25,000. The incorporators are: John H. Price, Cary R. Alburn, Charles S. Horner, L. Richards and J. L. Kalish.

THE MOUTH FLASH MANUFACTURING COMPANY, Cleveland, Ohio, has been incorporated by George W. Miller, Richard L. Sergeant, Patrick C. Lavey, M. B. Miller and G. A. Miller. The company proposes to manufacture flashlights and is capitalized at \$25,000.

THE KANSAS CITY BATTERY & SUPPLY COMPANY, Kansas City, Mo., has been organized with a capital stock of \$6,000 and proposes to deal in automobile and storage batteries and other automobile accessories. The incorporators are J. L. and Eva. L. Lederer and Louis L. Gubiner.

THE GENERAL LIGHT, HEAT & POWER COMPANY, Dover, Del., has been organized to operate electric plants and engage in similar business enterprises. The company is capitalized at \$3,000,000, and the incorporators are Samuel B. Howard, Louis H. Gunther and George V. Reilly, all of New York City.

New England States

LEE, ME.—The Loescher Tanning Company, recently organized with a capital stock of \$800,000, proposes to generate and distribute electricity in the towns of Lee and Springfield for lamps, heaters and motors. The officers are: Harris N. Merrill of Winn, president; Harvey L. Haskell of Lee, treasurer, and M. L. Merrill of Winn, clerk.

PORTSMOUTH, N. H.—Plans are being prepared by the Rockingham County Light & Power Company for the construction of an addition to its power plant, to cost about \$150,000. Harry M. Hope, 185 Devonshire Street, Boston, Mass., is engineer.

SPRINGFIELD, VT.—The Jones & Lamson Machine Company has awarded a contract to I. L. Hall of Springfield for construction of an addition, 30 ft. by 60 ft., to its power house.

HOPEDALE, MASS.—The contract for the construction of the large addition to the power plant of the Draper Corporation at Hopedale has been awarded to Dillon Brothers of Milford.

WORCESTER, MASS.—The Worcester Electric Light Company has been granted a permit to erect a transformer station at the rear of Grafton Street, to cost about \$30,000.

NEW LONDON, CONN.—Contract has been awarded by the Connecticut Power Company to the Stone & Webster Engineering Corporation, 147 Milk Street, Boston, Mass., for the construction of an electric power station at Crowell.

WATERBURY, CONN.—The contract for the construction of the dam at Southbury on the Housatonic River, just north of Otter Rock, has been awarded to C. W. Blakeslee & Sons of New Haven. A large power house will also be built at the dam, site for which is now being prepared. W. Spencer Murray is president. The headquarters of the company are located at Waterbury.

Middle Atlantic States

BROOKLYN, N. Y.—The contract for the installation of an electric-lighting system in the structural shop at the Brooklyn Navy Yard has been awarded to the L. K. Comstock Company, 30 Church Street, New York City, electrical engineers, at about \$10,500.

FLUSHING, N. Y.—Contract has been awarded by the New York & Queens Electric Light & Power Company, Long Island City, for the construction of a new substation, 95 ft. by 102 ft., on Lawrence Avenue, near Broadway. The cost is estimated at about \$50,000.

GROTON, N. Y.—The Groton Electric Power Corporation, recently incorporated with a capital stock of \$20,000, is planning to construct and operate an electric generating plant and distribution system for local service. J. B. Carey, O. E. Wasser and I. J. Magee, 622 West 113th Street, New York City, are the incorporators.

NEW YORK, N. Y.—Line connections between its power house at West Fifty-ninth Street and East Seventy-fourth Street are planned by the Interborough Rapid Transit Company.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 1, for furnishing four motor-driven hydraulic pumps and two accumulators at the navy yard, New York, N. Y. Specifications (No. 2547) can be obtained on application to the above bureau.

NEW YORK, N. Y.—Property at Nos. 150 to 154 West Sixteenth Street, adjoining Seventh Avenue, has been acquired by the Interborough Rapid Transit Company, on which, it is said, it will erect a transformer station to supply electricity to operate the Seventh Avenue subway. The company will build similar stations 2 miles above and below that point.

RIVERSIDE, N. Y.—The Long Island Lighting Company and the Riverhead Electric Company have filed a joint petition with the Public Service Commission regarding the transfer of the franchises, plant and system of the Riverhead company to the Long Island company, and with reference to the Riverhead company exercising a new franchise in the town of Riverhead.

SCHENECTADY, N. Y.—The General Electric Company, it is reported, is contemplating the construction of a new plant at Cold Spring during the coming year. J. A. Wood, 50 Church Street, New York City, is consulting architect.

TUCKAHOE, N. Y.—Plans are being considered by the Business Men's Association for the installation of an ornamental lighting system on Main Street.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

DOVER, N. J.—The New Jersey Power & Light Company has secured a contract for furnishing electricity to operate the plant of the Dover Boiler Works. About 180 hp. will be required.

NEWTON, N. J.—Plans are being considered by the town committee for improvements to the street-lighting system. An appropriation of \$8,000 has been made for street lighting for 1918.

CRANBERRY, PA.—The Cranberry Creek Coal Company, it is reported, is planning for complete electrification of its plant at Cranberry. For some months past extensive improvements have been under way, electric machinery being installed and the breaker entirely remodeled, at an expenditure of about \$200,000. Energy for operating the plant will be supplied by the Hazleton (Pa.) Electric Company.

EASTON, PA.—The Alpha Portland Cement Company of Easton, it is reported, is planning to take over the Alex R. Watson coal mining plant at Wilsonburg, recently purchased. The plant will be equipped with electrically-operated machinery.

ERIE, PA.—Plans have been prepared by the Union Iron Works for the erection of a new power plant, 60 ft. by 90 ft., on Cascade Street, to cost about \$15,000.

GLEN ROCK, PA.—The Ebert Furniture Company is planning to build a new power plant at its new factory.

HARRISBURG, PA.—The Harrisburg Railways Company is contemplating the construction of a new street railway direct to Steelton.

HARRISBURG, PA.—Work has begun on the construction of a substation at Reilly and Marion Streets, for the Harrisburg Railways Company, to cost about \$5,000.

KULPSVILLE, PA.—The Borough Council has begun work on the installation of a new electric street-lighting system.

MOUNT JOY, PA.—Plans are being considered by John H. Witmer, it is reported, to equip the milling plant recently acquired at Bossertown for electrical operation.

PHILADELPHIA, PA.—The DeLong Hook & Eye Company is erecting a power plant at its works at Twenty-first and Clearfield Streets.

PHILADELPHIA, PA.—Plans have been filed by the Treen Box Company for the construction of a one-story power house, 30 ft. by 60 ft., in connection with its plant.

PHILADELPHIA, PA.—M. Zifferblatt, 2115 South Eighth Street Philadelphia, is considering the installation of new power plant equipment at his factory at Fourth and Cherry Streets.

PHILADELPHIA, PA.—Plans have been prepared by the Henry H. Sheip Manufacturing Company, which operates a wood-working plant at Sixth Street, for an addition to its power plant.

PHILADELPHIA, PA.—Plans are being prepared by the Bureau of Docks, Navy Department, Washington, D. C., for the construction of a power plant at the League Island Navy Yard. The cost of the building is estimated at about \$45,000.

PHILADELPHIA, PA.—The Philadelphia Drying Machinery Company has awarded a contract to the Driscoll Company, 1411 Walnut Street, for the construction of a new boiler house, 25 ft. by 26 ft., one story, on Stokley and Westmoreland Streets.

PHILADELPHIA, PA.—Plans have been filed by the Girard Point Storage Company for the construction of a power plant, 35 ft. by 45 ft., at Twenty-sixth Street, to cost about \$31,000. John N. Gill & Company, Otis Building, have the contract.

PHILADELPHIA, PA.—The Department of Public Safety is considering an appropriation of \$250,000 for the installation of an underground system to place the overhead wires of the Electrical Bureau underground. Improvements to the police signaling system are also under consideration by the department.

PHILADELPHIA, PA.—Revised plans have been made for the construction of a new power plant at the Philadelphia General Hospital at Thirty-fourth Street. The Standard Construction Company, Drexel Building, has submitted low bid of \$238,600 following changes in plans. The initial bid of the company was \$226,800.

PITTSBURGH, PA.—Contract has been

awarded by the Armstrong Cork Company for the construction of a new one-story power house, 50 ft. by 52 ft., to cost about \$30,000, at its Oakdale works, to the Walker & Curley Company, East End Building, Pittsburgh.

POLK, PA.—Bids will be received by the Board of Trustees of the State Institution for Feeble-Minded of Western Pennsylvania at Polk, until Oct. 10, for the installation of a rapid sand-filtration plant, including three motor-driven centrifugal pumps and other appurtenances in connection with the water supply for the institution. Copies of plans and specifications can be obtained at the office of Chester & Fleming, consulting engineers, Union Bank Buildings, Pittsburgh, upon deposit of \$25.

READING, PA.—Rapid progress is being made on the construction of the new hydro-electric power plant of the Metropolitan Electric Company at Klappertal on the Schuylkill River.

READING, PA.—The Beard Construction Company, Berks County Trust Building, Reading, has secured the contract for construction of an addition to the power house of the J. T. Wilson Company at Second and Washington Streets.

READING, PA.—The Metropolitan Electric Company of Reading, a subsidiary of the Eastern Power & Light Company; the Edison Electric Illuminating Company of Lebanon and the Lebanon (Pa.) Valley Electric Light Company have been consolidated under the name of the Metropolitan Edison Electric Company. The new company has acquired all the properties of the above companies, including electric generating plants and distributing systems which practically supply the entire electric-light and power service in Reading, Lebanon and surrounding territory. The Metropolitan Edison Company has also acquired the outstanding common stock of the Pennsylvania Utilities Company, a former subsidiary of the General Gas & Electric Company.

SUNBURY, PA.—Plans are being considered by the Borough Council to establish a municipal electric-light plant in Sunbury.

WORMLEYSBURG, PA.—The Valleys Railways Company, it is reported, has acquired a site on Walnut Street, on which it proposes to erect new car repair shops and electric power station.

BALTIMORE, MD.—Plans have been filed by the Consolidated Gas, Electric Light & Power Company for improvements and extensions to its system, involving an expenditure of \$5,513,345, which will include the erection of an additional power plant in Westport and the distribution of electricity on a large scale in the suburbs, especially at points where large industrial developments are being made.

FREDERICK, MD.—Extensive improvements are contemplated by the Hagerstown & Frederick Railway Company, including the erection of a new power plant at dam No. 5 on the Potomac River about 7 miles above Williamsport. The new power station will be erected on the site of the former plant on the West Virginia shore and will be equipped with three large turbines having a rating of 2500 kw. The company also contemplates rebuilding dam No. 4, near Sharpsburg, where there is a large power plant, which has been closed down because of the failure of the water supply, owing to the leaky dam.

SEVY, W. VA.—The Greenbrier Colliery Company, it is reported, is contemplating the installation of an electric power plant, to cost about \$40,000. J. Wade Bell, of Sevy, is secretary and manager.

FARMVILLE, VA.—Plans have been filed by the town officials for the construction of a two-story addition to the municipal electric plant, for which contract has been awarded. The cost is estimated at about \$20,000.

RICHMOND, VA.—Plans are being considered, it is reported, by the Richmond Terminal Railway Company for the installation of a new heating plant, to cost about \$12,000.

ROANOKE, VA.—Contracts, it is reported, have been placed by the Roanoke Railway & Light Company for two additional turbines with a rating of 4000 kw. and 5000 kw.

SOUTH HILL, VA.—Plans are being considered by the Roberts Tobacco Company for the construction of an addition, 80 ft. by 180 ft., to its works. New electrical equipment and engines, boilers, pumps, etc., will be installed.

WASHINGTON, D. C.—Steps have been taken by the Georgetown Citizens' Association to secure a better street-lighting system for this part of the city. Gas lamps are still in use in a large part of the Georgetown district.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Mare Island, Cal., Schedule 1485—Miscellaneous rubber-insulated interior communication cable, 300 ft. brush holder, rubber-insulated, flexible cable, 60,000 ft. silk-covered bell cord, 15,000 ft. double-conductor telephone cord, 2300 ft. single-conductor lighting and power wire, 3000 ft. twin-conductor, leaded-armored lighting and power wire; Schedule 1484—miscellaneous, lead-sheathed, rubber-insulated lighting and power cable, miscellaneous incandescent lamp cord, miscellaneous rubber-insulated lighting and power wire, 220 lb. solid triple-braid, slow-burning underwriters' wire, miscellaneous triple-braid, weather-proof wire. Applications for proposal blanks should designate the schedule desired by number.

North Central States

COPPER CITY, MICH.—The installation of electric-lighting, water and sewer systems in Copper City is under consideration by the City Council.

DETROIT, MICH.—Bids will be received at the office of the Public Lighting Commission, 56 Atwater Street, for the construction of a substation building on Stone Street, east of Woodmere Avenue, and for an addition to a substation on Lawton Avenue, south of Warren Avenue, in accordance with plans and specifications prepared by Smith, Hinchman & Grylls, Washington Arcade, Detroit, Mich. F. T. Bowler is secretary.

GRAND RAPIDS, MICH.—The Grand Rapids Textile Machinery Company has awarded the contract for construction of a power house in connection with a new factory building to Hubert Hauser, to cost about \$8,000.

ST. JOSEPH, MICH.—Bids will be received at the office of the city clerk, St. Joseph, until Sept. 25 as follows: (1) For construction of sewer and sewage pumping station, including all material and appliances, except pumping station machinery, electric equipment and accessories thereto; (2) for all electrical mechanical devices, piping and equipment for pumping station, including installation. Clarence J. McMullen is city clerk.

CLEVELAND, OHIO.—The construction of a new factory and warehouse, 145 ft. by 266 ft., at 1131 East 152nd Street, to cost about \$160,000, is under consideration by the National Lamp Works of the General Electric Company.

SPRINGFIELD, OHIO.—The Superior Gas Engine Company is building a new boiler and power plant at its works. Contracts have been placed for boilers.

LOUISVILLE, KY.—Plans have been prepared for the construction of an addition to power house at the government works on the Ohio River at Dam No. 41, to cost about \$8,500.

LOUISVILLE, KY.—The construction of an addition to power house, to cost about \$8,000, is under consideration by the American Tobacco Company. D. X. Murphy & Brother, Louisville Trust Building, are architects.

EAST CHICAGO, IND.—Contract has been awarded by the George B. Lumbert Company, 154th Street and Todd Avenue, East Chicago, for the construction of a boiler house and pipe-bending shop, to cost about \$11,000.

GOSHEN, IND.—On recommendation of V. A. Harding, superintendent of the municipal electric plant and water plant, plans for the construction of a municipal central heating station have been deferred on account of the scarcity and high price of material.

LIGONIER, IND.—The Indiana & Michigan Electric Company, which recently purchased the local electric plant, is contemplating the erection of an electric transmission line from Elkhart to Ligonier.

CANTON, ILL.—The Canton Gas & Electric Company is planning to erect an electric transmission line between Ipava and Havana, and between Ipava and Lewistown. The company is planning to build a transformer station here.

WAUKEGAN, ILL.—The installation of a municipal electric-light plant in Waukegan is reported to be under consideration.

GREEN BAY, WIS.—Bids are being asked by the Oneida Motor Truck Company through Foeller & Schober, architects, for the construction of a new plant, 125 ft. by 475 ft., with a separate office building and transformer station, to cost about \$150,000.

MADISON, WIS.—The City Council has authorized the Wisconsin Telephone Com-

pany to lay underground conduits in University Avenue and Brook Street.

MARINETTE, WIS.—The Marinette Light & Traction Company has awarded contract for construction of a transformer station to John Crockett of Marinette.

MILWAUKEE, WIS.—Bids are being asked by the Wisconsin Gun Company for the construction and equipment of a transformer station, 25 ft. by 66 ft., for its new ordnance manufacturing plant at Thirty-fifth Avenue and Burnham Street.

RACINE, WIS.—The Hamilton-Beach Manufacturing Company, it is reported, will soon ask for bids for the construction of a three-story reinforced concrete and brick addition, 80 ft. by 150 ft., to cost about \$80,000.

CEDAR RAPIDS, IOWA.—Work will soon begin on remodeling of the electric plant of the Iowa Railway & Light Company at Cedar Rapids, to cost from \$38,000 to \$40,000.

MINGO, IOWA.—The contract for electric wiring in the new school has been awarded by the board of education of the consolidated district to the Whalen Electric Company of Des Moines. The cost of the building is estimated at \$50,000.

NEWTON, IOWA.—The Board of Education has awarded the contract for electric wiring in the Junior High School to the Capital City Electric Company, of Des Moines, at \$6,000.

GREGORY LANDING, MO.—Bids are being received by the Gregory Drainage District for equipment for a drainage system, consisting of two 42-in. centrifugal pumps, motors, engines, boilers, etc., for two 250-hp. units, one 10-ton traveling crane and other machinery. H. P. Foely of Gregory Landing is secretary.

HANNIBAL, MO.—The Hannibal Railway & Electric Company is contemplating three extensions to its system.

JOPLIN, MO.—J. P. Buchanan of Joplin, it is reported, is planning to equip a 400-ton concentrating plant at Picher.

KANSAS CITY, MO.—The County Court has granted the City & Leeds Railway Company a franchise to construct an electric railway to connect Kansas City with smaller towns of the county. C. H. Witthar of Independence, Mo., is president.

KANSAS CITY, MO.—Contract has been placed by the Kansas City Light & Power Company with the General Electric Company for two 25,000-kw. generating units for the initial installation in a new power plant designed for an ultimate capacity of 240,000 kw.

KANSAS CITY, MO.—The Kansas City Light & Power Company has notified the city authorities that it will be impossible to install more than 200 of the new lamps this year and that there will be at least six months' delay in placing most of the 500 new electric street lamps. The City Council has appropriated \$18,000 to replace the old gas lamps with tungsten lamps of 250 cp.

LEEDS, MO.—The contract for engine and generator for the municipal farm has been awarded to the Independent Electric Machinery Company at \$3,310 and old plant.

PARKVILLE, MO.—The contract for construction of a power house for Park College, 53 ft. by 82 ft., has been awarded to C. P. Breen, of Parkville.

CLAY CENTER, NEB.—Bids will be received by the Board of Supervisors of Clay County, Clay Center, until Oct. 2, for construction of a court house building as follows: (A) For general contract; (B) plumbing, heating and ventilating; (C) electric work. Specifications are on file at the office of W. F. Germandt, Keeline Building, Omaha, where copies may be obtained upon deposit of \$50 for "A," \$30 for "B," and \$15 for "C." Drawings and specifications are also on file at the office of the Building Material Exhibit, Minneapolis, Minn., and office of the Builders' Exchange, Omaha, Neb.

GREELEY, NEB.—Contracts have been awarded for the equipment of the municipal electric-light plant as follows: For electrical apparatus to the Western Electric Company of Omaha, at \$6,673; line materials to the Illinois Electric Company of Chicago, Ill., at \$1,216; transformer to the Midwest Electric Company; line construction to the S. O. S. Supply Company of Omaha. Contract has not yet been awarded for oil engine and accessories.

INDIANOLA, NEB.—The City Council has awarded the contract for the erection of an electric transmission line from McCook to Indianola to Nathan L. Jones of Norwich, Kan.

OAK, NEB.—At an election held recently the proposal to issue \$25,000 in bonds for the installation of an electric-light plant in Oak was carried.

PENDER, NEB.—At an election held recently the proposal to issue bonds to the amount of \$16,000 for the installation of a municipal electric-light plant was carried.

CHERRYVALE, KAN.—Funds are being raised to extend the ornamental lighting system on the east side.

GARFIELD, KAN.—The City Council is considering calling an election to submit the proposal to establish an electric plant in Garfield to the voters.

KANSAS CITY, KAN.—The Kansas City Railways Company is planning to erect a substation, 50 ft. by 75 ft., at Thirty-first and Montgall streets.

LEAVENWORTH, KAN.—Bids are being received by the superintendent of prisons, Department of Justice, Washington, D. C., for furnishing materials for electric lighting, telephones and clock installations at the United States Penitentiary, Leavenworth. Copies of specifications may be obtained upon application to the above office.

TOPEKA, KAN.—The City Council has ordered a special illuminating system to be installed on Kansas Avenue between Tenth and Eleventh Streets.

WICHITA, KAN.—The Wichita-Walnut Valley Interurban Railway Company, recently organized with a capital stock of \$2,000,000, contemplates the construction of an electric railway from Wichita to El Dorado, thence to Augusta, Douglas Rock and Winfield, where it will connect with the Southwestern Interurban Railway. The proposed railway will penetrate the oil fields of Butler and Cowley Counties.

Southern States

KELFORD, N. C.—The town clerk of Kelford would like to receive specifications, prices, etc., on electric storage batteries having a capacity of from 100 amp.-hr.; also on low-voltage, direct-current generators, switchboards, etc.

CHARLESTON, S. C.—Contract has been awarded by the Kiawato Club Company of Charleston for the construction of a clubhouse on Seabrook Island, 70 ft. by 100 ft., and a garage. An electric-light plant and water-works will be installed. David B. Hyer of Charleston is architect.

CHARLESTON, S. C.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., to the Simons-Mayrant Company, 11 Broad Street, Charleston, for the erection of a torpedo storehouse, 52 ft. by 155 ft.; shell house, 50 ft. by 103 ft.; magazine building, 50 ft. by 127 ft., one story. Electric wiring and lamps on one building. The cost is estimated at \$112,000 to \$114,000.

PACOLET, S. C.—The Pacolet Manufacturing Company has awarded contract for equipping the Pacolet Mills and the Gainesville Cotton Mills for electrical operation to Huntington & Guerry of Greenville, S. C. Several hundred electric motors ranging from 5 to 150 hp. will be installed. Energy will be supplied from the transmission system of the Georgia Railway & Power Company, which will supply 6000 hp. to the two plants. The main office of the Pacolet Manufacturing Company is located at Spartanburg.

ATLANTA, GA.—The Georgia Railway & Power Company has awarded a contract to W. H. George for the construction of a substation near the Ashby carhouse to furnish electricity in that section of the city. A new substation is being erected just beyond Buckhead to furnish the new extension to Camp Gordon with energy. The anchor towers and insulators on the Tallulah transmission line are being changed to the suspension type, at a cost of about \$125,000.

TY TY, GA.—The installation of an electric-lighting system in Ty Ty is under consideration. Further information may be obtained from the Ty Ty Drug Company.

CLERMONT, FLA.—The installation of an electric-light plant in Clermont is reported to be under consideration. L. H. Zinsser is interested in the project.

LAKE WORTH, FLA.—Bonds to the amount of \$15,000 have been authorized by the City Commissioners, of which the proceeds of \$10,000 will be used for extensions to the electric-lighting system and \$5,000 for enlarging the water-works system.

VERO, FLA.—The Vero Utilities Company, recently organized with a capital stock of \$20,000, is contemplating the construction of an electric-light plant. Later the company will establish an ice plant. C. G. Redstone is president.

LEBANON, TENN.—The City Commissioners have called an election to submit to the voters the proposal to issue \$25,000 in bonds to acquire the electric-light and water plant of the Lebanon Light & Power Company.

JONESVILLE, MISS.—The installation of an electric-light plant in Jonesville is under consideration. Messrs. Boyd & Alexander are interested.

SCOOBA, MISS.—The installation of an electric-light system in Scooba is under consideration. It is proposed to erect a transmission line to the Scooba Sanitarium.

VINTON, LA.—The Vinton Water, Light & Ice Company, it is reported, has engaged Xavier A. Kramer of Magnolia, Miss., as engineer in connection with improvements to the water system.

QUAPAW, OKLA.—The City Council is considering the installation of an electric-lighting system in Quapaw.

TAHLEQUAH, OKLA.—The Tahlequah Light & Power Company, it is reported, is contemplating improvements to its power plant.

TULSA, OKLA.—The contract for construction of the Young Men's Christian Association Building in Tulsa has been awarded to the Universal Construction Company, Ault-Kirkpatrick Building, to cost about \$150,000. As yet contracts have not been awarded for heating, plumbing and wiring. C. K. Birdsall, Commerce Building, Kansas City, Mo., is architect.

DALLAS, TEX.—The Dallas Electric Light & Power Company will soon begin work on the erection of its high-tension transmission line to the site of the aviation camp, a distance of 6 miles. The cost is estimated at \$25,000.

SAN ANTONIO, TEX.—The San Antonio Public Service Company, it is reported, is contemplating the construction of an extension to Camp Travis.

Pacific and Mountain States

NORTHPORT, WASH.—The Northport Power & Light Company has petitioned the commissioners of Stevens County for a franchise to erect and operate electric transmission lines over the Rossland Road from the international boundary line to the city of Northport.

OLYMPIA, WASH.—Considerable equipment has been purchased by the Olympia Light & Power Company to replace worn-out parts in the old machinery, which will increase the output of the plant considerably. Three 500-kw. transformers are to be installed in the new substation, where the high-tension line of the Stone & Webster Corporation enters into the local company's plant. Three miles of 55-ft. poles have been erected by the company.

OROVILLE, WASH.—The Okanagan Valley Power Company of Brewster has applied to the City Council for a franchise to erect transmission lines and distribution system to supply electricity for lamps and motors in the town of Oroville.

ROCKFORD, WASH.—Arrangements are being made by the Washington Water Power Company of Spokane for improvements to local street-lighting system. High-voltage power Mazda lamps will be used.

SEATTLE, WASH.—Bids will be received by the Board of Public Works until Oct. 5 for approximately 450 distribution transformers for use in the municipal lighting department during the coming year. Specifications are on file in the County-City Building.

SEATTLE, WASH.—The Board of Public Works has approved the recommendation to award the contract for furnishing meters for the ensuing year as follows: To the W. R. Hendry Company, \$10,000 worth; the Northwestern Supply Company, \$10,000; and the Fobes Supply Company, \$7,500.

SEATTLE, WASH.—Through error an item was published in the issue of Sept. 1 stating that a special election has been called to vote on an ordinance to acquire or build a municipal electric light and power plant in Seattle, to cost about \$7,000. The city of Seattle has a municipal electric plant representing an expenditure of about \$7,000,000.

SKYKOMISH, WASH.—The City Council is considering the installation of a municipal electric-light plant, to cost about \$7,000.

VANCOUVER, WASH.—The Interstate Bridge Commission has authorized the installation of an electric generating system to be installed on the Columbia River interstate bridge, to cost about \$7,000. Contract for equipment has been awarded to the General Electric Company at \$5,200.

WHITE SALMON, WASH.—The Northwestern Electric Company of Portland, Ore., it is reported, is preparing plans for the construction of a large hydroelectric plant on the White Salmon River between the present plant of the company and the town of Underwood. Rights of way, it is said, are now being secured. The cost of the plant is estimated at about \$400,000.

CANYON CITY, ORE.—The lessees of the electric plant at John Day, it is reported, are planning the installation of an electric-lighting system in Canyon City. The town is now lighted with gasoline lamps.

CORVALLIS, ORE.—The Independent Telephone Company is placing its wires underground here at a cost of about \$20,000. Most of the work is being done in the College Hill section.

EUGENE, ORE.—The Commissioners of Lane County have decided to equip the County Poor Farm with electric lamps and motors. A motor will be installed to operate the pump at the water plant. Electricity will be obtained from the transmission system of the Oregon Power Company.

PENDLETON, ORE.—The Council has entered into a new contract with the Pacific Power & Light Company for a period of five years. Under the terms of the contract the arc lamps now in use will be replaced with Mazda lamps of 400 and 600 cp. in the business section and lamps of 250 cp. in the residential districts.

PORTLAND, ORE.—The Portland & Oregon City Railway Company contemplates extending its railway from Baker Bridge to Viola.

AZUSA, CAL.—Preliminary surveys are being made for a dam site for another power project in San Gabriel Canyon by the United Light & Power Company of Los Angeles. It is proposed to build a dam at a point near Prairie Fork, impounding sufficient water for a continuous flow of 2000 in. From there the water will be carried by tunnel 10 miles to the proposed power house at the mouth of Graveyard Canyon. The proposed plant will develop 6000 kw. and will cost about \$500,000. The plans provide for the erection of a pole transmission line to Capistrano, from where it will deliver energy to the city of San Diego. This project is a revival of one undertaken some years ago by the Pacific Light & Power Company and found impracticable by engineers and dropped.

EL MODENO, CAL.—The taxpayers have filed a petition with the Board of Supervisors of Orange asking for the installation of a lighting system in El Modeno.

HOT SPRINGS, CAL.—Work has been started on the installation of an electric-lighting plant in Hot Springs. Energy to operate the system will be obtained from Deer Creek.

OROVILLE, CAL.—Extensions and improvements are contemplated by the Pacific Gas & Electric Company, including the construction of a concrete dam and buffer dam in Butte Creek at head of Butch ditch, to replace the rock-filled log dam; installation of lightning arresters at Coal Canyon and Lime Saddle power houses and the rewiring of transmission banks for "star" connection; installation of a 3½-in. centrifugal pump driven by a 15-hp. motor at Bridge and Montgomery Streets, Oroville, for the purpose of boosting pressure in water distribution; also the installation of a 50,000-cu. ft. gas holder in Oroville.

PITTSBURG, CAL.—The Great Western Power Company of San Francisco has purchased a site near Valona, where it will erect a large outdoor-type substation. The company contemplates an expenditure of about \$100,000 at Valona.

SAN BERNARDINO, CAL.—The erection of 39 miles of transmission line from Victorville to Barstow is under consideration by the Southern Sierras Power Company. The proposed line, it is understood, will be extended to Doggett and other sections in the vicinity of Barstow. The contract for construction of line has been granted to F. L. Somers.

SAN FRANCISCO, CAL.—Preparations are being made by the Western Power Company to enlarge its right of way from its power plant in Big Meadows to the Bay region. The company, it is understood, will as soon as rights of way have been secured erect another high-tension transmission line, paralleling its present lines from its generating plant to San Francisco.

SAN FRANCISCO, CAL.—The Board of Public Works has awarded the contract for the construction of the outer tracks for the Municipal Railways on Market Street, from Van Ness Avenue to Castro Street, to James M. Smith, at \$36,960. The Board of Works has asked the Board of Supervisors for an appropriation of \$413,985 to cover the above contract and for additional work, including \$61,525 for special track work; \$20,000 for trolley wires and poles on Upper Market Street; \$150,000 for Lower Market Street construction; \$90,000 for the line from the west portal of Twin Peaks tunnel to Twentieth and Taraval Streets; \$46,500 to complete the tunnel, etc.

TAFT, CAL.—The San Joaquin Light & Power Company of Fresno is erecting a 7-

mile electric transmission line to supply electricity for lamps and motors to the Reward and Union Oil Companies in the Canarris District.

POCATELLO, IDAHO.—The City Council has recently entered into a new street-lighting contract with the Idaho Power Company for a period of ten years. The new contract provides for a complete new street-lighting system, including 355 curb standards and 161 incandescent lamps in the viaduct and subway.

FLORENCE, ARIZ.—Arrangements, it is reported, have been made for the sale of \$50,000 in bonds for the proposed electric plant.

THATCHER, ARIZ.—The city of Thatcher is considering the establishment of an electric-light plant.

ANACONDA, MONT.—The Mountain States Telephone & Telegraph Company is contemplating improvements to its local system, involving an expenditure of about \$35,000.

COLUMBUS, MONT.—Preliminary work has been started by the Montana Power Company on its new power site on the West Rosebud River. A site for the proposed dam will be surveyed across the mouth of Mystic Lake, and a survey will also be run for a tunnel, which will tap the bottom of the lake a quarter of a mile from the foot of the falls.

LUSK, WYO.—Bids will be received by the town of Lusk until Oct. 15 (extension of date from Sept. 16) for improvements to the municipal electric-light plant as follows: One 100-hp. oil engine, with piping, water-cooling apparatus, starting equipment, etc., one 60-kva., three-phase, 60-cycle, 2300-volt, alternating-current generator, with exciter and rheostats, directly connected to engine, one 20-hp., 2300-volt, three-phase, 60-cycle motor, with compensator. For details see Searchlight Section.

GRAND JUNCTION, COL.—The construction of an electric railway from Grand Junction up into the Uintah Basin via Mack, Col., Ouray, Duchesne and Myton to Helper or Colton, via Indian Canyon or the Strawberry Valley, to connect the lines of the Colorado Midland Railroad and the Utah Coal Route, which will take over the railroad of the Denver & Rio Grande between Helper and Provo, is under consideration. C. M. McNeill, vice-president of the Colorado Midland Railroad Company, Colorado Springs, may give further information.

LOVELOCKS, NEV.—The Commissioners of Storey County have granted the Nevada Valleys Power Company a franchise to erect an electric transmission line over the roads and highways of the county. The company proposes to build an electric power plant in Storey County near the McCarren Ranch on the Truckee River, from which it will distribute electricity in the entire western portion of the State of Nevada, and may possibly extend its service to other adjacent fields.

Canada

NORTH VANCOUVER, B. C.—The City Council is considering taking over the plant and holdings of the British Columbia Electric Railway Company in North Vancouver.

MELITA, MAN.—A by-law providing for an issue of \$10,000 in debentures for the installation of a street-lighting system will be submitted to the ratepayers.

AYLMER, ONT.—Orders have been placed for material for remodeling and extending the Aylmer distributing system; a 13,200-volt transmission line will be erected from Thomas to Aylmer. Tenders are also being asked on motor-driven pumps for domestic and fire purposes.

BARTON TOWNSHIP, ONT.—The Township Council has decided to submit by-laws for the installation of hydroelectric service in Barton Township for which plans and estimates are now being prepared.

BRANTFORD, ONT.—At an election held recently the by-law providing for an issue of \$27,000 in debentures for the purchase of the local system of the Western Counties Electric Company and for extensions and improvements to the system was carried.

DASHWOOD, ONT.—Work is under way on the erection of a distribution system under the supervision of the engineers of the Hydro-Electric Commission of Ontario.

DRAYTON, ONT.—By-laws providing for the installation of Hydro-Electric power have been approved by the ratepayers. Arrangements are being made by the municipality for the purchase of the local system which will be remodeled and extended for the distribution of hydroelectric power. Contracts have been placed for material for a 4000-volt transmission line.

OIL SPRINGS, ONT.—Preparations are being made for the installation of an electric distributing system in Oil Springs.

1,239,443. APPARATUS FOR ELECTROLYTIC DEPOSITION; Frank L. Antisell, Perth Amboy, N. J. App. filed Oct. 31, 1913. Relates to anodes for plating out metals from solutions.

1,239,450. ELECTRIC ALARM; Joseph Banneyer, Chicago, Ill. App. filed July 7, 1913. May be readily applied to a bearing to detect overheating.

1,239,477. MODE OF PROTECTING STORAGE STRUCTURES FROM LIGHTNING; Joseph M. Gordon, Eureka, Kan. App. filed July 8, 1915. Sufficient electric conductors through which the electricity will be grounded.

1,239,507. ELECTRIC CLOCK; Eugen Kling-Muller, Philadelphia, Pa. App. filed Oct. 15, 1914. Gives an impulse to the pendulum at predetermined time intervals.

1,239,513. ACCUMULATOR CELL; Lee J. Perry, Chicago, Ill. App. filed March 10, 1916. Positive interlocking and spacing mechanism.

1,239,530. ELECTROLYTIC APPARATUS; Harry T. Shriver, West Orange, N. J. App. filed April 17, 1916. Arranged so that none of the gas ducts will furnish a path for the current.

1,239,531. CONNECTOR; Joseph F. Smart, New Britain, Conn. App. filed Nov. 7, 1916. Pull upon the flexible conductor will not produce a strain upon the terminals.

1,239,539. MASSAGING DEVICE; Otto J. Swenson, Los Angeles, Cal. App. filed Dec. 16, 1916. A plurality of rotatable bodies.

1,239,569. ELECTRICALLY CONTROLLED RE-LEASING MEANS; John P. Crandall, Buffalo, N. Y. App. filed Oct. 30, 1915. For filling machines.

1,239,572. PRECISION TEMPERATURE APPARATUS; Achilles de Khotinsky, Chicago, Ill. App. filed Dec. 9, 1916. Means for controlling the flow of water through a heater.

1,239,588. RECTIFIER FOR ALTERNATING ELECTRIC CURRENTS; Clark Gilbert, Bridgeport, Ohio. App. filed Jan. 14, 1916. Commutator having extended dead plates with brushes movable thereon.

1,239,592. SYSTEM OF MULTIPLE CONTROL; John Hays Hammond, Jr., Gloucester, Mass. App. filed May 28, 1913. Wireless impulses employed.

1,239,594. HEAT REGULATOR; Lee H. Harlow, Galesburg, Ill. App. filed Dec. 20, 1916. Thermostatic disks expand under rising temperature and increase reactance in circuit by moving solenoid in coil.

1,239,602. ALARM DEVICE FOR MOTOR VEHICLES; Benjamin F. Johnston, Ogden, Utah. App. filed Dec. 28, 1916. Sounded when the steering shaft of the car is operated.

1,239,609. ELECTRIC CONTROL APPARATUS FOR MUSICAL INSTRUMENTS; Frederick B. Little, Indianapolis, Ind. App. filed March 2, 1915. Plurality of sets of electrically operated tone producers, a single keyboard, and connections by means of which any one or more of the sets of tone producers can be operated from the keyboard.

1,239,654. ELECTRICAL APPARATUS; Robert B. Williamson, Milwaukee, Wis. App. filed Aug. 26, 1914. Means for conducting heat from the portions of the core and windings that are remote from the spaced ventilating ducts of the core.

1,239,697. ELECTRIC CONNECTION FOR AUTOMOBILE LAMPS; John G. Kearby and Zephaniah Robinson, Mineral Wells, Tex. App. filed May 13, 1916. Provided with two metallic studs.

1,239,698. ELECTROPNEUMATIC ORGAN VALVE; Halsey G. Kinder, Chicago, Ill. App. filed Dec. 20, 1916. Improvement in the primary valves.

1,239,702. TELEPHONE FOR LONG DISTANCES OR FOR DEAF PERSONS; Robert L. Aho, Finland, Russia. App. filed March 21, 1913. Provides an auxiliary apparatus so that conversation can be carried on with the telephone over much greater distances.

1,239,710. ELECTRICAL SYSTEM OF DISTRIBUTION; Alexander McGary, New York, N. Y. App. filed Jan. 26, 1914. Improvements in storage-battery charging method to prevent gassing to the battery.

1,239,720. CARBON-FEEDING MECHANISM; Walter G. Preddy, San Francisco, Cal. App. filed May 29, 1916. Prevents abnormally high voltage across the arc when the same is burning, and increases steadiness of the light.

1,239,731. SEPARABLE SUPPORTING AND POLARITY ATTACHMENT PLUG; Milton H. Shoenberg, San Francisco, Cal. App. filed Oct. 12, 1915. Supports any device that may be secured thereto in case the

Record of Electrical Patents

Notes on United States Patents
issued on September 11, 1917

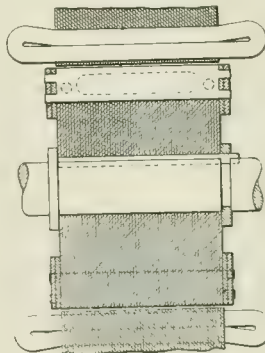
plug sections become purposely or accidentally separated.

1,239,759. AUTOMATIC ELECTRIC-ARC-CONTROL MECHANISM; Haydn M. Baker, Jr., Brooklyn, N. Y. App. filed Oct. 21, 1914. Compensates for the material burned away in the production of the arc.

1,239,761. ALTERNATING-CURRENT MOTOR; Alonzo C. Bell and Thaddeus R. Bell, Westfield, N. J. App. filed June 2, 1917. Initial torque sufficient to overcome the load but without excessive rush of current in the rotor. When the rotor is approaching or has arrived at full speed, the active cross-section of the conductors is automatically increased so as to carry the increased current without overheating.

1,239,772. ELECTRIC REGULATION; John L. Creveling, New York, N. Y. App. filed Jan. 16, 1912. Pressure upon the carbon pile prevents generator current exceeding a certain predetermined limit.

1,239,777. STARTING AND LIGHTING SYSTEM; Justus B. Entz, Cleveland, Ohio. App. filed April 20, 1912. Automatic cut-out which will disconnect the shunt winding from one of the terminals of the ma-



1,240,018—Alternating-Current Motor

chine in case the battery and generator circuit is accidentally opened when the machine is in operation.

1,239,790. COMBINATION LOCK FOR ELECTRIC CIRCUITS; John F. Hendrickson, Wollaston, Mass. App. filed Aug. 9, 1916. Electrical circuit may be completed when the key is inserted to operative position.

1,239,795. PROTECTIVE DEVICE; Ernest O. E. Klippnahn, Dobbins, Cal. App. filed April 9, 1917. Notifies attendant when a coil in a machine is defective, or throws a suitable circuit breaker.

1,239,822. PROCESS FOR THE MANUFACTURE OF AROMATIC AMINO-OXY COMPOUNDS; Alfred Piguet, Ewald Steinbuch and Robert Stocker, Basel, Switzerland. App. filed Oct. 27, 1916. Electrolytic reduction of an aromatic nitro-compound in an acid electrolyte.

1,239,830. CIRCUIT CLOSER; Corliss Sheldon, Saratoga Springs, N. Y. App. filed April 8, 1915. Depends upon the fusion of metal or other normally solid substances for automatically establishing an electric circuit.

1,239,831. WIRELESS TELEGRAPHY; Frederick G. Simpson. App. filed May 27, 1914. Provides means for charging the condensers, but prevents discharge from the latter through the charging circuit.

1,239,832. TRAFFIC-DIRECTING SIGNALING DEVICE; Charles A. Singer, St. Louis, Mo. App. filed May 12, 1915. Can be seen from the front and from the rear of the vehicle.

1,239,833. MULTIPLE SWITCH; Charles A. Singer, St. Louis, Mo. App. filed May 11, 1916. Compact switch equipped with means for governing the operation of the controlling elements.

1,239,835. STORAGE BATTERY AND METHOD OF MAKING SAME; Roland L. Smith, Everett, Mass. App. filed May 17, 1917. Leakage eliminated.

1,239,840. CONTROL SYSTEM FOR ELECTRIC MOTORS; Norman W. Storer, Pittsburgh, Pa. App. filed June 18, 1913. Concurrently opens all of the unit switches in case the master controller is moved backward a predetermined amount.

1,239,841. MERCURY-RECTIFIER DISTRIBUTING SYSTEM; Norman W. Storer, Pittsburgh, Pa. App. filed Feb. 3, 1916. Designed for varying loads which are frequently subjected to severe overload conditions.

1,239,850. CROSSING BELL; Eugene W. Vogel, Oak Park, Ill. App. filed Nov. 6, 1914. Readily accessible for repair or adjustment.

1,239,876. ELECTRIC FUSE; George A. Burnham, Saugus, Mass. App. filed July 1, 1915. Plurality of fuse strips associated in a common fusing zone, so that fusing of any one will rupture the adjacent strips.

1,239,887. FIRE-ALARM SIGNAL BOX; Frederick W. Cole, Newton Highlands, Mass. App. filed April 19, 1916. Relates particularly to accessory means for testing and protecting the transmitter and other costly components of the box.

1,239,896. TRANSFORMER; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed Aug. 9, 1916. Relates to transformers which are directly connected in circuit with double-anode vapor rectifiers.

1,239,902. INSULATOR; Walter T. Goddard, Hamilton, Ontario, Canada. App. filed June 7, 1916. For high-frequency current conductors, having a serviceable joint between the porcelain and metal.

1,239,934. INDICATOR FOR VEHICLES; William A. Miller, Los Angeles, Cal. App. filed Feb. 16, 1916. Electric lamps mounted at the opposite ends of a reciprocable bar.

1,239,979. ALTERNATING-CURRENT MOTOR; Charles P. Steinmetz, Schenectady, N. Y. App. filed Sept. 1, 1915. Condenser-type single-phase induction motor with secondary winding having inductively changing effective resistance which will not only start but will operate at full speed with satisfactory efficiency.

1,239,984. MANUFACTURE OF CRYSTALLINE FUSED ALUMINA; Frank J. Tone, Niagara Falls, N. Y. App. filed Feb. 26, 1916. Treatment of ores containing alumina and alkali by electricity.

1,240,018. ALTERNATING-CURRENT MOTOR; Sven R. Bergman, Nahant, Mass. App. filed June 3, 1915. Secondary winding with relatively high impedance at or near standstill and relatively low impedance at running speeds.

1,240,038. TALKING MACHINE; Frederick J. Empson, Sydney, New South Wales, Australia. App. filed Dec. 31, 1912. Improves and controls the reproduction of the sound waves.

1,240,049. FIRE ALARM; Christian J. Jenne, San Francisco, Cal. App. filed Feb. 9, 1917. Enables trouble to be located without sending in an alarm that will call out the fire apparatus.

1,240,050. SOUND CLARIFIER FOR SOUND PRODUCING OR REPRODUCING INSTRUMENTS; Correl W. Johnson, New York, N. Y. App. filed Feb. 27, 1917. Eliminates counter current or interfering eddies.

1,240,062. ALARM APPARATUS; Frank A. Lelles and James M. Nangle, Greensburg, Pa. App. filed Jan. 13, 1915. Improved thermostatically controlled fire-alarm apparatus.

1,240,067. INSULATOR AND CUT-OUT SWITCH; Harry L. Lowe, Clinton, Ind. App. filed Dec. 22, 1916. Means for actuating and holding the switch member in either open or closed position.

1,240,075. SIGNAL APPARATUS; Edward Mayer and William M. Correll, Ashland, Neb. App. filed Feb. 21, 1916. Gives either a single or uniform sustained signal or a succession of signals of a varying character.

1,240,076. GRID FOR BATTERY PLATES; Robert S. Meares, Arkansas City, Kan. App. filed Feb. 8, 1917. Tendency of the plate to buckle is overcome.

1,240,147. CIRCUIT-CLOSING DEVICE; Robert P. Johnston, Asheville, N. C. App. filed Jan. 22, 1916. May be applied to the steering wheel of an automobile.

1,240,156. SIGNAL; William Sparks, Jackson, Mich. App. filed May 11, 1915. Solenoid-actuated diaphragm vibrator.

1,240,157. FUSE PLUG; Willie O. Besaw, Reedley, Cal. App. filed Aug. 26, 1916. Multi-element type.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN

Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, SEPTEMBER 29, 1917

No. 13

The Ethics of Price Raising

WE HAVE spoken in strong terms several times of late concerning the burdens imposed on central stations by increased costs, and have held consistently to the view that wherever real hardship was inflicted upon the company a remedy was at hand. Application to the proper authorities for the right of raising the price of the product has in numerous instances brought relief. We note with interest, however, that twice recently there have been attempts on the part of the organized central stations of some particular jurisdiction to seek from the public authorities blanket permission for a general, though not considerable, rise in the schedule. In both cases the commissions denied the request without prejudice to the rights of individual companies to ask in their own behalf for help. Such a treatment of the matter may be disappointing to some of the petitioners, but it is sound ethics nevertheless. The burden of extra costs does not fall with equal severity on all the central stations of a single state. It may be true that all stations have ground for complaint, but not in equal amount. Where a supply company is so situated that the coal shortage affects it very severely, or where its territory of service is so great as to impose an extraordinary burden of labor, there is just cause for expecting a commensurate measure of relief, which may be greater or less than will be equitable in the case of another company within the same general territory.

This seems to have been the view that commissions have taken, and it is one that is likely to be followed in other instances. A systematic reckoning by all stations of their increased costs and the distribution of them should be made to serve as a basis for suitable claims in the matter of increased rates. Very important information can thus be placed at the disposal of the various commissions, on which they can base a fair judgment as to the future of the schedule. But such co-operative effort on the part of the stations evidently cannot wisely go to the extent of a general plea for increases. The rights of the matter are to be determined in each individual case, and the indications so far are that they will be so determined and the necessary relief will be secured. The main point which the company in trouble should consistently keep in mind is that commissions are designed to protect the rights of all the people, investors as well as customers. It is of no use to plead the condition of war as a reason for charging what the traffic will bear. That procedure has been followed in too many instances, quite aside from the electrical business, to make it popular or successful. A company that has through various stages

merged itself into sorry over-capitalization must be extremely cautious in setting up its claims, and is liable to raise uncomfortable queries as to the actual cash invested on which a due return is claimed. In the vast majority of instances, however, the concern that finds itself hard pushed and goes to the commission to spread the cards upon the table is likely to win rather than to lose, as numerous instances throughout the country show. We reiterate therefore our advice to those who are overburdened frankly to ask for help in a situation which is likely to be more trying rather than less as time goes on.

The Penalty of Sloth

OVER and over again we have dinned into the ears of the public the almost criminal negligence of permitting the water powers of the country to remain unutilized in face of the crying needs of industry and the certainty that the nation's supply of fuel must be conserved. And yet, despite the absolute certainty that unused water represents an irremediable loss of energy, in spite of steadily rising costs of fuel and of everything in which fuel prices figure, the legislative authorities have dawdled along, pulled one way and another by contrary currents of politics, beset by the pleadings of general interests, of special interests and no interests at all, until the time has come when the penalty of delay is enforced by fate against the unready. It is difficult to speak with patience of the many attempts which have been made to obtain opportunity to develop water powers on a fair and permanent basis; and now the country needs the power, the mines are short of labor, the railroads are gorged with traffic, the coastwise shipping has been drafted into transatlantic service, and industrial plants already are beginning to shut down for lack of fuel.

The full development of the country's hydraulic resources cannot supersede in any full sense the use of fuel, but it can prevent the shortage of fuel being disastrously felt even in time of stress like this. The long and short of the matter is that war conditions have forced upon us a fuel situation which normally might not have been reached for a couple of centuries, and absolutely nothing is being done as yet to put an end to the water-power deadlock. This deadlock is largely due to timid Congressmen whose socialistically inclined constituents are terrified by the boggy man of monopoly shaken in their faces by demagogues. There is no such thing possible as monopoly of water power under the powers of regulation possessed by our government. There has been plenty of capital all along ready to go into any transmission enterprise that prom-

ised reasonable profit, asking only that some tenure of life should be granted to its efforts, and that it should not at the end of a few years be robbed of the results of its endeavor. All these things ought to be sufficiently self-evident to those who have watched the progress of the attempts at water-power legislation. Everything has been held up by unreasonable and indefensible projects of regulation so drastic in their nature as to frighten off any sane investor. Millions upon millions of horsepower therefore stay unutilized. The time has come when the country wants them.

The next year will probably see these United States transformed into a prodigious munitions plant, and every branch of industry which can tend to successful carrying on of the war now in hand must be pushed to its utmost capacity. At such a crisis it is not pleasant to find the Niagara power tied up, largely for sentimental reasons, by needless restrictions and to realize that at any time Canada, also busy with war industries, may stop the exportation of its Niagara power. If inaction continues much longer, the natural result will be to drive the large power-consuming industries, particularly the electrochemical ones, into Canadian territory, where they may by chance find a kinder welcome than has been extended to them on the American side of the falls. The grimmest thing about the whole situation is that it has developed so swiftly as to give no time even for the most willing efforts to furnish prompt relief. It is no quick or easy job to bring a hydroelectric plant of 100,000 hp. or so into productive activity, and time is the one thing which money cannot buy. There is chatter in newspapers about the conservation of coal and oil. No single stroke would have gone so far toward bringing this about as a proper hydroelectric law enacted two years or more ago. It is already far too late to reap in time for the exigencies of war industries the full advantage which the country has in its water powers. The most that can be hoped for now is that if Congress gives relief swiftly some substantial portion of the work may be accomplished let us say within the next year, in time for the succeeding campaigns. Of the other millions of available horsepower, some are beyond hope of quick redemption and others can be brought into action in two or three years. Rapid and complete development of everything capable of it is the first and immediate step to be taken, leaving the fuller working up of the situation for later efforts. Another six months will show with terrible force the foolishness of delays in the past. Let us have no more of them.

Treating Wooden Poles

THE discussion by Herbert W. Meyer of this very important subject is based on the inspection and study of a distribution system containing 20,000 poles, and is therefore of exceptional interest because of the large number of observations from which average conditions may be judged. Poles decay from an onslaught of what are practically micro-organisms which infect

the wood and break down its cellular structure. The object of treating is in the main to kill these invaders and to render the wood immune to their attacks by saturating it with a substance deadly to them. This preservative is sometimes applied by a tank treatment of a more or less thorough character, sometimes laid on with a brush. Mr. Meyer's data cover not only the untreated poles but those treated by both these methods. The facts gathered in the article indicate that a thorough brush treatment actually does, in the locality considered, lengthen the life of a pole by about a third. On the other hand, there is good reason to believe that poles treated in an open tank will last twice as long as those brush-treated. The difference in cost found by Mr. Meyer amounts to only \$1.10 in a little more than \$20. The extra expense of the tank treatment is therefore money exceedingly well spent.

The A. I. E. E. and Industrial Research

THE world war has made evident to all the nations as never before the vital economic importance of industrial research and of the application of science to manufacture. In several of the Entente countries manufacture was carried on, here and there, by pure rule of thumb. In factories of that type the leaders were often men of considerable experience and ability but without any technical scientific training. It was natural in many cases that such leaders should be jealous of attempts at interference by well-meaning scientific experts, who, with relatively small industrial experience, sought to devise experimental improvements in long-established processes. Why should such costly and inexperienced meddlers be allowed to interfere with the regular work of production? The result was that when technically trained Germans began to make improvements in manufacture by painstaking investigations the rule-of-thumb factories had to let go the production of the newly improved material and concentrate work in other departments not yet encroached upon. It was so much cheaper to go on manufacturing in the well-known time-honored ways and let some one else pay the expense of researches, which, after all, might not be successful.

The enormous expansion of manufacturing production in Germany during the last twenty years was partly due to thrift and laboriousness on the part of the workers, and also partly due to the assiduous cultivation of foreign markets, through government-fostered agencies, scattering price lists in the metric system, which the foreign buyer understood; but in a large degree it was also due to the steady and plodding application of applied science to the improvement of factory methods.

When the war broke out the Entente Allies discovered to their dismay that many important articles of manufacture had fallen unnoticed into enemy hands exclusively. Then it became glaringly evident that the rule-of-thumb policy of manufacture was only seemingly the cheapest, and that in the long run it was

actually uneconomical. Scientific workers, chemists, physicists, engineers and inventors had to be hastily enlisted to rehabilitate important departments of various industries that were suddenly hard hit.

We are perpetually reminded of the all too evident horrors and disasters of war, but even war carries certain benefits and mitigations. One compensation which this war has brought to the world at large has been the realization that in future no industry can be permanently maintained in the front rank without perennial good management on one hand and perpetual economically conducted scientific research for improvement on the other. It has at last become self-evident that the proper kind of industrial research, economically conducted, will pay in the long run. These facts have been known to the leaders of individual industries all over the world for many years. The war has by this time impelled their truth upon the leaders of nearly all the industries. The general attitude of industry toward applied science has been changed in three years of war as it might not have been changed during thirty years of peace.

Industrial research is manifestly not a new subject. It is merely a subject of rapidly expanding importance which has changed from local to national importance. What needs to be studied is the proper guidance for it. Injudiciously administered, it may defeat its own purposes. The question is essentially one of experience and education. The experience of those manufacturing concerns which have already benefited by industrial research calls for study. The applied sciences, moreover, have to be studied in technical schools and colleges by the young men and women entering business administration, and at least the elements of those sciences have to be studied in vocational schools by the more ambitious among those entering the ranks of industry.

Electrical workers are called upon, like workers in all other lines, to study the same subject with a view to increasing individual, local and national efficiency. What are the best steps to take for getting the best results out of industrial research in the factories, plants and central stations? Are the best methods for small concerns the same as those which have been found to be best by large concerns? By what means can the technical schools and colleges help in the movement?

These are some of the questions which may be expected to present themselves at the next meeting of the

American Institute of Electrical Engineers, Oct. 8, at Philadelphia. The general subject for the meeting is "Industrial Research," and papers are scheduled for presentation at the meeting on different aspects of this very important topic. It is to be hoped that there will be a good attendance and that plenty of constructive suggestions may be offered in the discussions.

Modernizing a Condenser System

JOHN HUNTER'S second paper on the modernization of the great St. Louis central station furnishes an impressive example of the elaboration involved in the plant of a big supply company. The casual onlooker going into a generating room is impressed by the silent magnificence of the great whirling masses of metal, but seldom stops to think that these items of equipment are but the end of the line, from coal pile to kilowatts, and that behind them lies the boiler room with a mass of details in machinery and accessories of which the layman has very little conception. In this case increased capacity implied an entire rearrangement of the old system of supplying condensing water, and new and capacious channels had to be cut through solid rock. The details of the extensive work undertaken are of great interest to the steam engineer.

Of its magnitude the ordinary reader can perhaps gain the best notion by realizing that the suction tunnel for the condensing water in the new station requires at full load the pumping of 300,000,000 gal. (1,135,600,000 l.) of water a day, approximately three times the amount used in the general water supply of the entire city of St. Louis. Fortunately the hydraulic conditions are such that the amount of energy consumed in this pumping is far less serious than the statement of gross amount would indicate. The importance of close attention to the condensing system of the station is emphasized by the fact that St. Louis is not a region of dear coal where condensation can produce its maximum benefits; but even here it paid to go to the expense of an elaborate system for doubling the condenser water capacity in order to keep the turbines up to their fullest efficiency. With the old reciprocating-engine plants one could take a chance sometimes with mediocre condensing facilities, but today there can be no neglect of this feature of the installation. Its value is likely to be more appreciated in the near future even than now.

CONSTRUCTION and extension of electric service plants were held up for a long time owing to the high prices of materials, but we begin to hear of new installations being completed again as a result of the second reaction which took place when it was believed that conditions would not improve and might grow worse. One of these is a 20 000-kva. hydroelectric development in Maine, the features of which will be described in the Oct. 6 issue of the ELECTRICAL WORLD. Another subject which will be discussed and which should be of interest to electric serv-

The Coming Issues

ice companies is how a Middle West company has rearranged the copper and transformers in its distribution system to care for increased loads. A new method of testing current transformers which does not require the use of special apparatus and which is highly precise will also be explained. In the second issue of October there will appear the third installment of an instructive series dealing with the rehabilitation of a St. Louis station. This installment will dwell on the features of the steam-making equipment.

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Prolonging the Existence of Cedar Poles

Inspection of Those on Large Distribution System—Estimated Life of Poles and Cost of Treatments—Comparison Between Brush and Open-Tank Methods

BY HERBERT W. MEYER

SOME of the information gathered from an inspection of 20,000 poles in the distribution system of the Minneapolis General Electric Company are presented in this article. The object of this inspection was to make a complete record of the condition of every pole in the system, especially those which needed to be

According to the experience of this company, the average life of untreated poles is about nine years and of the brush-treated poles about twelve years. It may be noticed that the minimum life given for brush-treated and untreated poles, as well as poles which have stood in the line until the creosote has evaporated to a large extent, is the same in each case. This apparently in-



FIG. 1—THICK MAT OF FUNGUS ON POLE BUTT

replaced. Additional information of more general interest was brought to light as a result of the investigation.

METHOD OF SECURING DATA

A tool similar to a brick hammer was used to dig away 6 in. or 8 in. (15.2 cm. or 20.3 cm.) of earth at the butt of each pole and to probe into the decayed wood to ascertain the extent of the rot. A memorandum was then made of the conditions observed and such additional information concerning the insulators, guys, lines, transformers, lightning arresters, and so on, attached thereto as might be required. On the opposite page of the notebook was indicated the location of each pole. The final step of the inspection was to label the pole on the street side with a brass tag. On this was marked the year when it was expected that the pole would have to be replaced.

To predict the life which a pole might be expected to give is not always easy, since a variety of factors must be considered. The basis for different lengths of life assigned is shown in Table I.

The foregoing statements apply to Western red-cedar poles. Northern white-cedar poles have not been set in these lines in recent years, so that similar data cannot be given for them. However, a number of these poles which were set more than twenty years ago are still standing and are giving excellent service at the present time.

TABLE I—CONDITIONS GOVERNING LIFE OF POLES

Condition of Butt	Estimated Life, Years
1. Newly set pole, brush-treated with creosote well above ground line	8 to 15
2. Newly set untreated pole.....	8 to 10
3. Creosote treatment gone, but wood still firm.....	8 to 11
4. Butt becoming soft, often accompanied by the appearance of fungus-fruited bodies	6 to 8
5. Sap wood rotted; heart wood firm.....	4 to 7
6. Sap wood rotted; heart wood showing rot in the neighborhood of checks	0 to 4
7. Heart wood showing rot around the entire circumference.	0 to 4
8. Sound shell; rot within.....	0 to 6

consistent assumption is based on the fact that brush-treated Western red-cedar poles often have a sound shell at the butt and still have rot beneath. A condition of this sort is due to the fact that the wood has become infected before being set and often before being treated, so that rot begins within the sap wood and is stopped at the outside surface, which has been penetrated by the antiseptic treatment.



FIG. 2—NUMEROUS FINE BRANCHES OF TREE ROOT GROWING INTO A POLE

Rotting of wood, as is quite generally known, is caused by vegetable growths which feed upon its substance and so alter its characteristics that we say the wood has become rotted. Ordinarily these vegetable growths are fungi, but there can be little doubt that the roots of grass and trees attack wood in a similar manner. Indications that this is true are given by

Fig. 1, which shows a thick mat of fungus on a pole butt, and by Fig. 2, which shows a tree root having numerous fine branches investing the entire sapwood,

COMPARISON OF ESTIMATED COSTS OF BRUSH-TREATED AND OPEN-TANK-TREATED POLES

Year	COST PER POLE		COST PER POLE PER YEAR WITH INTEREST AT 6 PER CENT		Difference	No. of Treated Poles in Use	Saving per Year
	Brush-Treated	Tank-Treated	Brush-Treated	Tank-Treated			
1917...	\$22.48	\$23.58	\$3.22	\$2.39	\$0.83	2,460	\$2,040
1918...	22.69	23.79	3.25	2.42	0.83	4,900	4,060
1919...	22.90	24.00	3.28	2.44	0.84	7,400	6,200
1920...	23.11	24.21	3.31	2.46	0.85	9,800	8,300
1921...	23.32	24.42	3.34	2.48	0.86	12,300	10,600
1922...	23.53	24.63	3.37	2.51	0.86	14,800	12,700
1923...	23.74	24.84	3.40	2.53	0.87	17,200	15,000
1924...	23.95	25.05	3.43	2.55	0.88	19,700	17,300
1925...	24.16	25.26	3.46	2.57	0.89	22,200	19,800
1926...	24.37	25.47	3.49	2.59	0.90	24,600	22,100
1927...	24.58	25.68	3.52	2.61	0.91	27,100	24,600
1928...	24.79	25.89	3.55	2.63	0.92	29,500	27,100
1929...	25.00	26.10	3.58	2.65	0.93	32,000	29,800

growing into a pole and acting to all appearances exactly like the fungus.
As the poles of the system under consideration had

been brush-treated with three coats of hot creosote, there can be no doubt that such a treatment is profitable, compared with the use of untreated poles. However, it appears that far better results could be obtained by preservative treatment which would penetrate the entire sapwood and prevent the evil previously mentioned.

On the basis of facts gathered from this inspection, a comparison was made of brush-treated and open-tank-treated poles. The results are given in the table. This is based on the following data: Cost of average pole complete set in line, brush-treated and open-tank-treated, \$22.48 and \$23.58 respectively; average life of brush-treated and open-tank-treated poles, twelve years and twenty-four years respectively; estimated increase in cost of average pole in next twelve years, \$2.50, and estimated number of poles in system in twelve years, 32,000. It was also assumed that one-twelfth of 32,000 poles would be replaced or set new each year, until in twelve years the entire system would consist of tank-treated poles.

The inspection was made by the writer under the supervision of L. D. Smith, general superintendent, and G. L. Mitchell, electrical engineer, of the Minneapolis General Electric Company.

Residential Street-Lighting Equipment

Principles Involved in Selecting Lamps and Accessories, in Determining Lamp Heights, and in Installing Ornamental Systems in Small Towns and Cities

BY JAMES R. CRAVATH

Last week this series on street lighting for small towns and cities took up the general principles for observance in lamp spacing and location with overhead circuits in residential sections. A further discussion of lighting for residential sections is contained in the present article, wherein are brought out the principles involved in the selection of lamps and accessories, in determining proper lamp heights, and in installing ornamental systems.

IN SELECTING lamps for residential sections the size of lamps should be in accordance with the amount of money available for lighting the particular district. A street-lighting expenditure of \$1 per capita is a very common figure in small towns. A few exceed and many fall below this standard.

As to the size of lamp that should be used, many believe that the 600-lumen, 60-nominal-candlepower lamp is the smallest which should be employed anywhere in street lighting. There is much force in this contention, because a reduction in size below 600 lumens involves so little reduction in annual cost that the saving hardly seems worth the decrease in light. The reason for this is that the fixed charges on distribution and lamps are just as much for lamps rated at less than 600 lumens as for the 600-lumen lamps. These fixed charges are considerably more than the electrical energy and lamp renewal costs. For example, if electrical energy costs 2 cents per kilowatt-hour and a 47-watt, 600-lumen lamp is used, the electrical energy cost will only be \$3.76 per lamp-year on a 4000-hour schedule. Adding to this \$3 for lamp renewals makes \$6.76 for the variable cost proportionate to the size of the lamp. The

maintenance and fixed charges will nearly always be in excess of \$10 per lamp for all the smaller sizes of tungsten lamps without regard to their exact size. A little saving in lamp wattage therefore makes small difference in the total price. Even the 600-lumen lamp is rather small for anything but the most sparsely settled outlying districts, where it acts somewhat as a pilot or beacon light to indicate the location of the roadway.

On the well-settled residence streets, lamps of 1000 lumens and 2500 lumens at street intersections with mid-block lamps, where necessary, as before outlined, represent the best practice of to-day.

In the most densely settled residence streets, unless the blocks are of such dimensions as to make mid-block lamps advisable, lamps larger than the 2500-lumen gas-filled tungsten units are advisable. The next largest sizes of tungsten lamps are the 4000-lumen and 6000-lumen. At this point the magnetite arc comes into competition, as a 4-amp. arc, if equipped with short-life high-efficiency electrodes, is a somewhat more efficient light producer than the gas-filled tungsten lamp. The maintenance and trimming of the arc is also likely to be less than the lamp renewals of the incandescent unit.

The deciding factor in such a case is likely to be the relative amount of the street lighting to which the arc is suited. If there is a district large enough, and situated so that it can be supplied from one or more magnetite arc circuits and load a transformer and rectifier

¹ELECTRICAL WORLD, Sept. 22, 1917.

set, the use of the arc would be indicated, provided that either one of the two following conditions exist: (1) If the number of smaller lamps required in the outlying districts is relatively small, these small lamps, which of course must be tungsten, can be supplied from the magnetite arc circuit at 4 amp., although this practice is not recommended by the manufacturers and has some drawbacks as will be explained later. (2) If there are enough of the smaller outlying district lamps to justify a separate circuit and transformer, the incandescent lamps can be supplied from a 6.6-amp. transformer without rectifier. There are many magnetite-arc circuits of 4 amp. upon which 4-amp. series tungsten lamps are operated with fair success. It is not considered the best of practice at the present time, however, because the surges on circuits of arc lamps are likely to be greater than upon an incandescent lamp

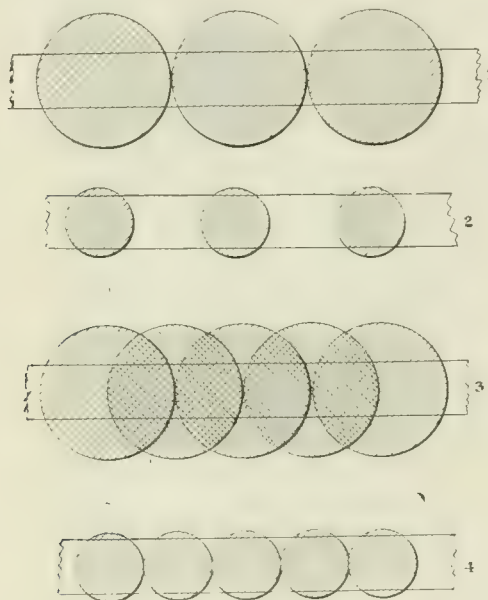


DIAGRAM FOR SHOWING BEARING OF SPACING ON USE OF REFRACTORS

circuit, to the detriment of the life of the incandescent lamp. Furthermore, since the magnetite-arc circuit is direct-current, there is more danger when a lamp burns out that an arc will be maintained between the terminals in the lamp which will ultimately not only destroy the lamp base but the receptacle and film cut-out. In spite of these disadvantages the use of the 4-amp. incandescent lamp on a magnetite-arc circuit is probably the best plan when only a few such lamps are required.

If the nature of the block and lamp distribution of the district is such that large and small lamps must be interspersed, it is in general likely to be better to adopt the tungsten lamp throughout, so that the various sizes can be operated on the same 6.6-amp. alternating-current series circuit. Of course, each case must be figured according to its conditions, taking into account the relative investment and the lumens obtainable per lamp with the given type of equipment proposed. Comparison in light output in lumens of the different lamps and accessories should be made in accordance with the figures given in a previous article assuming the same light-distributing equipment for each lamp.² In other words, should a refractor be assumed

in one case, then a refractor giving a similar distribution should be assumed in the other. Likewise the small internal reflector on the magnetite arc and the radial wave reflector on the tungsten lamp may be considered as approximate equivalents. Diffusing globes are similar in action on both arc and tungsten lamps.

SELECTION OF ACCESSORIES

Where lamps are spaced from 600 ft. to 250 ft. (182.88 m. to 76.2 m.) apart the type of light distribution obtained with the refractor is undoubtedly the best. The refractor as ordinarily used, giving the maximum candlepower about 80 deg. from the vertical, will give its maximum candlepower in a direction to strike the ground on a level at 100 ft. (30.48 m.) distant when the lamp is about 17.5 ft. (5.33 m.) high. This will, of course, fall short of striking midway between lamps when they are over 200 ft. (60.96 m.) apart. By raising the lamp to 22 ft. (6.71 m.), which is about as high as it is usually practicable to go in residential streets, even with center suspension, involving minimum tree interference, the rays of maximum candlepower will strike the ground about 125 ft. (38.1 m.) away. This would indicate that 250 ft. (76.2 m.) would be a spacing which would cause the maximum rays to meet at a point midway between lamps with a 22-ft. (6.7-m.) lamp height. With a 17.5-ft. (5.33-m.) lamp height the lamp spacing corresponding would be 200 ft. (60.96 m.). For lamp spacing between 150 ft. and 250 ft. (45.7 m. and 76.2 m.) there is room for some difference of opinion as to whether a refractor or some form of accessory giving more light near the lamp is best. Such a distribution as is obtained with a radial-wave reflector is satisfactory, but the appearance of the unit will often be objected to on streets where such a short spacing can be afforded. For spacings 150 ft. (45.7 m.) or less there is no question that a diffusing globe gives more satisfactory distribution than a refractor.

To sum up: for the great bulk of residence district lighting at the present time the type of light distribution offered by the refractor is the best. For special ornamental lighting in districts where a closer spacing than 200 ft. (60.96 m.) is to be used a diffusing globe is best for very short spacings, and for spacings between 150 ft. and 200 ft. (45.7 m. and 60.96 m.), as measured in air line between lamps, either a diffusing globe or some combination of refractor and diffusing globe is best.

As explained in a previous article,³ it is not necessary to adjust refractors so that they give their maximum candlepower 80 deg. from the vertical. They can be adjusted to give their maximum as low as 65 deg.

The reasons for the use of refractors on long spacing and the objections to their use on short spacings can perhaps be best illustrated by the accompanying diagram. Here the upper row of lamps equipped with refractors have the circles which they cover represented by lightly shaded areas. In the second line is a row of lamps equipped with diffusing globes the effect of which is to illuminate the ground near the lamp more brightly, as indicated by the more heavily shaded circles. However, as it appears to the ordinary eye, this illuminated circle appears much smaller and the dark unlighted spaces between lamps much greater than

²ELECTRICAL WORLD, Sept. 8, 1917.

³ELECTRICAL WORLD, Sept. 8, 1917.

with the refractor as spaced in the first upper line. If we space refractors as in the third line, there is an overlapping of the areas covered by each lamp. Now, while this overlapping is considered desirable in interior lighting because it helps us to avoid objectionable shadows, it is not desirable in street lighting, where obstructions lying in the street as well as many other objects must be distinguished by the shadows which they cast. For example, a paving stone the same color as the surrounding street lying in the street midway between the refractor units in the third line might be lighted so evenly from both directions that it would be hard to distinguish, since there would be but small shadows and no difference in color to permit it to be distinguished. Another objection to the refractor arrangement which is evident on the third line with close spacings is that such a quantity of the light is not falling upon the street at all. This, of course, applies also to the refractor arrangement with long spacing in the first line, but in the first line the intersecting street gets some of the light which otherwise would be wasted, and even if the lamps were not at a street intersection the necessity of bringing up the illumination midway between lamps would make the waste of light a secondary consideration. In the case of the refractor with a close spacing in the third line, however, we have a better alternative in the fourth line by using a diffusing globe or any device that will produce a greater street brightness near the lamp. Here on the fourth line there is not so much overlapping of light from two lamps as in the third line, and more of the light falls on the street surface.

Refractors for tungsten lamps are made both in bowl and band type. There is also a dome-shape refractor of recent design used inside of a stippled diffusing globe and employed in large numbers in Cleveland. The band refractor as applied to tungsten lamps allows a considerable portion of the downward light to be emitted without going through the refractor. This band type has the advantage of being small and less expensive than the bowl type which extends under the lamp. Cleaning is slightly easier than with bowl type. However, when lighted it does not present quite so finished an appearance as the bowl type, as the lamp filament is visible from points under the lamp and the lamp bulb is not concealed by the refractor.

LAMP HEIGHTS

From what has already been said in this article in connection with refractors and in a previous article concerning glare it is evident that within practical limits the higher lamps are placed the better. These practical limits are usually the shade trees and pole line. With center suspension it is usually practicable to maintain lamps at a height of 20 ft. to 22 ft. (6.07 m. to 6.71 m.) above the ground. With lamps on brackets over the curbline the 22-ft. height is desirable if there are no trees to obstruct, but usually tree limitations make it necessary to put the lamp down to a height of about 15 ft. (4.57 m.). The lower the lamp the greater the necessity for close spacing. This is partly on account of the trouble from glare with low lamps and partly because it is impossible to get adequate illumination midway between lamps with any devices now available.

For ornamental boulevard lighting systems, which

are usually on heavily shaded streets, the closer spacings demanded by ornamental considerations make it permissible to use lower lamps than would be satisfactory on ordinary streets where longer spacings prevail. Nevertheless, it is advisable to maintain a height of 14 ft. to 15 ft. (4.2 m. to 4.5 m.) for such work, this being about the maximum practically obtainable at the present time with the posts on the market.

ORNAMENTAL SYSTEM IN RESIDENCE STREETS

The extension of ornamental lighting systems into residential streets is by no means so general as the movement for business-street "white-way" lighting. However, it is on the gradual increase. It is usually handled financially by special assessment or private enterprise among interested property owners. The method of treatment of this ornamental lighting must depend altogether on the amount of money available and the names of the property owners interested. In some cases the main object of the property owner seems to be to get the wires underground and then get up some kind of ornamental post rather than to improve the lighting conditions greatly. On account of shade-tree conditions, as previously explained, it is usually not feasible to go above 14 ft. to 16 ft. (4.2 m. to 4.9 m.) lamp height. As far as illumination is concerned, this lighting should be done with high posts and long spacings were it not for shade-tree interference. However, the ornamental effect of frequently spaced lamp posts is not to be overlooked by the designer, and therefore it is a mistake to attempt such lighting with posts at long intervals where funds are available to place them at short intervals. Where spaced at short intervals the best effects can be obtained by the use of diffusing globes, as already explained under the head of "Selection of Accessories."

The steel-taped, lead-covered underground cable which can be buried directly in the sod of the parkway is undoubtedly the cheapest and best method of wiring to this class of work. It is more reliable than a cheap pulled-in duct conduit and much less expensive than a good duct conduit line.

The usual place for the cable is just inside the curb in the sod of the parkway. A trench 1 ft. (30 cm.) deep is sufficient. Intersecting streets can be crossed either by removal of the paving surface or by boring underneath the pavement. Where the soil is not full of rocks and boulders and there is a good permanent pavement the latter is to be preferred. A work hole is dug in the parkway outside of the curb on each side of the street and an iron pipe made up from short lengths forced through with a jack or a pipe-forcing machine. The cable is pulled in behind the pipe as the pipe is withdrawn.

On large series systems of this kind a disconnecting series pothead in the bottom of the post is desirable so that a grounded lamp post can be cut off without opening the circuit. On the other hand, if the lead-covered cable is carried direct to the lamp terminals possibilities for trouble are much reduced, so that on small systems the elimination of the pothead and cut-out is probably the best plan.

Present preference is for a post-head globe or fixture rather than a bracket, although very good and artistic results can be got with either form.

*ELECTRICAL WORLD, Sept. 8, 1917.

Graphical Presentation of Electrolysis Data

Electrolysis Department Which Will Also Report General Conditions in Subways Advisable—Relative Advantages of Three Schemes of Presenting Data

BY H. A. COZZENS, JR.

MANY large operating companies have found it practicable to establish and maintain an electrolysis department, the function of which is to make routine tests on all cables, to gather data on the potential of the cable sheaths with respect to other structures, and to report on the general condition of the underground system. These reports serve as a basis for recommending either new or additional bonds and drainers, negative returns, or whatever remedy may seem advisable in mitigating electrolysis.

The work of the department is in many cases limited by the attitude of the company toward bearing the expense of such investigations. However, it so happens that additional work, such as reporting on the general condition of the subway, making manhole inspections and reporting on the temperatures of cable sheaths, may be assigned to the department so as to make its work extend throughout all seasons and be invaluable to the company in producing efficient and continuous operation.

A distinct advantage is that the work of the electrolysis department is centralized and conducted from one office. The subway and cable work may be conducted in the various municipalities under the direction of the resident superintendent. Under this plan a wide range of conditions may exist in various cities, and one single department inspecting subway systems is in a better position to decide and recommend changes than the individuals in any one locality.

The work of an electrolysis department is practically the same in all companies as regards the method of securing the data. The men are equipped with suitable instruments, preferably a combination millivoltmeter and voltmeter designed especially for electrolysis work. The leads from the electrolysis instrument terminate in two long rods which may be pressed against the cable sheaths without the necessity of the observer entering the manhole. These rods make it possible to secure the readings rapidly and easily. In each manhole the potential difference between the cable sheaths and various structures such as water and gas mains, telephone cable sheaths, railway tracks and the ground, as well as the current flowing along the sheath, is secured.

These data are collected on sheets covering the following entries: Street intersections—time; electrolytic survey—potential of cable (plus or minus) to track, water mains, gas mains, telephone and earth; current determination—distance on sheath, millivolt drop, amperage and direction of flow; subway inspection: (1) cables—corrosion or pittings, properly racked, protected at duct edge, sharp bends, insulated on hangers, fireproofed, leakage of compound, bonded, sheath temperature; (2) manholes—water, debris, illuminating gas, ventilated. Space is included for "remarks." The sheets may be of the loose-leaf variety, which permits them to be filed for reference from year to year. It is obvious that in one month's time a single group of men may bring in a considerable quantity of

data. After the data are secured the question is how to present the information so that it may be readily interpreted and understood by those who have only a slight knowledge of electrolytic conditions and their elimination. Many engineers are contented to glance over the field sheets and, if the readings are minus in the majority of places, to accept conditions as being satisfactory in that locality. After this preliminary and hurried study, the data sheets are usually filed away and forgotten.

Some definite method of reporting the findings of the department should be adopted. On rainy days no surveys can be undertaken, so an opportunity to work up reports in some form or other is afforded. There are

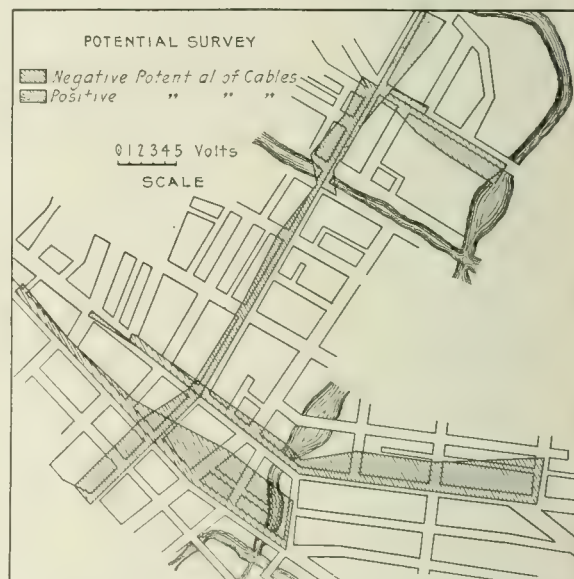


FIG. 1.—POLARITY OF CABLE SHEATHS TO OTHER UNDERGROUND STRUCTURES INDICATED BY COLOR OF BANDS AND POTENTIAL BY WIDTH

many ways of presenting data, each of which has its advantages, and all are governed largely by local conditions and personal approval. In what follows no attempt is made to prove the merits of any one scheme nor are those illustrated considered above improvement.

One of the most elementary schemes for graphically presenting data is shown in Fig. 1, which represents a section of a large map. Each year as the survey is made the potential observations are entered thereon. Where the potential of the cable sheath is minus to other structures, meaning that the current is flowing from those structures on to the cable sheaths, the readings are entered in green. Where the potential is plus, the reverse holds true and the readings are entered in red. It is assumed that the company is interested primarily in the potential of its own cable sheaths and not in the condition of structures outside the ownership of the company. These maps are for routine tests only and do not indicate any elaborate tests or special findings.

The advantages to be gained by the presentation of data in this manner are: (1) An executive can, at a glance, tell by the green indications that conditions are satisfactory from a potential standpoint with regard to the cable sheaths. If there are red spots, he can see if they are isolated or exist in a particular locality and are

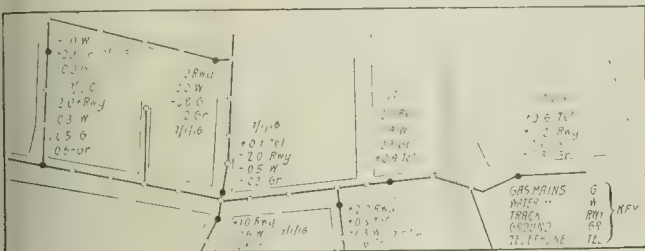


FIG. 2—POLARITY OF CABLE SHEATHS INDICATED BY COLOR OF DOTS AND POTENTIAL BY FIGURES

influenced by the potential conditions of some other structure. Each year the readings are added to those already indicated on the map so that a record is obtained of any changes in the electrolytic conditions in this locality.

The disadvantage in connection with such a plan lies in the fact that no comparison can be established between the potentials in the various vicinities or in different years unless the map is studied carefully and the readings are kept in mind when looking at other sheets. The mere indication in color does not show the magnitude nor the relation between the observations.

To eliminate this disadvantage and yet embody the merits of the former scheme, the plan shown in Fig. 2 may be adopted. Several copies of the map of a municipality are made as white prints from a tracing which should show the subway construction in the city. One of these prints is devoted to the potential survey between the cable sheaths and some one other structure. A datum or base line is drawn through the center of the street and the readings are plotted to a convenient scale. The coloring remains the same, green for satisfactory conditions and red for the reverse. At a glance a person can determine the potential difference existing between the cable sheaths and any one structure. It is possible to tell if there is a gradual increase or decrease in potential and also the relative magnitude of the difference throughout the system.

In Fig. 3 a more elaborate scheme for illustrating the potential difference is shown. This method shows the relation between distance and potential difference.

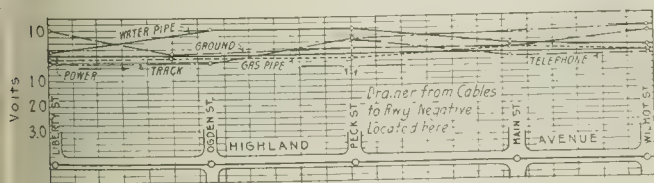


FIG. 3—RELATION BETWEEN DISTANCE AND POTENTIAL DIFFERENCE

It is particularly adapted for use in cases where the subway systems extend radially from one generating station to several substations. Each arm of the system may be plotted as a unit on a separate sheet.

The subway system is laid off to a convenient scale as shown in the lower part of the diagram, and the manholes are definitely located as related to distance

from the generating station. The streets are then built around the subway system so as to make the location of manholes convenient by reference to the street intersections. The vertical scale is laid off in volts, the portion above the datum line being treated as positive and that below as negative. The potential of the cable sheath is assumed as zero and the potentials of the other structures are referred to the sheaths.

For instance, assume that the potential of the cable sheath is minus two volts to a water main. In other words, the potential of the water main is two volts higher than that on the sheath so that the curve representing the water main would pass through a point two volts higher than the datum or cable-sheath line at this location. Assuming that there is an exchange of current, structures located above the datum line indicate a higher potential and that the current is flowing from these structures onto the cable sheaths. If the structures are represented by curves below the line of the cable sheaths, the current is flowing away from the sheaths onto the other structures.

The advantage of this chart is that the potential differences of all structures are indicated on the one chart

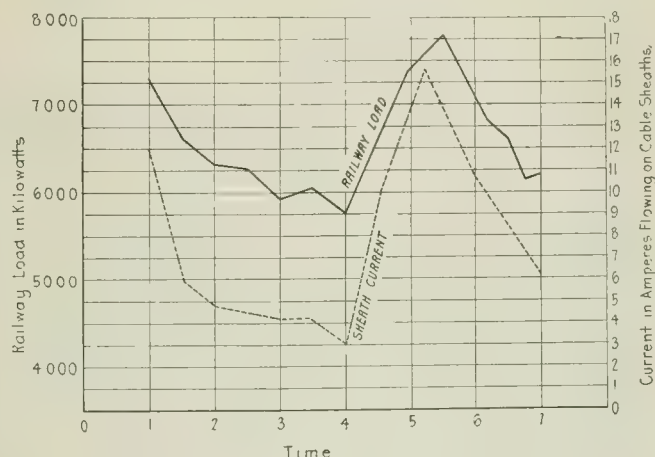


FIG. 4—OBSERVATIONS OF SHEATH CURRENT WITH DIFFERENT RAILWAY LOADS

making comparison easy. The relationship and magnitude of the differences are shown so that any abrupt change may be analyzed.

The mere acquiring of data as to the potential differences in a cable system is not by any means the most important work in an electrolysis survey. The potential differences will by virtue of their magnitude and direction indicate where the most damage is likely to occur from electrolysis. However, electrolysis occurs chiefly where current leaves a sheath and flows to the earth. Furthermore, the fact that current flows onto the sheaths is not always an indication of the most satisfactory condition, since the current is likely to become excessive and provisions must be made by the use of drainers to remove the currents or to reduce them. Hence it is of importance that current readings be taken in conjunction with the potential differences so as to determine the presence and the magnitude and the direction of the currents on the cable sheaths.

To determine the current, the potential drop is taken along the sheath for a certain distance, and, knowing the resistance, the value of the current is computed. These values, together with the direction of the current, may be entered on the charts. In Fig. 3 a drainer is

located as indicated and the current is flowing toward the drainer and thence overhead to the railway negative.

These surveys may in some instances reveal considerable variation of current on the cable sheaths. It is sometimes well to take current readings over a period of time so as to ascertain the maximum and minimum as well as the average value of the current. There are several forms of recording meters which may be attached to the cable sheaths and will give the drop on the cable sheath over several days so that a continuous record of the current flowing may be obtained. The record as taken from the recording meter and the railway load curve extending over the same period may be plotted together as in Fig. 4. This chart will aid in establishing that the current on the sheaths is due to the leakage from the railway tracks, as there is a marked similarity in the form of each curve.

The values of the current flowing on the cable sheath may be plotted against distance as in the case of potential differences illustrated in Fig. 3. This form of curve will show the current increments as the cables near the station and will point out the localities in which the greatest leakage is present. The current increment should be uniform as the station or a drainage connection is approached. These methods are only a few of the numerous forms in which electrolytic survey data may be plotted. The charts will in most cases be of great value in analyzing the trouble and selecting an appropriate remedy.

THE CANTONMENT—A CIVIC OPPORTUNITY AND DUTY

Experience of Central Station Manager in Rockford, Ill., in Assisting His City to Secure and Serve One of the National Army Camps

When the choice of cantonment sites was under consideration at Washington electric utility executives in many cities were confronted with a civic opportunity and a chance to perform a national duty.

Adam Gschwindt, vice-president and general manager Rockford (Ill.) Electric Company, saw the opportunity. Within the Chamber of Commerce, of which he is past-president, he at once organized a committee of eight, representing the leading basic industries. It was composed of a real estate man, a financier, a newspaper man, a steam transportation authority, an electric transportation executive, a lumber and fuel dealer, a water supply man and an electricity supply man. This committee was on its way to Washington within a few hours. It submitted to the War Department the advantages of Rockford as a cantonment site. Rockford has been dry for eight years. Organized vice has not existed for fifteen years. Its water supply is excellent. The camp site lies between two rivers. It had natural advantages necessary for a rifle range. Transportation facilities and electric supply were available. The city is large enough to take care of the soldiers' visitors. And the site was not far from Chicago, from which a large part of the Illinois quota of the new National Army will be drawn.

Considerable political ingenuity, time given to various viewing boards, frequent trips to the national capital—all hopefully and cheerfully donated—were finally fol-

lowed by the good news that Rockford would get the camp. That was the signal for the committee to begin real work. There were leases to be secured on 4000 acres of land, some land to be purchased outright, property damages to be met, \$100,000 to be raised and roads and electric lines to be built. All this had to be done immediately, and in the face of none too much willingness on the part of some property owners.

When all preliminary necessities had been carried out successfully and skillfully, and workmen and material began to arrive, people began to visualize—to get the proper perspective on Camp Grant. The sound of so many carpenters hammering that the noise is like the patter of raindrops is certain to awaken realization of what is required to construct in eight weeks a city to house 40,000 men. Such things have been found more successful in conveying the proper impression than statistics, impressive as figures are.

The camp site, for instance, comprises 4000 acres. Land leases were taken at \$20 an acre a year. The camp will house 30,000 to 40,000 men, or two-thirds as much as the total population of Rockford. In construction 6500 workmen and 1000 soldiers are employed. Wages of workmen range from \$3.50 per day for water boys to \$8 a day for certain mechanics, with the average about \$6. The connected electric load at the camp will be about 1000 kw. The original lamp order was for about 40,000 40-watt incandescent bulbs.

These things and more the committee of eight, under Mr. Gschwindt as chairman, had not only to grasp for itself, but also to digest for the community. The committee saw that getting the camp was an incident compared with serving it. And serve it they must, was the unanimous resolve, for both patriotic and selfish purposes. As one man put it, "What that major did not want was nothing." The committee of eight has supplied the major's wants for the men in his charge from smoking tobacco to bridges. Nothing has been impossible.

The camp, now under roof, is connected by concrete and macadam roadways with the city. Electric light and power and telephone service are provided. For the electric utility man, who was in the thick of it from the start, the civic opportunity has been grasped and the first phase of the national duty is almost fully discharged. The result is twofold.

First, the direct effect on the income account, even as early as July, from increased use of commercial lighting by merchants who by catering to the 7500 men doubled weekly sales. Second, the indirect result visible in the public attitude. Even in local politics the complexion of things has changed for the utilities; especially for the electric railway, which has a franchise pending this will be valuable immediately. The utility executives, by their successful and whole-hearted participation in the cantonment program, have placed their companies upon a plane so high in the public mind that it would be political suicide for the demagogue to use his old-style attack.

With the full quota in training the soldiers will practically quadruple the actual earning populace of the city. To realize what will be the result of Rockford's attainment of its ambition—namely, that the camp become permanent—is to appreciate fully the importance of what Mr. Gschwindt terms "the civic responsibility of the utility manager."

OPERATION OF ICE-PLANT MOTORS AT CONSTANT LOAD

By Varying Other Factors to Insure This Condition
Maximum Use of Equipment Is Obtained
Under Best Conditions

The advantages of the exact control of machinery permitted by the use of electric power are well demonstrated in the case of the Greater New York Ice Company's plant, which receives energy from the Edison Electric Illuminating Company of Brooklyn. Since the ice company pays for energy on a maximum-demand rate, it has undertaken to take full advantage thereof by operating its machines on the basis of power input, keeping that constant and varying other factors to meet the changes in operating conditions. With all known factors held constant, variations in the power curve point directly to unsuspected troubles—hot bearings, etc.—which are immediately hunted down and remedied. In consequence this plant is operated at a very high efficiency, it being claimed that 250 tons (227 t.) of ice are produced in twenty-four hours by 350 hp. in motors operating the compressors. At the same time the cost for the energy consumed is minimum.

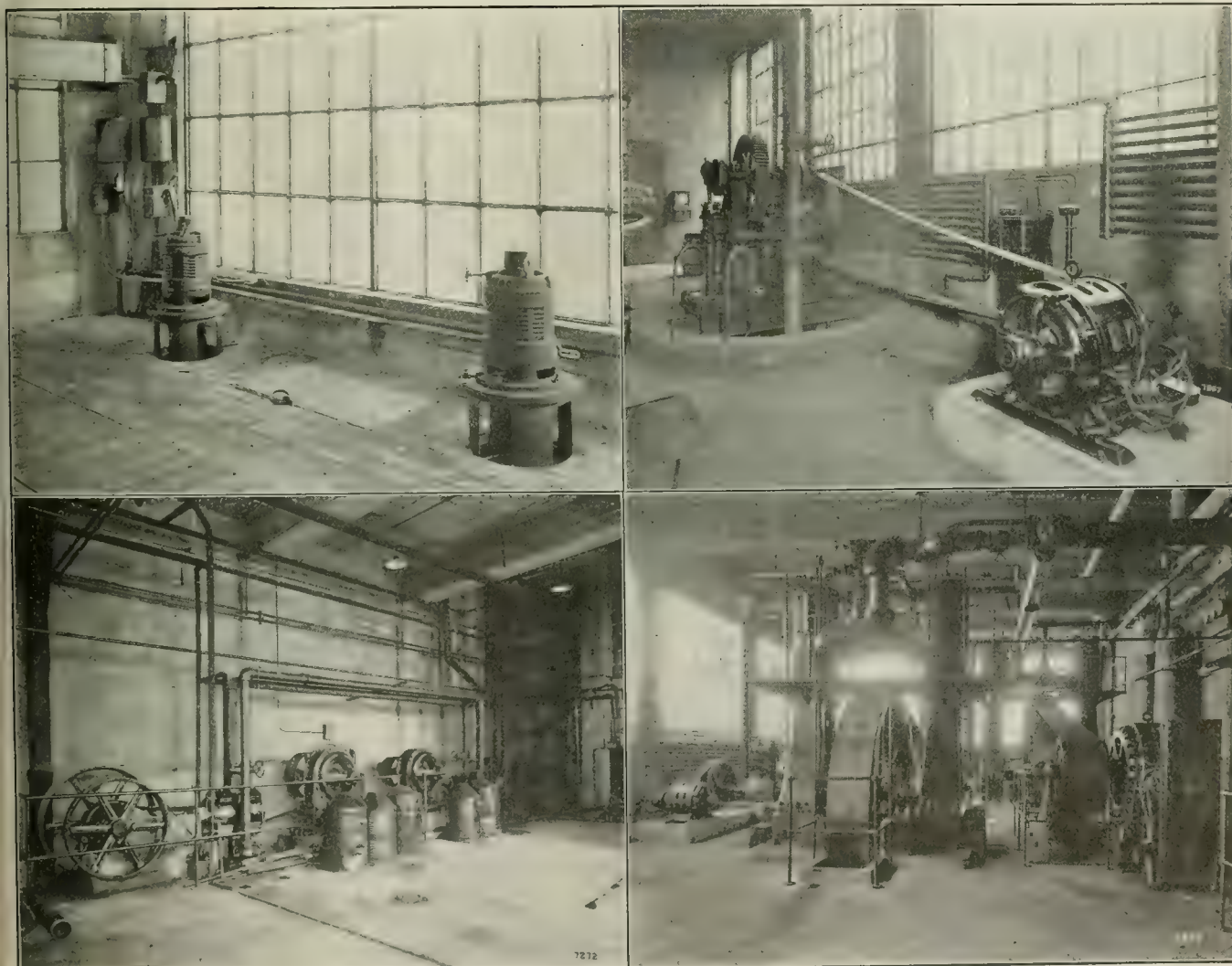
As is the case with many modern ice plants, the

Greater New York Ice Company uses raw water only. Water from the city mains and from wells on the property is pumped into the cans after being purified and filtered and is frozen while being agitated by compressed air. In many plants it is necessary to pump out the core water from each can, because of the impurities that collect in it, and add fresh water before the final freezing; but the water supply of the Greater New York Company is so good that this does not have to be done.

Energy is received at 6600 volts in a compartment from which all unauthorized employees are excluded. In this compartment are the high-tension switchboard, with its meters and section switches, and the transformers which reduce the voltage to 440 volts for power purposes and 110 volts for lighting.

DESCRIPTION OF THE EQUIPMENT

The main equipment of the plant consists of two York compressors, one a 16-in. by 18-in. (40.7-cm. by 45.7-cm.) machine driven by a 200-hp., 480-r.p.m. Westinghouse squirrel-cage motor, and the other a 14-in. by 16-in. (35.6-cm. by 40.7-cm.) machine driven by a 150-hp., 725-r.p.m. motor. These motors are started by auto-starters, which first apply low voltage, and then,



SOME METHODS OF APPLYING MOTORS IN NEW YORK ICE PLANT

The brine agitator motors shown in the upper left-hand corner are rated at 2 hp. each and require no starting compensators. To the right is a 25-hp. motor driving a 500-

gal.-per-minute pump with a 70-ft. lift; it is used in winter to operate a 24-ton compressor. Below at the left are two air compressors driven by 40-hp. motors; at the

right are three compressors (a 24-ton auxiliary, one 14-in. by 16-in. and one 16-in. by 18-in. machine) driven by 25-hp., 150-hp. and 200-hp. motors respectively.

when the motor is nearly at full speed, connect the motor directly across the line.

In addition, there is a small 24-ton (21.8-t.) York compressor, driven by a 25-hp. Westinghouse squirrel-cage motor, which is used to keep the rooms and tanks cold on nights and Sundays in winter when the rest of the plant is shut down. As this machine is idle in the summer, its motor is used to drive a 500-gal.-per-minute pump (1893-l.-per-minute) with a 70-ft. (21.3-m. lift during this season when additional water supply is needed. Two compressors serve to supply the air used for agitating the water in the cans while freezing. Each compressor is belted to a 40-hp. General Electric motor.

Altogether, there are 2802 cans, providing a capacity

of 250 tons in twenty-four hours. These cans are immersed in the cold brine, which is kept in motion so as to reach all the cans uniformly by agitators driven by 2-hp. vertical Westinghouse motors. These motors are started by simple switches, which connect them directly across the line.

When the freezing is completed three cans are lifted at a time by an electric hoist and taken to the end of the room, where they are dipped into warm water. This loosens the ice cakes, and these are dumped out and are lowered to the storage room below by an automatic elevator, which does not start until all three cakes are on board.

N. S. Friedmann, 90 West Street, New York, was consulting engineer for the ice company.

Modernizing Fifteen-Year-Old Steam Plant

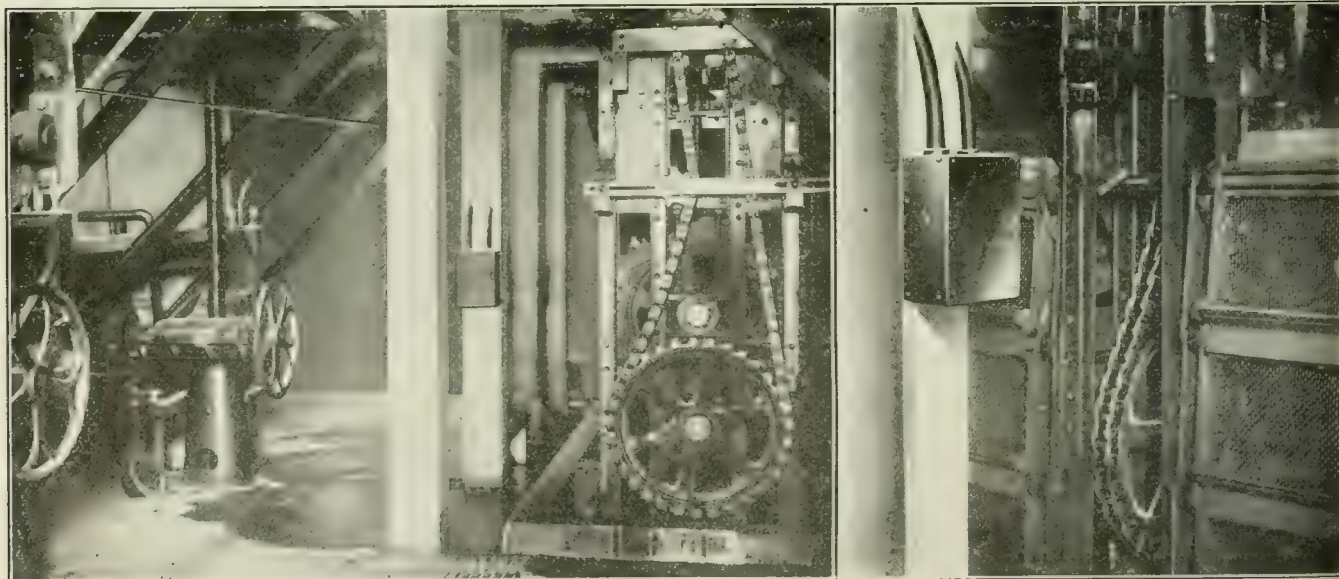
Second Installment of a Series of Articles on the Rehabilitation of the Ashley Street Station of the St. Louis Company—Features of New Circulating-Water System and Method of Construction

BY JOHN HUNTER

Chief Engineer Union Electric Light & Power Company

THE effect that growth of load and developments in steam and electrical equipment have had on the Ashley Street station of the Union Electric Light & Power Company, St. Louis, Mo., was outlined in the Aug. 4 issue of the *ELECTRICAL WORLD*, attention being called to additions and changes which are under way to make the plant a modern steam installation. In this issue the features of the circulating-water system which is being installed for the condensers will be described

river wall of the building, there being two gates in each of the two intakes, the upper for use during high stages of the river and the lower for use during lower stages of the river. Thirty-six-inch and 42-in. (91.4-cm. and 106.6-cm.) pipes carried water from these intakes across and below the basement of the boiler room and supplied water to a common 54-in. (137.1-cm.) suction header. This header was connected with the suctions of two 70,000,000-gal. (264,973,300-l.) centrifugal



FIGS. 1 AND 2—SLUICEGATE-OPERATING STANDS, AND VIEWS IN REVOLVING-SCREEN ROOM

and methods of overcoming certain construction difficulties will be discussed.

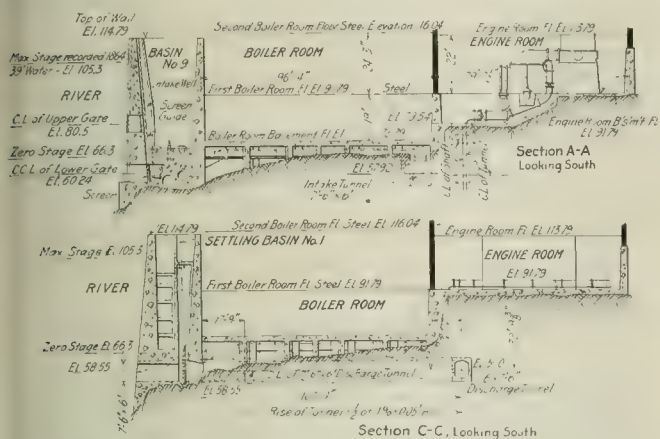
All of the condensing equipment for the generating units in this station is supplied with water pumped directly from the Mississippi River, upon the banks of which the station is situated. The original circulating-water intakes consisted of openings through the east

pumps, which in turn supplied cooling water to the surface condensers through a common discharge header. Tandem-compound engines rated at 1000 i.hp. drove the centrifugal pumps.

In extending the station three additional 25,000-kva. turbines are being installed. The condensers serving these units each have 40,000 sq. ft. (3716 sq. m.) of

cooling surface, requiring 50,000,000 gal. (189,266,000 l.) of circulating water per day under full load and with normal river temperature. To supply this additional 150,000,000 gal. (567,800,000 l.) per day necessitated the rearrangement of the circulating-water system and involved the building of new intakes.

The arrangement decided upon involved the abandonment of the old discharge lines which return the circulating water from the condensers to the river. This



FIGS. 3 AND 4—CROSS-SECTIONS THROUGH INTAKE AND DISCHARGE OPENINGS TO RIVER AND REVOLVING SCREEN ROOM

was made necessary because the river end of these pipes was in the exact location at which new intakes could be placed to best advantage. Moreover, these outlets were at a point too far upstream with reference to the general arrangements of intakes, the logical point for the outlet being at the extreme down-stream end of the plant. Therefore the new circulating-water discharge was made of such size and installed in such a position that it would carry all of the water from all generating units to the river at the extreme down-stream end of the plant.

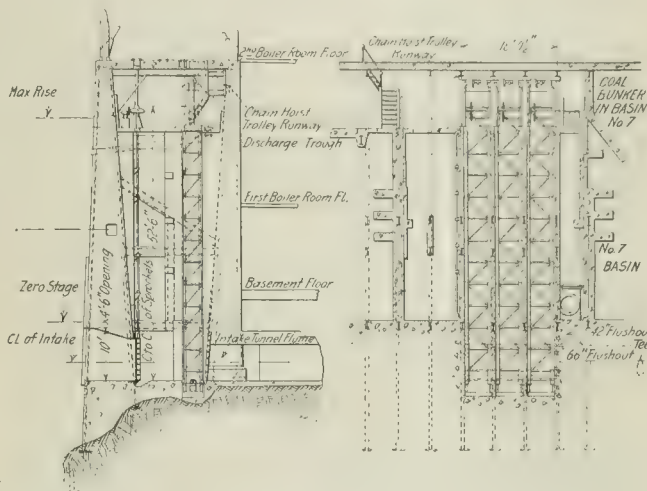
It was early decided that all new circulating-water lines should be tunneled through solid rock which underlies the station, these tunnels to be lined with reinforced concrete as the nature of the rock would require. The discharge tunnel was built first. Construction shafts were first sunk at suitable places in the boiler room and the tunneling in the rock was carried forward almost to completion without connection with the river end.

Practically all portions of the tube, whether open-cut or tunnel sections, were lined with a 12-in. (30.4-cm.) reinforced-concrete coating next to the rock. Inside this was applied a four-ply waterproofing membrane made of high-grade roofing paper mopped into place with hot asphaltum. On this membrane was then poured a 4-in. (10.2-cm.) reinforced-concrete lining designed to protect the waterproofing and take up all manner of wear within the tunnel.

The concrete for the tunnel lining was mixed in the boiler-room basement, delivered to a 1-yd. (0.76-cu. m.) bucket carried on rails within the tunnel and poured therefrom by hand into the forms. The concrete for the roof of the arch, after having been thoroughly tamped into place and allowed to set, was found to have settled away from the roof of the rock, leaving a gap in some cases 0.25 in. (6.4 mm.) wide. This opening was filled and the bond between the roof of the lining and the rock assured by use of a cement gun. At intervals of about 10 ft. (3 m.) a 2-in. (5.1-cm.) hole was drilled

in the roof of the tunnel and thin grout forced into the openings under 60 lb. (4219 gm. per sq. cm.) air pressure.

The construction costs on this tunnel were approximately as follows: Excavation per linear foot, \$14 (\$46 per m.); concrete linings per linear foot, including forms, \$5.50 (\$18 per m.).



At the same time excavation was being carried on beneath the building, work on the river end of the discharge tube was being pushed forward. This involved the building of a chamber which would accommodate a 6-ft. by 8-ft. (1.8-m. by 2.4-m.) sluiceway and extensive dredging and excavation of the riverbed for the tunnel outlet.

The method followed in cutting through the river wall was somewhat novel. An open caisson was sunk on the river side of the outer wall to a depth of approximately 40 ft. (12.2 m.) below the water level. The edges were heavily cushioned so that when brought up tightly against the outer concrete wall a watertight joint would be formed. Pumps were installed inside the caisson, and when all preliminary work had been completed and the water withdrawn the tunnel was extended into the caisson.

One of the most difficult operations in connection with the new discharge tunnel construction was the cutting over of the four 12,000-kw. condenser discharge lines into the tunnel without interrupting electric service. The work of removing portions of the old headers and replacing them with other pipe and connections to the new tunnel had to be done between 1 a. m. on Saturday and 4 p. m. on the following day. One seam of rivets in each of the elbows was left undrilled as a precaution in case of misfit. Drawing up of the plates, drilling of new holes and driving of rivets occupied a large portion of the available time.

This discharge tunnel, which runs practically the full length of the station, lies 33 ft. (10.1 m.) below the level of the old basement floor. While driving this tunnel it was necessary to blast out shafts and insert castings for the reception of future discharge connections from the new turbines. The suction tunnel from the new intakes into the new suction headers is approximately at the same elevation as the new discharge tunnel, both of which are about 10 ft. (2 m.) below the suction header of the old circulating-water system.

In building the new intakes advantage was taken of

the two walls around the plant to accommodate nine compartments which would serve as settling basins for the water purification system. One of the basins was used as a screen chamber for the new intakes. Through the outer walls two new intake openings were blasted in a manner similar to that employed in making the discharge tunnel, using the same caisson. On the outside of the openings heavy bar screens were built, the function of which is to keep out any heavy material or driftwood floating along the river. Inside of the same wall were installed two heavy sluiceways, measuring 6 ft. by 8 ft. (1.8 m. by 2.4 m.). These gates open into the screen chamber proper, which was formerly a settling basin. Three revolving screens spanning the intake tunnel are installed in this chamber.

Since, as mentioned before, the discharge from the old circulating-water system was in close proximity to the site selected for the new intakes, piping was so laid out and connected that it is now possible to discharge water from either one of the circulating-water systems

pose. The necessity of such large units was due in this case to the wide range in the stage of the Mississippi River at St. Louis, this varying from -4 ft. (-1.2 m.) to $+36$ ft. ($+10.9$ m.), changes as rapid as 6 ft. (1.8 m.) in one hour having been experienced. The original intakes of the station were equipped with screens mounted in frames which were lifted and lowered by means of motor-driven cables, there being a pair of screens in front of each intake gate. The operation of the new screens, however, is so successful and they fulfill the objects for which they were built so well that it is anticipated the old sliding screens will be replaced by more modern revolving screens at an early date.

One of the interesting features in connection with the operation of the new discharge tunnel is the fact that a very marked siphon effect is obtained which reduces the power required to drive the circulating-water pumps to an almost negligible quantity. During the extremely low stages of the river, however, it has been found that this siphon is less effective owing to the carrying in of considerable quantities of air with the circulating water. At the higher stages of the river this action is not noticeable.

The revolving screens were made by the Chain Belt Company, Milwaukee, Wis., the grouting machine by the Ransome Concrete Machinery Company, Dunellen, N. J., and the circulating pump by the Wheeler Condenser & Engineering Company, Carteret, N. J., which also furnished the condensers and condenser auxiliaries. The circulating-water pump, which is driven by a turbine made by the Kerr Turbine Company, Wellsville, N. Y., is the single-runner type designed for 3600 gal. (13,627 l.) a minute against a head amounting to 30 ft. (9.1 m.).

Other features of the Ashley Street station will be presented in subsequent issues of the *ELECTRICAL WORLD*.

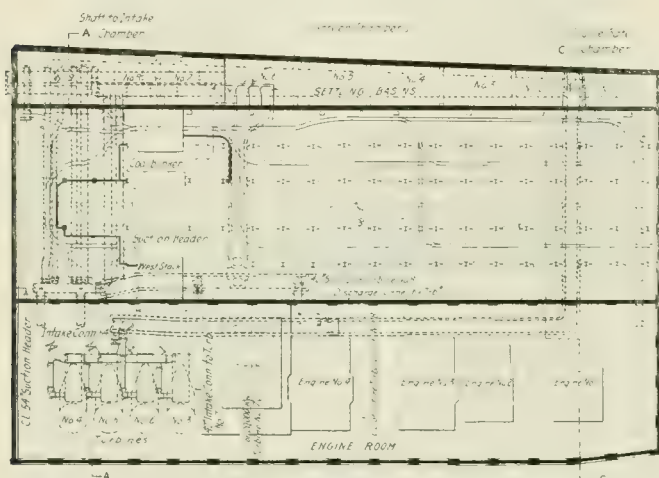


FIG. 5—ARRANGEMENT OF CIRCULATING-WATER PIPING

back through the intakes of the other system, thereby flushing out all the drift or sand which is suspended in the river water in great quantities.

The new suction tunnel, besides being situated in such a place as to furnish water to the three new 25,000-kva. turbines, was connected at one end of the cross tunnel to the 54-in. (137.1-cm.) suction header of the old system. It is thus possible to supply water to any or all of the generating units in the station through either of the suction intakes. The elevations of the suction tunnels are such that it is possible to supply water to the circulating pumps when the river is 8 ft. (2.4 m.) below the zero stage. The lowest stage of the river which has ever been recorded in the St. Louis district is 4 ft. (1.2 m.) below zero. Hence the station is well protected against possible interruption of circulating-water supply through low stages of the river. The suction tunnel is designed for a maximum flow of 5 sec.-ft. (0.14 cu. m. per second) while pumping the maximum quantity of 300,000,000 gal. (1,135,600,000 l.) per day. This quantity of water is approximately three times the amount used by the entire city of St. Louis for all purposes.

The revolving screens used in connection with the new installation are mounted on 53-ft. (16.2-m.) centers, these screens being at the time of their installation the longest that had ever been built for such pur-

A Lamp Filament for Motion-Picture Machines

Because in any faint source of light the rays entering the condensing buses necessarily form a conical beam, Albert S. Moffat of Belmont, Mass., proposes, in patent No. 1,222,119, to dispose an incandescent-lamp filament in a hollow pyramidal form the base of which is similar in contour to the picture space to be illuminated, and to have the filament composed of a long helix wound in a spiral about such a pyramid.

To this end the filament will not only intensify the light emitted therefrom but will concentrate it upon the rectangular space occupied by a motion-picture section. In the usual form of light the rays issue in the shape of a cone whose base is circular and consequently must lap over the rectangular picture space to an extent fully equal in area to that of the space utilized. By having the filament in a helix a maximum of light rays is obtained in the minimum of space. By having the helix wound as a hollow pyramid the emitted rays are concentrated upon a smaller space than would be the case were the helix coiled in a single plane parallel with the plane of the picture. This is because the rays from the inner winds can pass the outer winds only by issuing in a straight line within the outer winds, and so on to the film, conforming in contour to the rectangular shape of the picture.

STATION AND OPERATING PRACTICE

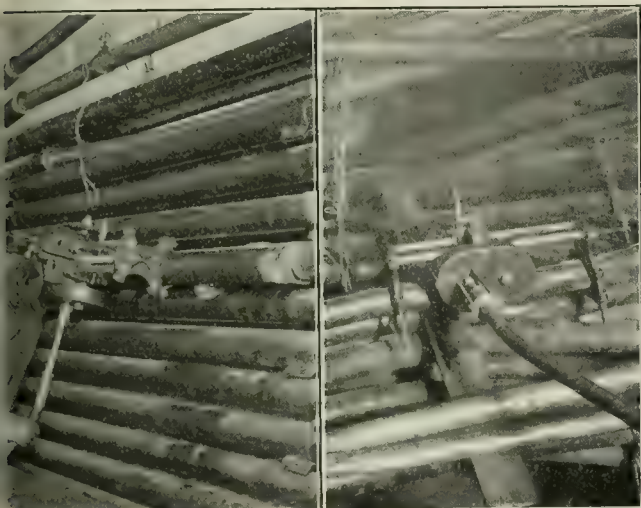
A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

REMOVING IRON PIPES FROM ENERGIZED CABLES

Tool Consists of a Hand-Operated Key-Seating Machine Which Is Similar to a Portable Milling Machine

BY W. R. DEYO

Conditions sometimes arise in cable work where it is desirable to remove the conduit from cables without purposely or accidentally interrupting service through the cable. Such conditions arise when a new manhole is built over existing pipes in a subway run, or in cable



REMOVING CONDUIT FROM CABLE IN TWO DIFFICULT POSITIONS

vaults where the pipes extend directly from the manhole to the distributing point or bus, as the case may be.

Several methods for removing such pipes have been tried, but have been found objectionable for various reasons. Either the process was slow and expensive or the cables were exposed to serious mechanical injury. Probably the first method employed was that of the "cape chisel" and hammer, the chief objection to which was its slowness and consequent expense. Another method is the use of a tool which works on the principle of a can opener. This tool is very satisfactory for removing 3-in. (7.6-cm.) iron pipes containing small cables where there is enough clearance between the pipe and cable to allow the cutter to enter without denting or damaging the lead cable sheath. It can be used successfully on cables where the clearance between pipe and cable sheath is $\frac{3}{4}$ in. (1.9 cm.) or greater.

The oxy-acetylene process has been used with considerable success in certain cases. However, the liability to burns, in spite of asbestos and copper shields, is so great that concerns specializing in this type of work will not guarantee their work to be free from damage to cable sheaths.

The company with which the writer is connected is

using a tool which consists primarily of a hand-operated key-seating machine. This tool is nothing more or less than a portable milling machine with an adjustable head for raising or lowering the cutter to the desired depth and a lateral feed for moving the cutter along the length of the pipe, which can be operated either by hand or automatically. This machine can be adapted to motor drive by means of a flexible shaft and a gear reduction. A carbon-steel slotting cutter $2\frac{1}{2}$ in. by $\frac{3}{64}$ in. (6.4 cm. by 1.2 mm.) ground on the sides for clearance is very satisfactory, but a wider cutter can be used satisfactorily if desired.

The maximum permissible peripheral speed of carbon-steel cutters in wrought iron is approximately 70 ft. (21.3 m. per minute). A $\frac{1}{2}$ -hp. motor is sufficiently large for operation, but motors of this size usually have a speed of about 1800 r.p.m., so that a gear reduction of sixteen to one is necessary to give the proper speed to the cutter. At the above speed the machine will remove about 3 ft. (0.9 m.) of pipe per hour. With high-speed steel cutters the operation can be speeded up considerably, but it is almost impossible to obtain them at present. In localities where power is not available, the machine can be operated by hand at a fairly good rate of speed. Several hundred feet of pipe have been removed from working cables by this company without a single interruption of service or even a scratch on a cable sheath due to the cutter.

KNOWING MOTOR LOAD IS AN IMPORTANT MATTER

Individual Ammeters Are Not Necessary for Each Motor Circuit if Provision Is Made for Temporary Connection

BY J. A. HORTON

No purchaser of an electric generator hesitates to pay for an ammeter by means of which he may know the current that his machine is carrying. When it comes to buying an ammeter for a motor, however, "that is another story." Perhaps this averseness or rather indifference to knowing what a motor is doing is due to there being so many more motors than there are generators, the hasty assumption being that each motor would require its own ammeter. Such is not the case. Suitable and inexpensive provision can be made on each motor circuit so that a portable ammeter can be temporarily cut into that circuit without interrupting operation. One simple way is to tap both terminals of one set of fuse clips so the portable ammeter leads may be connected thereto and the fuse then removed. Of course it would be advisable to fuse the ammeter circuit for the same value as the circuit, but this is not absolutely necessary, as the other fuse or fuses in the same circuit may be depended on for protection. A short-circuiting switch is advisable to protect the in-

strument from heavy starting currents, even when it is installed permanently. The switch should be kept closed except when it is desired to read the current.

An instance where such a device would have saved money is cited below: An old-style two-pole, compound-wound, 500-volt generator had been used as a shop motor for years. Beginning with one lathe, a drill press, a banding machine and a field coil winder, lathes, banding machines, slotters, coil machines, presses and a vacuum fan had been added without any thought of the ultimate capacity of the motor. One day it was noticed that the armature was smoking, and it occurred to some one to measure the current. This was done and the current was found to be 75 per cent more than the rating of the motor. The armature was left in service, but was relieved of some of its load by applying individual motors to several of the connected machines.

MEASURING LEAKAGE AND CHARGING CURRENTS

Method Employing Ordinary Instruments Available for Determining Suitability of Rubber Gloves and Insulators

BY W. B. BUCHANAN

The leakage and charging currents in rubber gloves and insulators are very small in value even at high voltages, so unless special instruments are available for measuring them directly other less direct methods must be employed. The following method was developed to obtain results by means of instruments in common use.

The apparatus employed consisted of a 25-cycle, 110-220/16,500-33,000-volt testing transformer, a 150-volt voltmeter, ammeters of 1-amp. and 3-amp. range, and a 2-amp., 150-volt wattmeter. A 110-volt exploring coil on the transformer supplied potential to the wattmeter and voltmeter, while the current coils of wattmeter and ammeter were connected in the primary and short-circuited by a knife switch at all times except when the meters were being read.

To use the apparatus the values in the low-tension side are read first with the high-tension open-circuited, then with the gloves or insulators between terminals. The change in the resulting readings in the primary is due to the load only and is the low-tension equivalent of the high-tension current change. In this case the voltage ratio of the transformer was 300 or 150.

With load the increase of the power component of current, as shown by the wattmeter, above that obtained with the same exploring coil voltage on open circuit is the primary equivalent of the leakage current on the high-tension side, while the reduction in the wattless component that is due to the load is the primary equivalent of the charging current. On account of the fact that the exciting current at no load has a very large wattless component, a very small charging current may be detected and measured accurately enough for comparative purposes. The leakage-current measurement depends mainly on the sensitivity of the wattmeter and personal errors in observation.

An example worked out from the results of an actual test will serve to illustrate the method: From readings taken on open circuit the values of 0.64 amp. and 33.4 watts were obtained with an exploring-coil voltage of 66.7 volts corresponding to a high-tension voltage of

10,000 volts. With a 12-in. (30.5-cm.) rubber glove subjected to a 10,000-volt water-to-water test, the readings were found to be 0.563 amp. and 35 watts.

The power component of primary current at no load was $33.4/66.7 = 0.501$ amp. and at full load $35.0/66.7 = 0.525$ amp. Hence the actual leakage current in high-tension side was $(0.525 - 0.501)/150 = 0.024/150 = 0.00016$ amp. The leakage current could have been obtained by dividing the increase of watts input by the high-tension voltage, thus $(35 - 33.4)/10,000 = 0.00016$ amp.

The wattless lagging component due to exciting current on open circuit is $\sqrt{0.64^2 - 0.501^2} = 0.398$ amp. That due to exciting current on load is $\sqrt{0.563^2 - 0.525^2} = 0.202$ amp. The difference, $0.398 - 0.202 = 0.196$ amp., is the low-tension equivalent of the charging current in the high-tension side, hence its value at 10,000 volts is $0.196/150 = 0.0013$ amp.

These results are quite consistent with those given by C. W. Ward, in the May 12, 1917, issue of the ELECTRICAL WORLD. Two gloves which had slightly greater leakage current stood the 10,000-volt test for one minute, but as the wattmeter showed slight increase in readings at this time, the voltage was continued until at the end of three minutes the gloves punctured. It appeared from these results that a leakage current in excess of that usually obtained for the given type of gloves indicates a local weakness which causes failure.

This method was also used to obtain corresponding results on telephone insulators, with very satisfactory results. At 15,000 volts and 25 cycles the measurements indicated 1.2 to 1.7 watts loss on different types of insulators and a charging current of 0.0013 amp.

For exact measurements the wave form of voltage supplied should be very close to the sine wave, but for comparative tests, where the same supply is used, this requirement is not so essential.

PORTABLE HOIST DESIGNED FOR HANDLING STATION APPARATUS

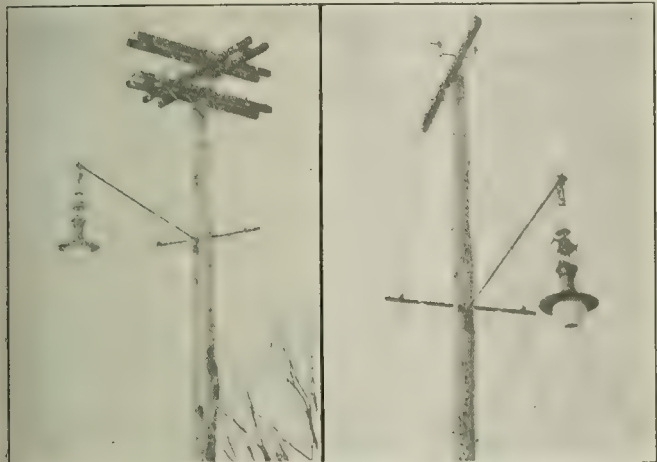
Mounted on Carriage and Driven by an Electric Motor, It Is Used to Handle Substation Apparatus and Transformers

To facilitate the handling of substation apparatus and transformers a portable electric-motor-driven hoist or winch was developed by the Puget Sound Traction, Light & Power Company, Seattle. This device consists of a 7.5-hp., 600-volt direct-current motor geared to an intermediate shaft through two-gear ratios and mounted on a channel-iron truck. A clutch is provided on the intermediate shaft for operating the main drum. By means of the gear ratio a rope speed of from 10 ft. to 30 ft. (3.05 m. to 9.1 m.) per minute is obtainable. By means of the clutch on the intermediate shaft the main drum may be disengaged and the niggerhead used independently. The winch is provided with two heavy forged hooks that are used for anchoring it. A 600-volt direct-current motor was used on account of the accessibility of the 600-volt direct-current energy supply in all parts of the district served. This hoist was described by C. F. Terrell of the Puget Sound Traction, Light & Power Company at the recent annual convention of the Northwest Electric Light & Power Association at Spokane, Wash.

STURDY MAST ARMS FOR STREET LAMPS

Lamp-Supporting Arm Made of Pipe and Guyed from Angle-Iron Cross-Arm Carrying Insulators for Risers from Lamp

BY N. NESBITT TEAGUE
Augusta-Aiken Railway & Electric Corporation, Augusta, Ga.
For supporting its street arc lamps the Augusta-Aiken Railway & Electric Corporation uses mast arms made of galvanized pipe, the horizontal guys for which



CONSTRUCTION EMPLOYED FOR SUPPORTING STREET LAMPS

are fastened to the ends of an angle-iron cross-arm. The latter also supports insulators for the lamp circuit, as shown by the accompanying illustration. The angle-iron cross-arm is 2.5 in. by 2.5 in. by 6 ft. (6.4 cm. by 6.4 cm. by 1.8 m.). Angle iron used for a cross-arm has a neater appearance and is stronger than the wood cross-arm which was formerly used. The iron is drilled to hold Locke pins, which hold the insulators for attaching the loops to the lamp.

The pipe is purchased in the district, the fittings being the only standard parts. The cost of these mast arms is very reasonable. All mast arms, mast-arm cables and pulleys are grounded, the ground wire extending down the side of a pole and terminating in a 6-ft. (1.83-m.) pipe driven into the ground at the foot of the pole. This work was carried out under the direction of J. J. Borger, general superintendent of the electrical department.

POWER NEEDED BY MOTORS IN WOODWORKING PLANT

Tests of Machines Each Equipped with More Than One Motor Illustrate Fluctuating Character of Load

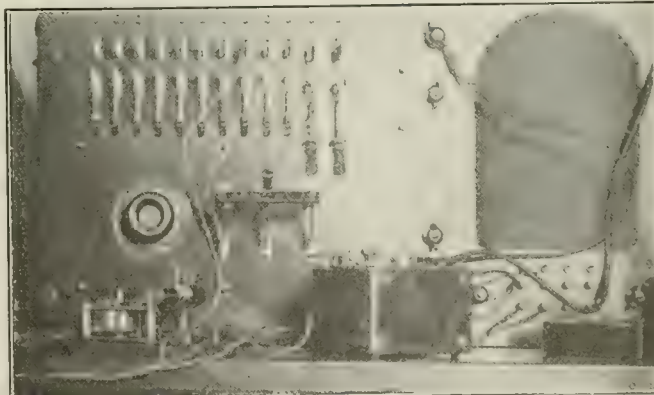
In the factory of the Rockwell Manufacturing Company, a woodworking concern in Milwaukee, tests were made on two machines in the company's plant, each of which is equipped with more than one driving motor. The first test was made on a 30-in. (76.2-cm.) Whitney planer, equipped with two 5-hp. motors. Each motor consumed 1.1 kw. driving the machine idle, the load rising to approximately 1.15 kw. per motor when the feed was started. The spindle speed of the planer was 3550 r.p.m. When the planer was taking a 1/16-in.

(1.58-cm.) cut from four pieces of hard wood 2 ft. (60.96 cm.) in length each motor consumed 2 kw. The spindle speed of the machine at that time was 3500 r.p.m. There were occasional momentary surges to 3 kw. on each motor, but the load was fairly steady at 2 kw. during the cut. When the planer was operating with high-speed feed, taking a 5/16-in. (7.93-cm.) cut from a piece of maple 22 in. (55.88 cm.) wide, with a spindle speed of 3200 r.p.m., the motors took 6.5 kw. each, the load occasionally rising sharply to 10.5 kw. When this cut was diminished to 1/4 in. (6.35 cm.) with the high-speed feed the load was 6.5 kw., occasionally rising sharply to 9.5 kw. for each motor connected.

The other test was made on a three-drum, 66-in. (167.64-cm.) door sander, equipped with four motors. The 7.5-hp. motor attached to drum No. 1 consumed 1.2 kw. driving the drum idle. During the sanding operation the power consumption varied from 2.5 kw. to a trifle over 4 kw., but it was fairly steady during the majority of the time, being between 3 kw. and 4 kw. The 7.5-hp. motor driving drum No. 2 consumed 1 kw. driving the drum idle and required from 2 kw. to 8 kw. while operating the drum under load. The 7.5-hp. motor operating drum No. 3 consumed 1 kw. with the machine idle and took from 1.5 kw. to 5 kw. during the sanding process. The 2-hp. motor which operates the feed required 0.3 kw. for driving the feed idle and 0.5 kw. under load.

TESTING ROTATING STANDARDS Contact Device on Clock Operates Relay Which Controls Potential Circuit of Tested Meter

A contact-making clock which has a one-fifth second movement has been developed in the meter shop of the Northern New York Utilities, Inc., of Watertown, N. Y., to help in testing rotating standards against a standard indicating wattmeter. When the clock makes contact it excites a relay which closes and opens the potential circuit of the rotating standard at the begin-



CONTACT-MAKING CLOCK BEING USED WITH ROTATING STANDARD

ning and end of a stated time, or one minute. Before this device was used it was found almost impossible to obtain two timings alike, owing to the fact that the time had to be checked by a stop watch and because the switch in the potential circuit had to be opened by hand.

This apparatus was devised by H. H. Devereaux of the meter department of the company.

CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

RATES PER KILOWATT-HOUR FOR LIGHTING OF PARKS

Bureau of the Census Publishes Data for 1916 Concerning Eighteen Cities Which Have Metered Electrical Service

The rates per kilowatt-hour for metered electric energy for park lighting in certain cities have been ascertained by the Bureau of the Census and published in the general statistics of cities for 1916. Only eighteen cities state the rates now in force, as shown in the accompanying table. Differing conditions and restrictions in lighting contracts may account for some of the variations in rates. These may be affected by franchise considerations or street privileges or other matters of a similar nature.

City	Rate per Kw.-hr.	City	Rate per Kw.-hr.
St. Louis, Mo.....	\$0.03¾	Wilmington, Del.....	\$0.05
Baltimore, Md.....	0.02	Oklahoma City, Okla..	0.06
Los Angeles, Cal.....	0.04	Peoria, Ill.....	0.04
Buffalo, N. Y.....	0.07	Wichita, Kan.....	0.05
Seattle, Wash.....	0.03½	El Paso, Tex.....	0.08
Portland, Ore.....	0.02¾	York, Pa.....	0.10
Toledo, Ohio.....	0.05	Topeka, Kan.....	0.05-0.07
Dayton, Ohio.....	0.04	Colorado Springs, Col.	0.03
Kansas City, Kan.....	0.06	Zanesville, Ohio.....	0.03

DATA FROM NORTHWEST ON ELECTRIC WATER HEATING

Sub-Committee of Northwest Electric Light & Power Association Reports Interestingly on This Subject

One of the drawbacks to the electric range is the matter of heating water electrically at a cost low enough to give satisfactory service. Considerable attention is being paid to this phase of electric cooking on the Pacific Coast, and a rather comprehensive report was made by the sub-committee on electric water heating at the recent annual convention of the Northwest Electric Light & Power Association.

Replies received to a questionnaire from thirteen companies operating in Washington, Oregon and Idaho were as follows:

Question No. 1—Are you heating water electrically?

Answer—Four, no; nine, yes.

Question No. 2—What is your rate?

Answer—One, a meter rate of 3 cents less 10 per cent, and eight flat rates ranging from \$3 to \$6 per kilowatt per month.

Question No. 3—What size and types of heaters are you using?

Answer—Nine, non-automatic circulation, varying from 1 kw. to 5 kw.; six, non-automatic immersion, varying from 0.5 kw. to 2 kw.; one, automatic immersion, varying from 1.5 kw. to 3 kw.; one, plaster type, no capacity given.

The non-automatic circulation type of small capacity seems to have been used the most extensively and the non-automatic immersion next. The consensus of opinion seems

to be that since the heaters are operating on a flat rate the small capacity non-automatic circulation type is the most popular under these conditions.

Question No. 4—How many installations have you and what is the connected load?

Answer—Stations reported a total of 1930 heaters in use with a connected load of 3560 kw.

Question No. 5—Are your consumers satisfied?

Answer—Five, yes; two, mostly yes, in some cases no; one, have been unable to meet all demands with 1500 watts; one, very little complaint.

Question No. 6—Are you connecting water heaters on double-throw switches with ranges to prevent both operating at one time?

Answer—Five, yes; four, no.

Question No. 7—Are you insulating boilers, and how?

Answer—Five, yes, with J-M felt and Keystone; one, yes, with good covering top with wool; two, in some cases; one, no.

Question No. 8—In your opinion will electric water heating increase the popularity of electric cooking?

Answer—Eight, yes; one, no.

Question No. 9—Do you do wiring for water heaters yourself or sublet it to wiring contractors?

Answer—Five, place some with contractors and do some themselves; three, let all to contractors; one, does all.

Question No. 10—If sublet to contractors, please outline your arrangement with them for doing the work?

Answer—One, pay them cash for installation; two, get bids, awarding to lowest bidder; two, all work done time and materials; one, get material at cost and allow regular time; one, get bids, submit them to consumer, if accepted company pays bill and extends credit to consumer.

Question No. 11—Does the price at which you sell water heaters include wiring and installation?

Answer—Two, no; seven, yes.

Question No. 12—What is the average cost of plumbing connections to average household boiler?

Answer—Cost varies from \$2 to \$7.50.

Question No. 13—What percentage of your water-heater consumers continue the service for twelve months of the year?

Answer—One reported 100 per cent; one, 90 per cent; one, 60 per cent; three, 50 per cent; one, none; one, not yet determined.

Question No. 14—What additional annual revenue do you secure from ranges equipped with water heaters?

Answer—One, from \$24 to \$72; one, \$42 per kilowatt; one, \$36 per kilowatt; one, \$20; two cannot determine.

Question No. 15—What success have you had in heating water for public baths, barber shops, and other commercial installations?

Answer—Two report no installations; three, small barber shops very successful; two, barber shops, fire engines and small hotels all very satisfactory.

Question No. 16—What is the most frequent complaint from consumers in regard to type of water heater you install?

Answer—One reports that induction heater hums and all too slow to bring water up to desired temperature when much hot water has been drawn off; one, trouble with heaters filling up with lime; two, breakdowns and leaks; two, no troubles; one, circulation type, no circulation, "plaster" heater too slow; two, not sufficient hot water.

Question No. 17—What steps are you taking to remedy these troubles?

Answer—One is insulating boilers and increasing size of heaters; one is making more careful investigation of con-

sumers' requirements; one is restricting circulation to raise temperature; one is making repairs to get heater back in service as soon as possible.

Question No. 18—Do you replace burned-out heater elements free of charge?

Answer—(a) During manufacturer's guarantee period, seven, yes; one, no. (b) After the guarantee has expired, one, yes; six, no; one, no burnouts; one, undecided.

Question No. 19—Has your company had experience from electric water heaters going to ground during lightning storms?

Answer—Two, yes; seven, no.

Question No. 20—Have you installed lightning protection ahead of your heaters?

Answer—All, no.

Question No. 21—Have you had trouble with heaters clogging up with scale, and what remedy have you applied?

Answer—Four, no trouble; one, has not solved the problem yet; two, remove and clean heaters.

Question No. 22—With regard to the immersion heaters, has the scale on any of them become so heavy that the heaters could not be removed from the boiler?

Answer—Six, no; one, yes.

IMPORTANT RATE RECOMMENDATIONS

In the matter of rates the committee had some very pertinent recommendations to make. It said:

Judging from the replies received from the stations of the Northwest, it would appear that the general practice to date in this territory has been to make a certain meter rate for cooking and a flat rate for water heating, which would not seem to be the best way of handling the business, as it has several disadvantages: First, it is wasteful of energy, as it encourages the installation of small-capacity non-automatic water heaters which are allowed to operate continuously whether needed or not, and with these small heaters attached to the ordinary 30-gal. (113.5-l.) boiler it is not always possible to maintain a sufficient supply of hot water for all requirements. Second, it does not allow the use of kitchen or other house heaters, as the cooking rate is usually too high for that purpose.

It would seem that the correct method of handling the matter would be a sliding scale block rate, either to include the lighting or not as desired, but so designed that the average lighting be covered by the first step, the cooking by the second step, and the water and air heating by the third step, or if the lighting is not to be included eliminate the first step. It is also desirable to use a yearly minimum rather than a monthly minimum. For ordinary cases the minimum really is of no consequence, but it often has a pronounced effect upon the prospective customer at the time of making the sale, and with a properly designed yearly minimum the station is fully protected. Everything should be done to make the matter appear as simple and attractive to the consumer as possible, and all complications and deeply theoretical rates should be avoided.

SOME OTHER SUGGESTIONS

Further recommendations of the committee follow:

It is believed the water-heating problem is of such magnitude as to require serious study by each station, and each installation should be given more or less attention, for the reason that the requirements vary so greatly. Owing to the differing climatic conditions, water cost of supplying energy, and costs of other fuel, it is difficult if not impossible to make up a set of instructions that can be followed and expected to produce perfect results in every case.

It is believed, however, that in general the following outline will cover a large proportion of the requirements. It is no doubt a fact that a thoroughly reliable thermally controlled circulation-type heater is the most satisfactory for ordinary residence purposes, provided the rate for energy will allow of its use, for the following reasons:

First—The majority of residences demand hot water at a number of faucets throughout the house.

Second—A large percentage are already equipped with 30-gal. or 40-gal. (113.5-l. to 151.4-l.) range boilers which cannot be changed.

Third—It is desirable to have at all times a sufficient supply of hot water to meet all demands.

Fourth—If the heater is of the correct capacity to operate a large portion of the time, the load factor is good and there should consequently be a low rate for energy. This is especially true if the heater be connected on the opposite side of a double-throw switch from the range.

ASKS FOR CO-OPERATION IN EDUCATION OF SALESMEN

Committee of the N. E. L. A. Commercial Section Urges Immediate Action to Spread Advantages of Courses

Co-operation from executive officials of member companies is of much value to the committee on education of salesmen of the Commercial Section of the National Electric Light Association in carrying out its program this year. Already the committee is greatly encouraged by the prospects for enrollment. Its members have given time freely to the development of the work and feel that the courses offer splendid opportunities for employees who can benefit from further educational advantages. They feel that the co-operation of officials is desirable in the initial step of acquainting employees with the importance of the courses and that study can be encouraged best by those who are in closest touch with the men and women whom the work is designed to benefit.

Fred R. Jenkins, Chicago, chairman of the committee, has made the following statement at the request of the ELECTRICAL WORLD in regard to the outlook for this year:

We are publishing four courses, using the correspondence method, for members of the association and employees of member companies. These courses include the commercial engineering course, prepared particularly for men in the commercial departments or those requiring a commercial training course to prepare them for the business.

The course in practical electricity is designed for all employees who enter the business without a technical education, giving them an elementary course in the fundamentals, and particularly adapted for the members of our association.

The elementary course in bookkeeping and accounting is given as a preparation for the advanced course in electric utility accounting. In the preparation of this advanced course the greatest care was taken. It specializes on accounting for electric utility corporations, following closely the N. E. L. A. classification of accounts.

The large response to the folder "Three Paths to Success," which was sent out recently by the association to all members would indicate that a large number of the member companies appreciate more than ever before the value of training courses, particularly at this time, especially prepared for them by the association.

It is in such times as these that both the companies and their employees appreciate the necessity of preparedness and special training, and the executives of member companies are taking advantage of our courses for this purpose, and we are urging every company to take immediate action in this matter.

It is found that where some executive of a member company, through the appointment of an educational director, takes an active interest in acquainting the employees with these courses no difficulty is experienced in organizing an enthusiastic class, and many of the companies have gone a great deal further, even to the extent of not only advancing the tuition fee, but agreeing to return a proportion of the tuition fee when the employees obtain certificates showing satisfactory completion of the studies.

It is expected that the member companies will take action in this matter, as the prices at which the association offers

these courses do not include any expense which would be incurred for selling purposes, other than the printed prospectus, and in order that they may be self-supporting to the association the co-operation of the member companies is absolutely necessary. The benefits received by these companies will be in proportion to the active interest they manifest. We anticipate a large enrollment this year.

ELECTRIC RANGE LINKED UP WITH FOOD CONSERVATION

Central Station Companies Point Out Ways to Save
Nourishing Fats and Juices of Foods and
Save the Fruit and Vegetable Crop

Conservation of food has now become a family byword, and efforts are being made in every direction to prevent waste. Central stations are co-operating with the national movement by showing the good economy of the electric range.

The Union Electric Light & Power Company of St. Louis, Mo., has taken the opportunity to link up electric cooking with the national food conservation program in the distribution of war bulletins, as is shown in the accompanying reproduction of a page from company literature. Here it is pointed out that in addition to economizing in the use of the common foods it is possible further to conserve the nourishing fats and juices of all foods by cooking in an electric range.

A number of companies have taken the opportunity offered by the food conservation campaign to advertise

windows as shown in the accompanying halftone illustration, others have special spaces in the building set apart for them as stated in the advertisement, while



Photo by N. Y. Ed. Co.

NEW YORK EDISON COMPANY SHOW WINDOW DEMONSTRATION
OF FOOD ECONOMY AND ELECTRIC COOKING

others have sent out notices that a demonstration will be given before any woman's club upon request.

The Summit (N. J.) company follows this latter plan and reports a number of range inquiries as a re-

FOR THE LEAN DAYS TO COME

In our BASEMENT APPLIANCE DEPARTMENT, each day between 2 and 5 P. M., skilled women from the New York State Food Supply Commission will demonstrate the best means of HELPING HOOVER conserve the nation's food supply by preserving vegetables and fruits.

TUESDAY

CANNING
CORN
SPINACH
OR
SWISS CHARD
CUCUMBER PICKLES

WEDNESDAY

CUCUMBER PICKLES
(Sweet or Sour)
CHUTNEY
PEPPER RELISH
VEGETABLES
MIXTURES

As this praiseworthy work is all done on a modern ELECTRIC RANGE, the demonstration possesses a double charm and an added ECONOMIC SIGNIFICANCE.

YOU ARE WELCOME

Buffalo General Electric Co.

TYPICAL FOOD-CONSERVATION ADVERTISEMENT OF THE BUFFALO
GENERAL ELECTRIC COMPANY

the electric range through canning demonstrations. The advertisement shown here gives an idea of how the range idea is subordinated to the national campaign. Some of these demonstrations are conducted in

U. S. War Bulletin No. 8

Advises observance of the following:

1. Eat one wheatless meal a day.
2. Eat beef, mutton or pork not more than once a day.
3. Economize in the use of butter.
4. Cut the daily allowance of sugar in tea or coffee and in other ways.
5. Eat more vegetables, fruit and fish.
6. Urge in the home or the restaurants frequented the necessity of economy.

To further conserve the nourishing fats and juices of
all foods

COOK ON AN ELECTRIC RANGE

SUBORDINATING ELECTRIC RANGE ADVERTISING TO THE
NATIONAL FOOD-CONSERVATION CAMPAIGN

sult. In this case the company installs a meter at each demonstration and at the close tells the audience exactly how much the electricity to perform each bit of cooking cost.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Lamps and Lighting

Development of a Permanent Street-Lighting Plan for a Small City or Village.—R. B. THOMPSON.—This paper describes the lighting work of one central station company after a close study of the principles and ideals of the Illuminating Engineering Society, and indicates work that can be accomplished in cities similar to the one described. The subject was discussed under the following headings: territory, highway lighting, lighting in cities, reason for street illumination, process of seeing, natural divisions of street illumination, types of equipment, illuminating engineering features, maintenance, principles adopted, plan adopted by the city, and results.—*Trans. Ill. Eng'g Soc.*, Aug. 30, 1917.

Generation, Transmission and Distribution

Interchange of Power.—E. C. STONE.—Emphasizes the advantage that can be taken of diversity factor when several systems are interconnected and cites a particular case in Pennsylvania, giving details of energy-exchange agreement, the load conditions on the systems interconnected, methods of operating to secure maximum economy and use of equipment, and tie-line conditions which give best results.—*Elec. Journal*, September, 1917.

Protecting Central Stations Against Short Circuits.—F. SCUMANNE.—First part of an article describing electrical installations in Baku, Russia, and its environs that furnish energy to the naphtha industries of that region, with an account of some typical accidents due to short circuits on this system which have come under the author's observation. The author traces these occurrences to their cause and makes recommendations for guarding against their recurrence. He classifies the accidents as follows: A. Defects in the conductors, including (1) defects in the choke coils, (2) breaking off of the conductor supports, (3) defective connections at the busbars, and (4) defective connections in the circuit breakers. B. Accidents due to the oil circuit breakers. Of these several instances are given. The first cause of all these accidents resides in the great power exerted by alternators working in parallel; such occurrences are unknown in small and medium-sized central stations. At the moment when an alternator becomes short-circuited the current is limited only by the impedance of the armature resulting from ohmic resistance and self-inductance. In many alternators, even those of comparatively recent construction, the value of the short-circuited current rises at first to forty or fifty times that of the normal current, then descends progressively to about ten to twenty times this current. However, most manufacturers recognize the necessity of limiting the value of the short-circuited current to ten or twelve times that of the normal current, so that it rapidly descends to five or six times that value. In coming to the remedy

for these short circuits two general means are suggested—to suppress the cause or to hinder its effects. Sometimes both methods can be tried at once. To suppress the cause the intensity of the short-circuited current must be diminished. Three plans are advocated: (1) to diminish the power of the machines installed where they are subject to this short circuit by dividing the total power of the central station into various independent groups; (2) to diminish the apparent power of the generators by raising the power factor of the installation; (3) to limit the short-circuited current by the insertion of reactors in the circuits. The only way to prevent mechanical effects from short circuit is to reinforce the fixation of the conductors—a means that, simple as it appears, is very complicated and hard to accomplish, because an insulator or connection which has withstood ten violent short circuits may fail the eleventh time. Moreover, the power generated by central stations is constantly increased, and the fixation which was sufficient yesterday is inadequate to-morrow. As to oil circuit breakers, the author does not concern himself greatly with explosions where the oil becomes ignited in the interior of the instrument—these are of rare occurrence with the new types of apparatus—but with the usual type of accident occurring to-day, in which when, following a short circuit, a circuit breaker is put out of commission the accident leaves the interior of the circuit breaker uninjured but damages the exterior and causes the walls of the cells to be burned and covered with grease. The oil circuit breaker is, the author holds, still an imperfect piece of apparatus and the cause of much danger. He describes recent improvements made in America and advocates that the circuit breaker be placed in the most favorable position possible to minimize the results of accidents and that unceasing vigilance be exercised in caring for it.—*Revue Gén. de l'Elec.*, Aug. 11, 1917.

Installations, Systems and Appliances

Automatic Operation of Bell Hoists for Blast Furnaces.—E. S. LAMMERS, JR., and C. H. HODGKINS.—Description of a method of using electric motors which has been made possible by recent developments in industrial controllers.—*Elec. Journal*, September, 1917.

Sphere Gaps for Lightning Arresters.—V. E. GOODWIN.—Discussion regarding the difference in dielectric spark lag between different electrodes under various conditions. As a result of experiments it was found that when an insulator, a horn gap, a needle gap and a sphere gap having spark-over potentials of 157 kv., 140 kv., 130 kv. and 170 kv. respectively were connected in parallel and a steep-front high-voltage impulse impressed, the discharge would take place in the sphere gap. The conclusion was reached that the time lag of insulation of apparatus should be made as great as possible while the time lag of the protective device should

be made as small as possible.—*Gen. Elec. Review*, August, 1917.

Electrophysics and Magnetism

Determination of Magnetic Flux Density and Permeability.—AUGUST HUND.—Method of studying test samples at any frequency. The samples to be tested are compared with a known and progressively variable self-induction, or "variometer," consisting of air-core coils in series with a non-inductive resistance. When the currents in the two branches of the system are equal in effective value and in phase their inductive effects on the secondary coil of the differential transformer will exactly neutralize each other, and no voltage will be induced in the coil. The two primary coils (P_1 and P_2) are symmetrically placed with reference to the secondary coil S , and have exactly the same number of turns, which are wound in opposite directions. Any kind of alternating-current detector connected across the terminals of the secondary coil will then give a no-current indication when the currents P_1 and P_2 are equal and in phase. A no-current adjustment is established when the coefficient of self-induction of the variometer is equal to the effective coefficient of self-induction of the test coil, and when the effective resistance of the test coil is also exactly balanced by the resistance of the variometer and the series resistance r . An absolute disappearance of the differential field, however, can generally not be obtained, since the wave form in the one branch is somewhat distorted, owing to the presence of the ferro-magnetic substance; but in most practical cases the minimum of the differential field can be very readily and accurately detected. For

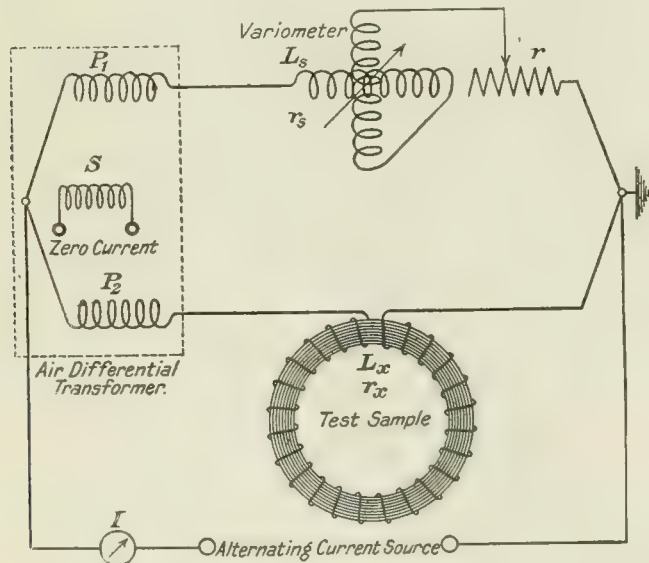


FIG. 1.—METHOD OF DETERMINING MAGNETIC FLUX DENSITY

very precise measurements it is advantageous to insert a condenser in series with the indicator in the secondary circuit of the differential transformer and tune this circuit to resonance with the required frequency. (This is especially recommended at higher frequencies, since tuning is then readily obtainable.) For frequencies up to about 2000 cycles a Wien vibration galvanometer may be used as a current indicator and the condenser dispensed with.—*Proceedings of Institute of Radio Engineers*.

Magnetization of Iron, Nickel and Cobalt by Rotation.

—S. J. BARNETT.—Observations were made with nickel

and cobalt rotated at different speeds and in each test H/n was found to be independent of the speed within the limits of experimental error, a result previously obtained by the writer in experiments with iron. Every set of observations gave the sign of H/n negative like that of $4\pi m/e$ for an electron. The mean magnitude of H/n is in all cases somewhat less than the accepted magnitude of $4\pi m/e$, viz., 7.1×10^{-7} electromagnetic units, obtained from other experiments on electrons in slow motion, ranging from 5.1 to 6.5×10^{-7} electromagnetic units for the most reliable observations, those at the highest speeds. The differences are in the same direction as in the earlier experiments on iron, which gave 3.6 and 3.1 in place of 7.1; but the experimental errors, on account of the great difficulties involved, are such that importance cannot be attached to the discrepancies. The investigation must rather be taken as confirming the equation $H/n = 4\pi m/e$ both qualitatively and quantitatively, on the assumption that only electrons are in orbital revolution in the molecules of all the substances investigated. It shows, moreover, that the effect is independent of the size of the body in rotation.—*Phys. Review*, July, 1917.

Units, Measurements and Instruments

An Electric Dynamometer.—E. M. OLIN and C. A. M. WEBER.—Limitations of the prony brake are outlined. A typical electric dynamometer is described and the method of using it to conduct different tests is explained. An interesting electric dynamometer for testing high-speed apparatus is also described.—*Elec. Journal*, September, 1917.

An Experimental Study of the Fahy Permeameter.—This permeameter was developed during the course of an investigation at the Bureau of Standards on the magnetic-mechanical properties of steel. In order to ascertain the degree of accuracy attained, as well as its fitness for general laboratory use, a critical experimental study of the instrument in its present form has been made. The instrument represents a distinct advance in the measurement of the magnetic characteristics of steel and other magnetic materials. In accuracy it far excels the direct-reading permeameters which have been rather commonly used both in this country and abroad. Normal induction measurements of solid bars show errors no greater than 5 per cent of the magnetizing force required for a given induction. The consistency of its readings taken at different times on the same specimen is so close that comparative results on similar materials can be obtained to a much higher degree of precision. Commercial materials, however, are seldom uniform enough to warrant better precision than 5 per cent. Hysteresis measurements are accurate within the limits of commercial requirements and the uniformity of commercial materials.—*Scientific Paper No. 306*, Bureau of Standards.

Fault Localization by Drop of Potential.—H. E. BLAKE.—In utilizing the drop-of-potential method the ideal conditions for success are indicated by the accompanying diagram. The distance to the fault, x , is obtained by the formula $x = l \times d_1 c_2 / (d_1 c_2 + d_2 c_1)$, in which x = distance of fault from a , d_1 = galvanometer deflection with s to a , d_2 = galvanometer deflection with s to d , c_1 = milliamperes with s to a , c_2 = milliamperes with s to d , l = length ab . Without altering galvanometer shunt, or variable resistance, and with two sound

lines available between the ends of the faulty cable, it is unnecessary to know their length or sectional area, because, with the two-way change-over switch s to d , the drop is measured by g between f and b only, af and cb automatically becoming extensions of the galvanometer leads. Similarly with s to a , the drop is then measured from a to f only, cb becoming an extension of the galvanometer lead to c . The result eliminates all errors except those of contact resistance, which can be guarded against by clean connections, and those due to the slight difference in length between the inner and outer conductors of a concentric system, owing to the bridging

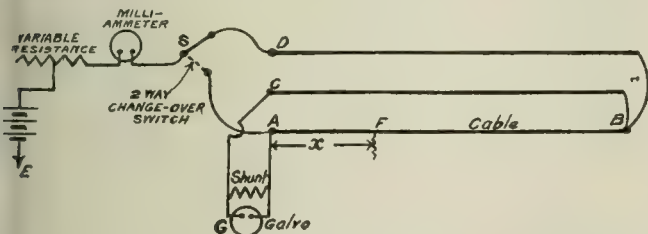


FIG. 2—CONNECTIONS OF APPARATUS USED TO LOCATE FAULTS

of the outers, where the cable has been cut for services. The errors entirely eliminated by this method of connection are those due to the fault-resistance loop at the far end and that due to the cable connections to the apparatus. When locating faults on alternating-current concentric low-tension systems it must be remembered that this system acts as a condenser giving high readings in volts from inner conductor to earth with ground insulation.—London *Elec. Review*, Aug. 24, 1917.

Miscellaneous

Insulating Lacquers.—MAX BOTTLE.—Generally speaking, an insulating lacquer should have the following properties: a sufficient insulation resistance, non-flammability, a capacity to repel or resist water, a reasonably long life, a power to resist oxidization and the effects of rust, a considerable degree of hardness, and a power to resist chemical action of different kinds. An insulation resistance of 1000 volts over a thickness of 0.025 mm. is generally sufficient. It must also resist changes of temperature, and it must adhere firmly, while possessing sufficient elasticity. If a lacquer is intended for use on overhead wires, it must dry quickly without being heated; this, of course, depends on the solvent used. If a drying oil, like linseed oil, is used with a suitable drying agent, it generally dries at ordinary temperatures in eight or ten hours, and a fatty lacquer, if slowly dried, is found to have greater power of resisting chemical or mechanical action than if it is more quickly dried. While the insulating lacquers on the market which contain copals and linseed oil are seemingly satisfactory, their permanence may be questionable. Probably the best lacquers are prepared by a new so-called "dry" process by the reaction between "formin" and carbolic acid, "formin" itself being prepared from the reaction between formalin and ammonia. These lacquers have excellent insulating properties.—Abstracted from *Elekt. Zeits.*, No. 11, 1917, in London *Electrician*, Aug. 24, 1917.

Electrical Conductivity of Metal Films.—ROBERT W. KING.—Reasons are given for rejecting Thomson's and Swann's theories of the abnormally small specific conductivity of metal films. A relation connecting con-

ductivity and thickness is deduced from the supposition of a more or less random arrangement of groups of atoms. This relation seems to fit observations upon films of platinum, gold and silver in a very satisfactory manner. It has been found that the thinnest films of gold and silver show a granular structure when examined with a "dark field" microscope, and that thicker films of these metals appear quite uniform. No structure has been observed in platinum films, but this is probably due to the limitations of the microscope. It has been found that, in order to just conduct, platinum films must be between 1.5 μ and 3 μ thick, gold and silver films between 6 μ and 8 μ thick. As it seems doubtful if particles of the sizes necessitated by these thicknesses can be detached from the cathode by the bombardment, their formation is probably due to the condensation of atoms of the metals. This supposition is further supported by the similarity between the writer's results and those of Weber and Oosterhuis obtained on films produced by condensation. It is pointed out that the recorded variations of n and k with thickness appear to present no obstacles to the acceptance of the present theory.—*Phys. Review*, September, 1917.

Errors in Thermometry.—LE CHATELIER.—An article on the measurement of high temperatures containing a brief description of the various methods at present in use and devoting some space to a consideration of the thermo-electric (Le Chatelier) type of instrument. Attention is called to the necessity of frequent regraduation of thermocouples, which alter in use. Further, the sensitivity of the galvanometers used varies with time, either from loss of magnetism in the permanent magnets or from changes in the verticality of the instrument. The moving coils, which are generally heavy, rarely have their center of gravity exactly in line with the points of suspension. The result is a disturbing couple, which tends to modify the galvanometer readings. Very often errors are discovered the exact cause of which it is difficult to trace. The most frequent trouble is that the wires of the couple come adrift when they are simply twisted together instead of soldered, or they break when heated in a reducing atmosphere. If contact ceases entirely, the trouble is easily discovered, but very often the wires continue to touch and allow the current to pass, but with a reduction in strength on account of the additional contact resistance, and the readings are therefore falsified without the observer being aware of the exact trouble. A cause of error frequent in factories arises through fine iron powder settling on the soft iron core and damping the action of the moving coil slightly. This source of error is even more difficult of discovery than those mentioned above. Finally, in laboratory tests, when the couple wires are not immersed sufficiently in the substance to be tested, the thermal conductance of the wires cools the thermojunction and materially affects the readings.—Abstracted from *La Nature* in London *Elec. Review*, Aug. 17, 1917.

Bibliography of Literature on Submarine Mines and Torpedoes.—DAVID B. RUSHMORE.—Refers to lists of books and articles on the subject from 1873 to the present time. The patents on submarines date back to 1850, on life and vessel-saving devices to 1884, and on torpedoes to the year 1862.—*Gen. Elec. Review*, August, 1917.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ORGANIZING FOR THE NEW LIBERTY LOAN CAMPAIGN

Trades Committees in Process of Organization in New York City—George B. Cortelyou Named Chairman for Public Utilities

In organizing the campaign for the second Liberty Loan, the distribution committee of the Liberty Loan committee in New York City has formed a trades committee. Up to Sept. 24 thirty-three men, each prominent in his industry or trade, had accepted chairmanships of trade committees. An advisory trades committee has also been formed by the main committee to keep in touch with the various individual trades committees. It is hoped that the total of the trades committees will reach 100.

George B. Cortelyou, president Consolidated Gas Company, New York, will be chairman of the public utilities committee. It is suggested by the main committee that the chairman of each committee appoint an active vice-chairman, a secretary who will be able to give the majority of his time to the work on the committee throughout the campaign, and a publicity man, selected from the committee, who will be able to devote practically all of his time to the work. A director of speakers should also be appointed by the chairman. Speakers for meetings throughout the trade will be supplied by the speakers' bureau of the Liberty Loan committee.

An experienced bond salesman will be assigned to each trade committee, who will supply the trade committee with standard selling talks, which the experiences of the last loan proved necessary, in order that all canvassers may work along the same lines. The bond salesmen will confer and co-operate with the canvassers selected by the trade committee.

It is suggested that each trade committee select a field force of canvassers composed of active salesmen in that trade; the more canvassers, the better showing that trade should make.

It is hoped that the members of the committee will endeavor personally to obtain subscriptions where they deem it advisable, while it is essential that every employer be visited. Canvassers should solicit subscriptions from firms and individual members and executives thereof. They should point out to each firm the business necessity of holding meetings of its employees and inducing these employees to subscribe as individuals on the partial-payment plan, either through the employer or through a bank, and as each firm agrees to undertake this activity, standard material for handling partial payments will be supplied.

The Consolidated Gas Company will send "buy a bond" circulars with its bills for September, and other gas and electric companies are expected to follow the same plan.

FURTHER DELAY IN THE WAR REVENUE TAX BILL

Differences Between House and Senate Conferees Block Action on Measure, Although Objectors May Be Forced to Give Up

The war revenue tax bill, which has been in conference between the House and the Senate, seems to be in a fair way to fail at the present writing. There has been a deadlock on certain questions during the last week or ten days. When this was written by the Washington correspondent of the ELECTRICAL WORLD it seemed possible, even probable, that the House conferees would report their disagreement with the Senate conferees to the House ways and means committee with the intention and expectation that the whole bill would be virtually rewritten in the House of Representatives.

There is even talk in Washington now that an effort will be made to postpone the passage of the war revenue tax bill until December. A bitter fight is in prospect over the bill. Some of the House conferees believe that the percentage of exemption of capitalization should range between 7 and 9 per cent. Other House conferees are insistent upon a flat 8 per cent capitalization exemption instead of the 6 per cent minimum and 10 per cent maximum provision in the bill as it came from the Senate.

When Speaker Clark stated to the Washington correspondent of the ELECTRICAL WORLD that no human being could tell what the House of Representatives might do with the war revenue tax bill, as previously reported in these columns, he had apparently in mind such a situation as now confronts Congress and the country. If the House conferees on the revenue tax bill fulfill their threats to take the conference reports before the House ways and means committee, there is scarcely any doubt, in the opinion of Washington observers, that the whole question of excess profits will be taken on to the floor of the House of Representatives and perhaps from there once more back to the Senate.

There is a feeling on the part of many members of the House that the Senate has exceeded its authority in framing this bill in the manner in which it has come to the House. Some members of the House are smarting under the allegation that the House committee frames appropriation bills but that the Senate really whips them into shape and always expects the House to consent to the details which the members of the Senate favor.

Many members of the House are laboring for an opportunity to either put something into the war revenue tax bill or take something out. They believe that senators have exercised such a privilege. In these circumstances it would not be surprising to the best in-

formed opinion in Washington if there should be a considerable delay on the passage of this bill unless Congressional leaders made a strong effort to push through the conference report.

CO-OPERATION ADJUSTS PASADENA COMPETITION

General Manager Brackenridge of Southern California Edison Company Commends Arrangement Which Eliminates Duplicate Distributing Systems

By co-operation between the Southern California Edison Company and the city of Pasadena an adjustment of the competitive situation which has existed for ten years has been made. The city is to purchase the distributing system of the company.

Announcement of the arrangement, made by C. W. Koiner, engineer of the Pasadena municipal lighting plant, includes the following details:

Value of Edison distributing system in Pasadena, \$500,714.79, payable in cash at the end of two years' lease.

The city to agree to purchase power for a period of thirty years, the rates for same to be fixed now for the first ten years and revised every five years thereafter, or, in case of disagreement, to be fixed by the Railroad Commission.

The Pasadena steam plant to be shut down and operated only as needed, or at the order of the Edison company.

Pasadena to agree to confine itself to the distribution of electrical energy to the city and to agree to sell to the Edison company its distributing system outside the city, with some exceptions.

Extensions to both systems during two-year-lease period to be made under contract.

As rental for the company's system Pasadena would pay to the Edison company an amount equal to 8 per cent per annum on the agreed purchase price and 3.36 per cent per annum, to be held by the city as depreciation reserve.

The Edison company is to assume the unexpired term of lease on its office in Pasadena.

Mr. Koiner also showed that the settlement will lead to the removal of more than 6000 duplicate poles from the streets and will eliminate the waste due to competition.

W. A. Brackenridge, vice-president and general manager Southern California Edison Company, made the following statement:

I have examined the report made by Manager Koiner to the Pasadena Commissioners covering the matter of the settlement of the power difficulties in Pasadena and believe that he has made a clear and concise statement of the entire situation.

If ever there was a time in the history of the nation when co-operation in every line is imperative that time is now, and it would be almost criminal for the Edison company to hold out against a settlement which would eliminate the waste of duplication in distributing systems, particularly when copper is in such demand for war purposes.

We find the great railways of the country being managed co-operatively for the benefit of the government and all lines of food production and distribution as well as every manufacturing interest in the nation trying to do their bit. This settlement is along the same lines.

I believe that the use of water power in place of oil for the manufacture of electricity for Pasadena will be at least

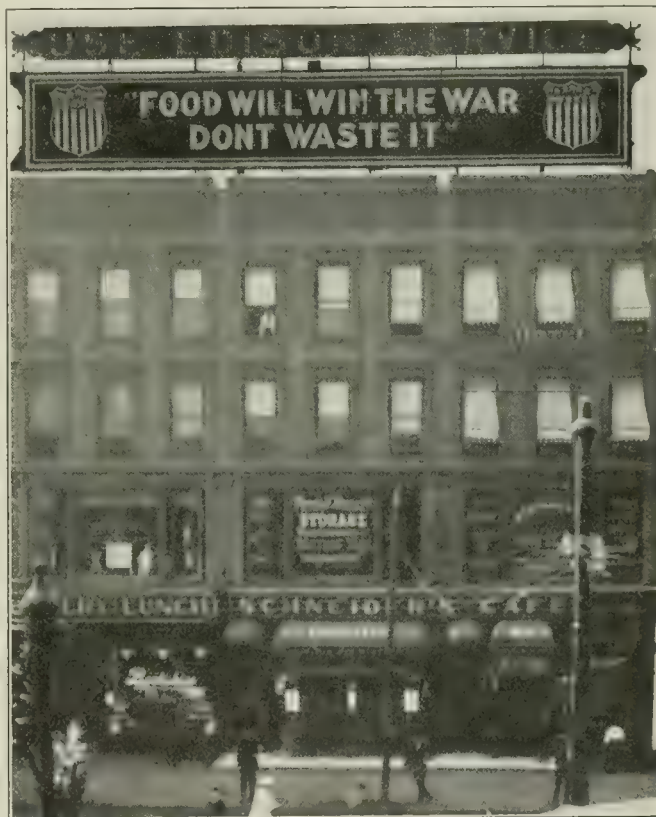
a small aid—at least a drop in the bucket. The elimination of thousands of poles in the streets will benefit the whole city. We can eliminate the duplication in operating expense and in pay rolls and, from our own selfish standpoint, we are glad that this will settle the ten years' controversy.

The day of co-operation is here. We face a new era in public utility management, and that company which does not co-operate fully and frankly with the public is doomed to failure. It is for this reason that the same settlement—and on practically the same terms—was made in Los Angeles as is now worked out for Pasadena.

CONSERVATION OF FOOD IS HELPED BY ELECTRIC SIGN

Brooklyn Edison Company Gives Use of Large Illuminated Billboard Sign to Help in Winning the War by Saving Food

Co-operating with the very excellent work of the Food Administrator, Herbert C. Hoover, the Edison Electric Illuminating Company of Brooklyn, N. Y., has given over its large illuminated billboard sign at Times



HELPING TO CONSERVE FOOD

Plaza, opposite the Long Island Railroad terminus, subway, elevated and surface railway stations.

The sign has been painted with the slogan: "Food Will Win the War—Don't Waste It." The letters are over 4 ft. (1.2 m.) high, and the American shields approximately 6 ft. by 10 ft. (1.8 m. by 3 m.). The border is in red, white and blue.

This is considered one of the busiest spots in Brooklyn, and it is estimated that over 300,000 people pass daily. The fact that this sign is in constant use by the Brooklyn Edison Company, advertising the sale of electric light, power and appliances, makes it an especially valuable addition to the work being done for food conservation.

ELECTRIC STEEL PRODUCTION REQUIRES 750,000,000 KW.-HR.

Electric Furnace Practice Discussed in a Number of Papers at Foundrymen's Convention, Held at Boston This Week

An entire session was devoted to recent aspects of electric furnace practice at the Boston convention of the American Foundrymen's Association this week. In a paper on "Recent Developments in the Application of the Electric Furnace to the Melting Problem," Douglas Walker, Booth-Hall Company, Chicago, pointed out that within the past year the electric furnace has become accepted as a standard type of melting equipment. A steel founder to-day buys on the strength of the known value of given combinations of features. Electric furnaces are to-day in operation in foundries for melting steel scrap, refining steel scrap, refining molten steel and melting gray iron, malleable iron, ferro-manganese, ferro-alloys, copper and copper alloys.

USES OF THE ELECTRIC FURNACE

The common use of the electric furnace in the foundry is for melting down steel scrap for steel-casting production, the latter being of superior quality. In some foundries the electric furnace is used for the melting and refining of steel, where an extra high quality of steel is desired, low in sulphur and phosphorus and meeting definite specifications. The Canadian and United States governments are both installing a considerable number of electric furnaces for this purpose, the chief object being the production of steel low in sulphur. Eventually the application of the electric furnace to the melting of malleable iron will be as important as it is to the steel industry to-day. At present reliable information on this branch of practice is very scarce. Ordinarily, the electric furnace cannot compete commercially with the cupola for melting gray iron. It is useful, however, in manufacturing aeroplane motor cylinders of very high-grade gray iron, owing to the facts that the sulphur content is kept down, that the metal is melted under conditions ideal for the production of iron free from air-holes, and that the iron produced from an electric furnace has the same density that is characteristic of electric steel. The use of the electric furnace for melting ferro-manganese is gaining ground, especially in large steel plants operating a number of open-hearth furnaces. In a representative case the loss of manganese was less than 10 per cent. The writer advocated the use of the basic process in operating electric furnaces for the production of steel castings under present market conditions, irrespective of the comparatively high cost of basic refractories. The author pointed out the increasing unwillingness of central stations to accept single-phase furnace loads and closed with brief comments upon the superiority of electric steel through greater uniformity, increased accuracy of meeting specifications and generally improved quality.

Results of operation in the plants of the Sivy Steel Casting Company, Milwaukee, Wis., and the Electric Steel Company, Chicago, were given in a paper by C. R. Messenger of the former company on "Comparison of the Electric Furnace and Steel Converter for Manufacture of Small Steel Castings." The author discussed the operation of two bottom-electrode, single-phase elec-

tric furnaces. The best results were obtained with acid linings. An average of 368 heats per lining has been obtained, with a refractory cost of 7.8 cents per ton of steel. The electrode cost was 70 cents per ton and the power consumption average 635 kw.-hr. per ton. The total costs show a slight margin in favor of the electric furnace, but the writer stated that in the East, where the freight on low-phosphorus pig iron is much lower, the margin would be in favor of the converter. In the best thirty-day period an average of 9.24 heats per twenty-four hours was obtained, the average melting time being two hours and twenty-five minutes and the average charging time ten minutes. The furnaces were of 1-ton capacity. The average labor cost was \$2.10 per ton of steel melted, including bringing scrap in from the yard and repairs. The consumption of electrodes on a furnace making 2029 heats in thirteen months was 13,170 lb., or 5.15 lb. per ton of steel melted. The present cost of graphite electrodes is about 13 cents per pound. The foregoing furnace was used in pouring very small castings with an average weight of less than 4 lb.; hence the furnace was not tapped until the metal was very hot and the power was left on longer than would be required in most foundries. A power consumption of 570 kw.-hr. per ton could easily be attained by greater care in operation. Repairs need not be made oftener than once in six weeks. Numerous classes of scrap can be utilized. Continuous service by the central station is most important. A plant with a power rate of 0.75 cent per kw.-hr. will save \$8 per ton in the cost of finished castings over a plant with a 1.5-cent rate, other things being equal.

THE CENTRAL STATION POINT OF VIEW

"The Electric Furnace from the Central Station Viewpoint" was the title of a paper by Edwin L. Crosby, Detroit Edison Company. So far about 200 electric furnaces, having an annual capacity of 1,200,000 tons of steel, have been installed or contracted for in North America. This steel production requires about 750,000,000 kw.-hr. Errors in installation and application should be avoided through a closer study of electric furnace equipment and service than has been made in the past. The power salesman should have a fairly good understanding of the metallurgical practice involved before attempting to give advice or data. With the possible exception of one type of arc furnace and the certain exception of the induction furnace, all steel furnaces on the market to-day, if properly installed, will operate with a power factor of 80 to 85 per cent during the early stage of the melting period, later rising to 85 or 90 per cent, and finally to 95 per cent or better during the refining period. Regulation, phase balance and wave distortion have not received sufficient attention. Present electrode regulation is at best very unsatisfactory, it being impossible with any existing equipment to obtain sensitive regulation without hunting of electrodes and disturbance of phase balance. Wave distortion common to arc furnaces may lower the efficiency of rotary converters and affect the accuracy of watt-hour meters. Any central station man who urges the installation of electric furnaces for steel based upon the present market may later have cause for regret, unless he receives a rate commensurate with the risk.

The fourth paper, "Notes on an Electric Furnace Design," by John A. Crowley, Detroit, Mich., described the design and construction of a 1-ton electric furnace built by the author. In choosing between a rugged, simple design and one more finished and complex, the author recommended the former, which will require little or no attention. Replacements can also be made more rapidly in case of breakdown. A 1-ton furnace of any design will range in price from \$15,000 to \$25,000. Most successful polyphase furnaces are equipped with automatic electrode control. In the case described, totally inclosed motors were employed to effect the electrode movements.

Below are given conversion cost data on a 1-ton furnace. The power and electrode consumption figures were obtained from furnaces of similar size operating in Europe. The price of scrap is based on Pittsburgh prices current about Sept. 1 and the labor costs are based on conditions existing in Detroit about Sept. 1. These figures may be readily changed to meet any special local condition. An average rate for power the country over is \$0.01 per kilowatt-hour. The figures are as follows:

Scrap (turnings)	\$24.00
Power, at \$0.01 per kilowatt-hour.....	7.00
Electrodes, at \$0.075 per lb.....	1.35
Slag material, lime, spar and coke.....	.30
Alloys (approximate):	
4 lb. 50 per cent ferro-silicon.....	.48
3 lb. 80 per cent ferro-manganese.....	.59
1 lb. aluminum .....	.65
Refractories (basic) .....	.45
Skilled labor melter, \$6; boy, \$3.50.....	2.38
Unskilled labor, two men forty minutes each heat to handle scrap and charge furnace, at \$0.32 per hour.....	.32
Cost of metal at the spout.....	\$37.52

The foregoing costs are based on twenty-four-hour operation with a minimum production of 8 tons per day.

ACTION OF BUSINESS MEN ON WAR AND NATIONAL PROBLEMS

Members of Chamber of Commerce of the United States Declare for Water-Power Development Legislation

Definite resolutions expressing convictions and recommendations of the Chamber of Commerce of the United States on many questions affecting industry, the war and the government were passed at the convention at Atlantic City last week.

Among these were declarations on the subject of water-power development, price revision, the Federal Trade Commission, daylight saving, co-operation for export trade and government purchases, price control and priority of shipments.

On water-power legislation the Chamber of Commerce passed the resolution published herewith. Another resolution set forth the great need of development of public land water-power sites.

The organization has placed itself on record in favor of government fixing of prices on essential products. As the cost of the various elements entering into production cost—raw materials, labor, transportation, etc.—may vary from time to time, the Chamber urges that such board or boards as have the responsibility of fixing prices "shall afford opportunity to industries affected to present changes in cost of production to

the end that such fixed prices may be revised when necessary in order that the proper relation between such cost of production and such fixed prices may be maintained."

As trade organizations are to-day in grave doubt as to the subjects they are permitted under present laws to discuss and as to the agreements between members into which they may enter and members of such associations are earnestly desirous to violate no laws, the convention expressed its feeling that business interests would be best served if the Federal Trade Commission or some similar government commission should be empowered to tell officers of trade organizations and business men what they are or are not permitted to do jointly with competitors in a lawful manner.

Action by Congress and the President was urged to make the daylight plan effective as a war measure.

Earlier expressions concerning the great importance of legislation to permit co-operation for export trade

DEVELOP WATER POWERS

Whereas the scarcity of coal and other fuels during the past year, with the resulting disastrous effect on every branch of commerce and industry, calls renewed attention to the great importance of developing at the earliest possible day unused water power in order to make available for public service an inexhaustible power not requiring the consumption of exhaustible power, and

Whereas increased use of water power, because it furnishes a cheap and reliable power of general application, reduces the drain on our stores of mineral fuel which when consumed can never be renewed, and thereby relieves a great stringency bearing on national defense due to the imperative need for fuel for both land and water transport and the manufacture of war supplies; be it therefore,

Resolved, That Congress should without delay enact legislation necessary to the early development of water power at sites now under federal control on terms which will advance and protect the public interest; also

Resolved, That the directors appoint a special committee to investigate this present need of water-power development and the character and extent of legislation required and report to this chamber as promptly as possible.

(Resolution passed by the Chamber of Commerce of the United States at Atlantic City convention last week.)

were reiterated. It was also resolved that although the occupation of the Senate committee on interstate commerce with proposals for other legislation of importance is thoroughly realized, the Senate committee on interstate commerce be asked to report for consideration the present bill, known as the Webb-Pomerene bill, to promote export trade.

In substance, the Chamber of Commerce holds that all government war buying should be assembled under control of one board or executive department, which should have full power to procure war supplies to the best advantage to the government as to price, quality and delivery and in a way to maintain essential industrial life without disturbing social and economic conditions, including the power to fix prices not only to the government but to the public on essential products and to distribute output in a manner to promote the national defense and the maintenance of our industrial structure.

ELECTRICAL SERVICE FOR LONG ISLAND CANTONMENT

Construction Work Necessary for Supply of Energy
at Camp Upton Is Finished on Schedule
Time

Electrical service for the cantonment at Camp Upton, Long Island, is being furnished by the Long Island Lighting Company both for lighting and power purposes. Some details regarding the construction work necessary for the electrical supply have been given to the *ELECTRICAL WORLD* by H. M. Case, managing engineer of E. L. Phillips & Company, who are in charge of the construction and engineering work for the Long Island Lighting Company.

Camp Upton, situated on a government reservation comprising 16,000 acres, is on the main line of the Long Island Railroad between the villages of Yaphank and Manorville. When entirely completed the camp will have from 15 miles to 20 miles (24 km. to 32 km.) of well-paved streets, a modern sewage system, a modern waterworks system and an electric light and power distribution system.

The streets will be lighted by approximately 350 100-cp., 6.6-amp. gas-filled tungsten lamps. There are five pumping stations, two for the waterworks system, aggregating 600 hp. in capacity, and three for the sewage system, aggregating 135 hp. The refrigerating plant is also operated by electric motors in capacity approximating 135 hp. Several hundred horsepower capacity of motors is also required for the laundry, hospital, many other minor power purposes and for heating. The larger motors, 75-hp. and 50-hp., are designed for 2200 volts, three-phase, thus taking energy directly from the distributing main without transformers. The smaller motors are 220-volt and 440-volt, three-phase, except the very smallest, which are operated single-phase.

It is estimated that the capacity required for indoor lighting will be approximately 725 kw., for street lighting 50 kw., and as so far planned the complete installation will aggregate approximately a connected load of 1900 kw.

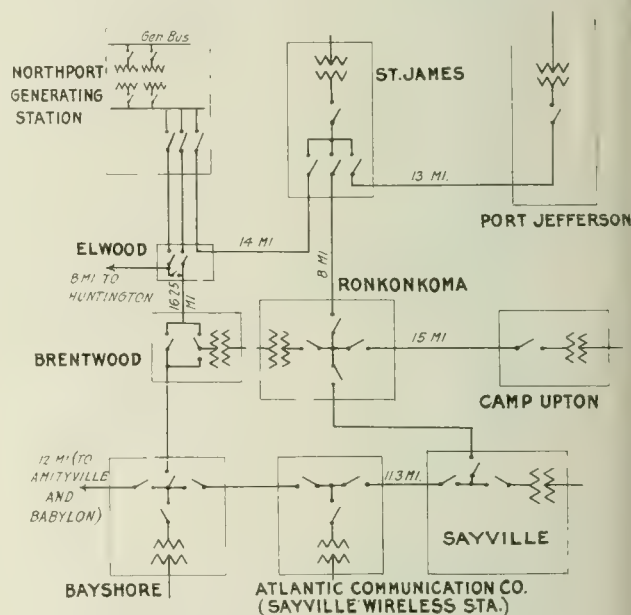
The street-lighting system is supplied through constant-current pole-type transformers in various sections or districts, each transformer being furnished with a pole-type oil switch operated by a rope from below. These transformers are placed on poles at brigade headquarters so that on necessity the guard on duty can promptly either darken or lighten the camp as may be required.

The distribution about the camp is 2300-volt, three-phase, on the main service avenues, with 2300-volt, single-phase laterals through the streets. The secondary distribution is largely 110/220-volt, three-wire system, only the terminal and lightly loaded ends being 110-volt, two-wire system. A separate three-phase power circuit is run from the main transformer station to the refrigerating plant and sewage pumping plants. This power circuit, as well as the primary laterals and the secondary distribution, is put in by the general contractor, the Thompson-Starrett Company.

All of the electrical work inside of the camp is constructed in accordance with specifications supplied by Frank Sutton, consulting engineer retained by the Quartermaster's Department of the government to plan and supervise this portion of the camp construction.

To reach the camp it was necessary for the Long Island Lighting Company to construct approximately 12 miles (19.3 km.) of 23,000-volt, three-phase, 60-cycle No. 4 hard-drawn copper-wire line from a point on its transmission system at Ronkonkoma to Camp Upton and to build 4 miles (6.4 km.) of 2300-volt distributing main from the substation, or a total of about 16 miles (25.7 km.) of line. Several miles of the transmission line had to be constructed through dense forests which had to be cleared out, and a part of it through swampy land which made setting of poles difficult. The transmission line is complete with 5/16-in. (8-mm.) Siemens-Martin steel-top strand, grounded at every tenth pole for lightning protection, as lightning is unusually severe in the Long Island district.

The main substation is near the southeast end of the camp and has a capacity of 1000 kw. in three 333-kva. transformer units. The transmission lines and transformer station are operated at present on a 13,200-volt delta-connected system. The system will shortly be



ELECTRICAL SYSTEM SERVING CAMP UPTON

changed to one of 23,000 volts, and all transmission lines, substation equipment and arrangements are laid out for use at the higher voltage, which will be operated with star-connected transformers having grounded neutral.

From the substation at Ronkonkoma the line was built to the east to reach Camp Upton, and by means of the loop system the camp can be served from either the south or the north by suitable switching arrangements at Ronkonkoma. The main generating plant of the lighting company is at Northport.

Most of the energy for the camp is supplied from the substation mentioned, but owing to the fact that the pumping plant at the wells is nearly 4 miles (6.4 km.) west of the camp, a second substation is supplied at a point on the transmission line opposite this pumping plant having a capacity of 300 kva. in three 100-kva. units, making a total substation capacity for the camp of 1300 kva.

It was a problem in the short space of time after the contract was made with the lighting company to secure material and labor and construct the 16 miles (25.7 km.) of line and substation by the time service was

required. Fortunately the constructing company had on hand copper, insulators and hardware; but it had great difficulty in getting poles. However, by having two men locate poles in different sections of the country and follow them closely by railroad, they were brought to the job in time.

By diverting to the job about sixty of the constructing company's linemen from various construction gangs, and by the kindly loan by the New York Edison Company of twenty-eight of its linemen for four days at the conclusion of the work, the work was completed in time and the current turned into the camp on Sept. 5. The actual time spent on the construction was twenty-seven days. The field construction was under the supervision of the chief of construction of E. L. Phillips & Company, A. McLaren.

The co-operative spirit shown by the New York Edison Company in voluntarily offering some of its men to help on this work was highly commended and much appreciated by the lighting company.

SHORTAGE OF POWER

IN KANSAS CITY, MO.

With the Co-operation of Manufacturers Requirements Are Kept Within Generating Limits During Morning and Evening Peak

A. E. Bettis, superintendent of engineering and construction for the Kansas City (Mo.) Light & Power Company, writes to the *ELECTRICAL WORLD* in reply to an inquiry regarding the shortage of power in that city:

We are handling the shortage of power in the following manner:

A schedule is made up showing total power available for every hour during the day, also a curve is made showing load at each corresponding hour. With the co-operation of the manufacturers we are able to keep the power down to within our generating limits during our morning and evening peak. This is done by the manufacturers agreeing to reduce their load on our morning and evening peak and operate at other hours during the night and day, thereby making up their lost operation.

This condition however in our city is improving very materially, and we hope in the near future that all of our customers will be operating normally.

At present we are installing considerable additional equipment to take care of this condition.

ASK FOR HIGHER RATES FOR

THE MILWAUKEE COMPANIES

Petition Filed as an Emergency Measure Under the Public Utilities Commission Act—Few Consumers Affected

Testifying before the Wisconsin Railroad Commission at Madison on Sept. 19, S. B. Way, vice-president and general manager Milwaukee Electric Railway & Light Company and Milwaukee Light, Heat & Traction Company, showed that more revenue is necessary to overcome higher operating costs.

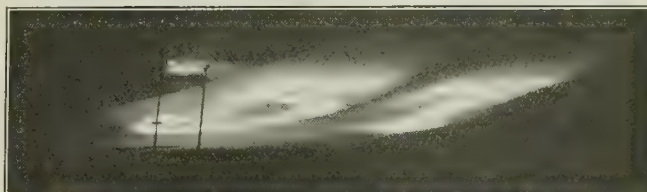
Mr. Way said that the companies are paying from \$2 to \$2.65 per ton for coal at the mines. It was testified that the proposed increase in rates, as reported in last week's issue of the *ELECTRICAL WORLD*, would affect 550 of the 50,000 patrons. The cost of coal to the companies during the next winter season would be \$17,000 a month more than it was during the last winter period.

FLOODLIGHTING HUGE SIGN

ON CALIFORNIA HILLSIDE

Nine 1000-Watt Projectors Are Used to Illuminate Gigantic Figures So that They Are Read as Easily by Night as by Day

An unusual example of floodlighting is the illumination of the huge Heinz "57" sign established on the hills south of Los Angeles, service for which is supplied by the Southern California Edison Company. This sign consists of the figures "57" in Arabic numerals, made of concrete painted white and occupying an

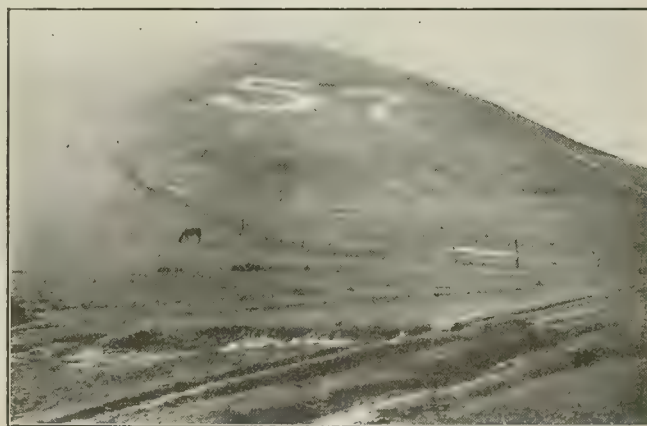


NIGHT VIEW OF ADVERTISING SIGN NEAR LOS ANGELES

inclined position of about twenty degrees on a sloping hillside which is green all the year round. The size of the figure "5" is 70 ft. by 130 ft. (21.3 m. by 39.6 m.), while that of the figure "7" is 85 ft. by 130 ft. (25.9 m. by 39.6 m.). The two figures together occupy a space of 130 ft. by 208 ft. (39.6 m. by 63.3 m.), or 27,040 sq. ft. (about 2500 sq. m.).

With the idea of still further increasing the advertising value of the sign, large floodlight projectors have been installed to make it effective by night as well as by day. The floodlighting installation consists of nine 1000-watt Western Electric Davis projectors arranged in a horizontal line and mounted close together on a platform which is supported by two poles. Energy is turned on by means of a time switch with the street lights half an hour after sunset and turned off three hours later.

Information from the Weather Bureau shows that foggy conditions interfere very little with the view of the sign as most of the fogs are between midnight



DAYTIME ASPECT OF THE SIGN

and dawn. Only ten nights in the year have there been fogs that would interfere with a view of the sign while illuminated.

It is estimated that during the day and that portion of the night when the sign is floodlighted an average of fully 2,000,000 people each month pass within view of it.

FALL SALES CAMPAIGN FOR CHRISTMAS GIFTS

Society for Electrical Development Will Conduct Movement to Promote Electrical Presents—
No Special "Week" This Year

To promote concerted action in selling Christmas electrical gifts the Society for Electrical Development will conduct a nation-wide campaign this fall. It will take the place of "America's Electrical Week," which will not be held owing to war conditions.

The society will announce its campaign to the industry on Oct. 10. Every central station and practically all contractor-dealers will be reached, fully 25,000 business organizations. An effort will be made

Electricity— America's Ally

Have you stopped to think what Electricity means to America in this war?

It turns the wheels of nearly a million factories; lightens labor in ten million homes; brings ease and comfort into the daily lives of a hundred million people. In the pursuits of peace it is man's ally; but when war appears, it becomes a veritable brother to Mars!

The critical eyes of a whole world are centered upon us as a nation. We are at the test! Whether it be work or service that each and every one of us are contributing, Electricity in some form will prove a great aid.

In helping to carry on the great war the Electrical industry is "doing its bit." Tirelessly, day in and day out, the Electrical men of this nation are marshalling the forces of heat, light and power for your greater efficiency and benefit.

On and under, land and sea, and in the air, Electricity is the supreme force. American ingenuity utilizes it to bring about the great ideals for which we stand and contend.

We, as Electrical men, stand ready to give you "service always," at all hours and in all seasons.

We are "doing our bit" by endeavoring to cut out waste and make our service as efficient as possible for your use and for the nation's.

Whatever your part in this great cause, remember your own personal responsibility. Remember Electricity. Make the best use of this greatest of all helps.

SOCIETY FOR ELECTRICAL DEVELOPMENT POSTER ON ELECTRICITY
IN THE WAR

to have the industry co-operate solidly in merchandising wares to the Christmas trade.

Following the general announcement an illustrated "how to" booklet will be mailed about Nov. 1, giving concrete suggestions for selling appliances and how the reader can tie into the national drive. Members and non-members of the society will be offered attractively designed window lithographs, window cards, window transparencies, poster stamps, etc., without cost. The official design is being prepared. It will embody into the Christmas spirit the slogan "Give something electrical this Christmas." The society will also send a portfolio of advertising suggestions for newspaper advertisements, mailing cards, folders, etc.

The campaign is not intended to be as large as either "Electrical Prosperity Week," 1915, or "America's Electrical Week," 1916. It will, however, be a real selling campaign.

ARMY AUTHORITIES SEIZE THE CHILLICOTHE PLANT

Officials of Camp Sherman Protect Service Against Interference by Authorities of Ohio City

Army authorities in charge of Camp Sherman, near Chillicothe, Ohio, seized the plant of the Chillicothe Electric Railroad Light & Power Company on the evening of Sept. 25, according to dispatches. The city authorities had previously ordered the company to shut off its supply of energy to the camp in order that there might be no interference with city street lights. The cantonment authorities took control of the plant in order to safeguard their service.

The arrangement under which the Chillicothe company is furnishing service to the plant is a temporary one, pending completion of a 50-mile transmission line under construction by the Ohio Utilities Company, an associated corporation.

So far as can be learned by the ELECTRICAL WORLD at the time of going to press, the transmission line which is under construction from a point near Columbus will be fully completed on Oct. 1. After that date both the city of Chillicothe and Camp Sherman will be supplied from this line and the Chillicothe plant will be held as a reserve station. It had been anticipated that the transmission line would be finished on Sept 10 or 15, but delays in the arrival of materials, even with government assistance in hastening shipments, made completion impossible on schedule time. As the requirements for energy for Camp Sherman exceeded preliminary arrangements it had been proposed to shorten the street-lighting hours in Chillicothe about one hour each evening during the present week. No interference with the supply of energy for residences or power for any other purpose than street lighting was anticipated when this arrangement was made.

RAPID CONSTRUCTION WORK AT CAMP MACARTHUR, WACO

The Local Electrical Company Pushed Operations Systematically and Was Ready for Service on the Day the Troops Arrived

F. L. Booth, manager Texas Power & Light Company, Waco, Tex., writes to the ELECTRICAL WORLD regarding Camp MacArthur at Waco:

As soon as we were assured of the location of the camp, we obtained an approximate maximum demand and made a survey of the distribution system to take care of the load. We found it necessary to strengthen our circuits, and built about one-half mile extension to reach the camp site. We also had our engineers work out some of the details on the distribution in this camp, and when the army officers arrived we were able to give them considerable assistance in working out the details.

We are serving the camp with 400 volts to the entrance of the reservation, where a meter house is located and the service is metered on the primary.

The contractor installed the entire distribution system and wired all of the buildings and tents. We were able to handle our part of the work promptly and had everything in readiness when needed, providing a sufficient amount of material. As soon as the camp was located we were able to render considerable assistance to the contractor in securing material and men to push this work, and we are pleased to say that Camp MacArthur was ready to give service the day the troops arrived.

Double Taxation of Utilities.—The validity of an assessment of the easement of a telegraph company in public highways is not affected by the validity or invalidity of any gross earnings tax which it may be required to pay, the Court of Appeals of Maryland held (101 A. 600).

Employees Must Be Paid Immediately on Leaving Service.—The power of the Legislature to enact statutes requiring payment of wages to employees at once on their leaving the employment of a corporation is one of the police powers, the Supreme Court of Arizona held in *Arizona Power Company versus State* (166 P. 275).

Eminent Domain.—Where proceedings are instituted by a power company against a landowner to condemn property by law, and an appeal is taken from the award of the assessors, the company, not having taken possession of the land, may dismiss the condemnation proceedings pending the appeal, the Supreme Court of Georgia held in *Georgia Railway & Power Company vs. Looney* (93 S.E. 206).

Use of Streets Without Franchise.—Use of streets for erection of poles to carry wires for street lighting is a street and not a municipal purpose, and any use which improves or benefits the street as a highway is a proper street use, according to the Supreme Court of New York (166 N. Y. S., 560). The common Council of Brooklyn, by its right to contract with a corporation to furnish lights in the streets, had no power to confer on the corporation the right to furnish light to abutting owners for profit. The fact that a gas, heat and power corporation used streets for several years and expended several millions of dollars on its plant did not create a franchise by estoppel. The fact that the State assessed a franchise tax on a light corporation did not constitute a recognition of a franchise by estoppel. A citizen and taxpayer may maintain mandamus to compel removal from streets of electric light poles which are owned by a company having no franchise.

Right of City to Construct Competing Plant.—A city invested with power to do so and having entered into a contract with a light company whereby it agrees not to erect or acquire a competing plant may be enjoined from violating such contract, the Supreme Court of Tennessee held in *Memphis Electric Light, Heat & Power Company vs. the City of Memphis* (196 S.W. 113). Grants of franchises and special privileges are always to be construed most strongly against the donee and in favor of the public. An ordinance granting to the electric light company a franchise to operate its plant for an additional period of twenty years, with the usual privileges as to the use of streets, etc., but specifically providing that "this ordinance shall not be construed as being an exclusive franchise," and containing no language expressly prohibiting the city from exercising its power to construct and operate an electric light plant, did not give plaintiff the exclusive right for twenty years,

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

and defendant city could not be enjoined from constructing a municipal light plant before the expiration of such period. That the city reserved in the franchise granted the electric light company the right to purchase its plant at any time did not create an obligation on the part of the city so to do during the term of the franchise should it decide to construct a municipal light plant, such provisions of the franchise being a mere option to the city.

Enforcement of Judgment Against City for Municipal Plant Supplies.—A municipal corporation can make a cash contract for necessary current supplies to be used in carrying on the legitimate business of the city, including the operating of its system of lights and waterworks, when made through its appropriate officers or committees, as effectually as when done by formal order or resolution of council entered in its minutes, where it appears that such contract of purchase has become obligatory through implied ratification by reason of the acceptance and use by it of the articles or supplies so contracted for, the Georgia Court of Appeals has held (93 S. E. 238). Where a suit is brought to recover the purchase price of supplies alleged to have been furnished the town as necessary to the present operation of its light and water plant, the municipality is entitled to plead and prove, by way of defense thereto, that at the time such alleged liability was incurred there was not a sufficient sum in its treasury which might have been lawfully used to pay it, and a sufficient sum could not have been raised by taxation during the current year for such purpose.

Duty to Anticipate Danger from Lightning.—It is a telephone company's duty to use the highest degree of care practicable in making and keeping safe its telephone apparatus, although it is not an insurer, the Missouri Court of Appeals held (196 S. W. 1030). Where one properly using a telephone was injured by electric shock, the doctrine of *res ipsa loquitur* applies, although the shock was or might have been caused by an electric storm, the occurrence being so unusual as to indicate that something was wrong with the instrumentalities which were solely under the telephone company's control, and it being the company's duty to guard against such possible injuries if they could be guarded against by the exercise of a high degree of care. The courts take notice that static electricity or lightning is likely to get on and pass over wires carrying manufactured electricity. A company whose wires enter a building is bound to anticipate that unless preventive devices are installed

lightning may follow its wires into the building and cause personal injury, and if such company is negligent in the use of proper devices it will be liable for resulting injury, although the lightning may be considered an act of God, since the carrying of it into the building may be the act of the owner. A telephone company had the burden of proving that the presence of excessive electricity causing a telephone user's injury was not due to its negligence in failing to use the highest degree of care in installing and maintaining the telephone, the theory that *res ipsa loquitur* is only a rule of evidence supplying plaintiff with proof of negligence by mere proof of circumstances of the injury, and that the burden of proof remains with the plaintiff, not being law in the State.

Liability for Damages Caused by Flowage.—When land is taken in invitum by eminent domain the damages belong to the owner at the time of the taking, the Supreme Court of New Hampshire held in *Spencer vs. Connecticut River Power Company of New Hampshire* (101 A. 528). Although by statute a power company could acquire the right to flood lands of other owners and be relieved from common-law liability for so doing by payment or tender of damages, until such payment it is liable in tort at common law for the damage done by such flooding. Where a power company had caused lands of other owners to be overflowed but had taken no steps to dispossess the owners of their rights, deeds from such owners to plaintiff conveyed the lands unhampered by the right to flowage then unacquired. By law, if the owner of overflowed lands brings petition for assessment of damages, it must be dismissed if the power company disclaims the intention to take the right to flood the land, and the proceeding is only maintainable if the company desires to acquire such right.

Duty of Lighting Company in Respect to Telephone Company.—In a telephone lineman's action for injuries resulting from coming in contact with high-voltage wires, evidence was held to show that the telephone company's pole on which he was working at the time of the injury was erected after the electric light company's pole adjacent thereto, and that at that time the electric company's high-voltage wires were already in place. After erection of a telephone pole in close proximity to an electric light pole it became the electric company's duty to remove its high-voltage wires to the outer ends of its cross-arms for protection of telephone linemen and in accordance with the usual custom, the Court of Civil Appeals of Texas held in *City of Weatherford Water, Light & Ice Company versus Veit* (196 S. W. 986). An electric light company owes a duty to its employees to place its high-voltage wires on the outer ends of its cross-arms for their protection and in accordance with the usual practice. After a telephone pole was erected in close proximity to an electric light pole it was the electric company's duty toward the telephone company's employees to inspect the insulation of its high-tension wires.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Increased Cost of Electric Light in Moscow.—Consul David B. Macgowan reports from Moscow, Russia, that owing to the rise in fuel and other costs and to increased wages Moscow electric light companies have increased charges for electricity 24 per cent.

Motor-Driven Steel Mill Starts at Mansfield, Ohio.—The Mansfield Sheet & Tin Plate Company started operating a motor-driven steel mill with a demand of about 3000 kw. on Sept. 17. The plant contains six hot mills, each driven through gearing by a 1500-hp. motor. There are also eight cold mills, each driven through gearing by 500-hp. motors. Energy is being supplied for the steel mill from the plant of the Mansfield Electric Light & Power Company.

Electrical Markets in South Africa.—Writing from Johannesburg, South Africa, United States Consul John P. Bray says: "British manufacturers still send most of the imports of electrical goods into this district. The United States exported \$317,602 worth in 1916. American standards and specifications often differ from those used in South Africa. Japanese manufacturers sent large shipments here. The qualities and prices of their products are said to compare favorably with English goods."

Hydroelectric Energy Markets in Stavanger, Norway.—Reporting from Stavanger, Norway, United States Consul Maurice P. Dunlap writes: "One company that has been buying American material is the Electric Furnace Products Co. (Ltd.), which is operating with American capital and developing the water power in Saude, to be used in the manufacture of carbide. The Florli Company was formed during the year with a capital of \$268,000, most of the stock being owned locally. This enterprise will obtain power from mountain lakes that empty into the Lysefjord. The needs of Stavanger for more electric power were apparent during 1916. The shortage of coal made it necessary to use all the energy available for power, lighting, heating and cooking. Temporary installations were made in as many private houses as could be accommodated, a maximum of 2 kw. being allowed each house. To utilize Norway's advantages in water power to the utmost is now the aim of the authorities. At Sirdal, in the southern part of this district, arrangements are being made to develop one of the waterfalls which will give 12,500 hp. at an estimated cost of \$1,600,000 and a yearly expenditure of \$165,000. This scheme will not be completed before August, 1919. In the meantime the water sources at Lake Oltedal, from

which Stavanger's present hydroelectric power comes, are to be increased by 5000 hp., and that from Florli may be taken over."

Eighty per Cent of Park Lamps Are Incandescents.—Statistics gathered by the Bureau of the Census show that 80 per cent of the lamps in parks in 1916 were incandescent lamps. The use of arc lamps, gas lamps and other forms of illumination has fallen away considerably in the last ten years. The relative use of the different kinds of illuminants is shown in the following table:

Type of Lamp	Per Cent of Total Number		
	Park Lighting, 1916	Street Lighting, 1909	Street Lighting, 1907
Electric arc	8.5	34.5	34.2
Incandescent electric	80.1	16.3	10.6
Gas	6.2	41.5	45.1
All other	5.3	7.7	10.1

Overcoming Camouflage.—One of the Cleveland papers has discussed color principles, as illustrated by M. Luckiesh, physicist, research laboratory, National Electric Lamp Works, in their possible application to camouflage. By looking through colored glasses, it was said, American soldiers may be able to defeat the attempts of the enemy to deceive by the use of certain shades and colors. By using screens of contrasting colors with field glasses uniforms or objects of any kind may be made to appear in contrast instead of in harmony with the surroundings. Camouflage, as used in the French army, is accomplished largely by the use of paint, and objects are made to blend with their surroundings. This form of deception may be defeated, should the enemy attempt it, by the use of glass screens of various colors. Because of the difficulties in the way, the application of light on a large scale for this purpose has been impossible, but at the same time they may be overcome.

Electrical Equipment in Jamaica.—Consul Ross Hazeltine, Port Antonio, reports that American manufacturers furnish most of the electrical supplies and equipment used in Jamaica. There is no local manufacture of these products. The imports are grouped separately under two headings, as follows: (1) Apparatus necessary for generating, storing, conducting, converting into power or light, and measuring electricity, and (2) telegraph and telephonic wire and apparatus. The imports of both groups fall under the list of articles admitted duty free. During 1914 the imports of the first group amounted to \$51,252 and in 1915 to \$34,021 and the second group to \$6,966 and \$6,588 respectively. The United States supplies a large percentage of the electrical equipment imported into Jamaica. This condition may be attributed to the fact that in many instances the original installations consisted of American equipment. Electrical accessories such as irons, fans, vibrators and cooking utensils have no sale owing to the fact that the local electric light plant operates at night only.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

San Francisco Section of the American Institute of Electrical Engineers.—At the regular meeting of this association, held Sept. 28, J. D. Galloway, chairman of the committee on engineering and inventions of the State Council of Defense, spoke on "The Civilian Engineer and the War," and Frank Rieber, of the Rieber Laboratories, spoke on "Engineering Problems of the War." A cordial invitation was extended to members of the American Society of Civil Engineers to attend.

Automatic Telephony as Applied to Industrial Plants.—The Philadelphia Section of the Association of Iron and Steel Electrical Engineers will meet on Oct. 6 at the Majestic Hotel. The speaker of the evening will be Thomas C. Thompson, of the Automatic Electric Company, Chicago, who will read a paper entitled "Automatic Telephony as Applied to Industrial Plants." The paper will be illustrated with lantern slides. For the November meeting every member is requested to prepare a short paper.

Philadelphia Meeting, A. I. E. E.—The three hundred and thirty-third meeting of the American Institute of Electrical Engineers will be held in Philadelphia on Oct. 8, under the auspices of the Philadelphia Section. The general subject of the meeting will be industrial research, and three papers will be presented by Dr. F. B. Jewett, C. E. Skinner and Dr. A. E. Kennelly. There will be afternoon and evening sessions and an informal dinner between the sessions. The regular monthly meeting of the board of directors will be held at 11 o'clock a. m., and several committee meetings will be held during the day.

International Association of Municipal Electricians.—The following officers for the ensuing year were elected at the annual meeting at Niagara Falls, N. Y. on Sept. 11 to 14: President, C. E. Diehl, Harrisburg, Pa.; first vice-president, H. Thomas, Scranton, Pa.; second vice-president, C. E. Convers, San Antonio, Tex.; third vice-president, R. C. Turner, Atlanta, Ga.; fourth vice-president, Arthur J. Bell, New Rochelle, N. Y.; secretary, Clarence R. George, Houston, Tex.; treasurer, W. H. Flandreau, Mount Vernon, N. Y.; executive committee, Jacob Grimm, Buffalo, chairman; Jay I. Franke, Perth Amboy, N. J.; Charles Downs, Altoona, Pa.; Arthur E. Platt, Bridgeport, Conn.; William Briggs, New Bedford, Mass.; James J. Mulcahey, Yonkers, N. Y.; W. L. Potts, Detroit; A. J. Balizet, Meadville, Pa., and Job Berry, Indianapolis. The 1918 convention will be held in Atlanta.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes



C. E. DIEHL

Clark E. Diehl, the newly elected president of the International Association of Municipal Electricians, is manager of the Postal Telegraph office at Harrisburg, Pa., and is also connected with the municipal service of that city, having supervision of the fire-alarm and police patrol systems. Mr. Diehl learned telegraphy on the Pennsylvania Railroad lines and for a time worked for that company. He has been manager of the Postal office at Harrisburg ever since that company first started doing business, in the eighties. In 1897, after an unsuccessful effort on the part of Harrisburg to operate its fire and police alarm system with some degree of reliability, Mr. Diehl was requested by the mayor of the city to assume charge and endeavor to get the system in shape. Ample assistance was provided by the city, and in a very short time the department was organized and a reliable service provided. Ever since Mr. Diehl has continued to supervise the department. Although Mr. Diehl never had a purely technical education, he has been an ardent student and applied himself to the study of electricity in a practical way. He has perfected a number of inventions, one of which has been of great value in improving the quadruplex system of telegraphy.

Arthur Williams of the New York Edison Company has been appointed chairman of the Food Administration conservation campaign committee of New York City.

W. H. P. Hill, formerly with the Northwestern Electric Company, Portland, Ore., has been appointed sales manager of the Idaho Power Company, Boise, Idaho.

Harry Hollis has resigned from his position as electrical engineer for the Reading (Pa.) Transit Company to take a similar position with the Bethlehem Steel Company at Lebanon, Pa.

Rufus E. Lee, who several months ago relinquished his interests in the Lee Light & Power Company of Clamanda, Iowa, has been appointed general manager of the Nebraska Electric Company, Cedar Rapids, Iowa. The Nebraska Electric Company is an Iowa corporation, operating in towns in

northeastern Nebraska, among which are Creighton, Wausa, Bazile Mills, Niobrara, Winnetoon, Bloomfield, Hartington, Wakefield and Emerson. Mr. Lee has been very active in State Association work and during 1914 was president of the Iowa Electrical Association.

Walter S. Finlay, Jr., has been appointed superintendent of motive power of the Interborough Rapid Transit Company and of the New York Railways Company to succeed the late H. G. Stott.

E. H. Davis, past-president of the National Electric Light Association and president of the Lycoming Edison Company, Williamsport, Pa., is recovering from a dislocated shoulder which he received in New York City from a fall.

C. C. De Bruler has resigned from the electric range sales force of the Milwaukee (Wis.) Electric Railway & Light Company, to accept the position as manager of electric range sales for the Colorado Power Company, Montrose, Col.

Prof. W. S. Franklin, formerly of Lehigh University, has accepted a position as special teacher and lecturer at the Massachusetts Institute of Technology, partly in the department of physics and partly in the department of electrical engineering.

Edward T. Moore, who has been with the Westinghouse Electric & Manufacturing Company for a number of years, has recently accepted a position with the Halcomb Steel Company and the Syracuse Crucible Steel Company, Syracuse, N. Y., as electrical engineer.

L. O. Vesper, who for the last two and one-half years has been electrical superintendent for the Aluminum Company of America and the St. Lawrence River Power Company at Massena, N. Y., has resigned to accept a position on the engineering staff of the Electric Bond & Share Company in New York.

John H. Barker, until recently chairman of the fan section of the Associated Manufacturers of Electrical Supplies, has resigned as sales manager of the Diehl Manufacturing Company, with which he has been connected for more than eight years, to go into business for himself as manufacturers' agent in New York City.

Fréling Foster, until recently advertising manager of the Hughes Electric Heating Company, Chicago, has joined the advertising staff of the Society for Electrical Development, with headquarters in New York. He will take the place made vacant by the resignation of E. M. Hunt, who has become connected with the *Review of Reviews*.



C. A. MENK

Charles A. Menk, formerly first vice-president of the Association of Iron and Steel Electrical Engineers, was elected president of the association at the eleventh annual meeting, recently held at Philadelphia. Mr. Menk has been in the employ of the Carnegie Steel Company at Homestead, Pa., for the last twenty-five years, during the last twelve years as superintendent of the electrical department.

I. B. Zimman, contract agent for the Nebraska Power Company, Omaha, Neb., has been placed at the head of the sales and service departments of the company in active charge of all of the company's dealings with the public.

Obituary

Robert K. Young, president of the Wellsboro (Pa.) Electric Company, died at the Blossburg Hospital, Wellsboro, on Sept. 12.

William P. Hancock, superintendent of the generating department of the Edison Electric Illuminating Company of Boston, Mass., died at his home in Boston Sept. 19. Mr. Hancock was one of the most widely known power-plant executives in the central station industry and was one of the strong men of the Edison operating systems of the country. He was born at Kennebunk, Me., in 1856, and after receiving his early education at Saco, Me., learned the millwright, brass and iron molder's trades, being employed for a time at the United States Navy Yard, Kittery, Me. Mr. Hancock's electrical work began with the New York Edison Company and later carried him to many parts of the country in connection with wiring installations with which he was associated. Twenty-five years ago he joined the staff of the Boston Edison company in connection with the building of the Atlantic Avenue station and rose steadily to the post of superintendent of the generating department. He was the winner of a medal some years ago at a convention of the National Electric Light Association, where he presented a paper on underground construction. Mr. Hancock was a member of the Engineers' Club of Boston and various other organizations.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

GOVERNMENT FIXES PRICE FOR STEEL PRODUCTS

Priority Board to Control Distribution of Iron and Steel Through Licenses, Placing Private Interests Last in List

Government prices for steel products, showing decreases from 47 to 70 per cent over recent high prices, were announced in Washington on Monday, following a voluntary agreement by the steel interests and the War Industries Board. Certain of the raw materials necessary to the production of steel were also reduced in price.

The distribution of iron and steel will be placed under the absolute control of the Priority Board through licensing. Preference will be given to the War and Navy Departments and the Emergency Fleet Corporation of the United States Shipping Board. Next will come the supply for the needs of the Allies. Private interests not engaged in war work must wait until the last before obtaining supplies.

Although the new prices apply to all, it is very doubtful if they will cause any drop in prices of electrical goods into which steel enters largely. In fact, the control of iron and steel distribution may prove a great hardship to certain electrical manufacturers. It is now known that the government has restricted the supply of sheet steel to electrical manufacturers because the rolling mills were needed to turn out tinplate. Any further reduction in the supply of iron and steel will result therefore either in deliveries much more delayed or in the temporary withdrawal of certain articles from the market.

Conditions of supply and demand, however, have been so chaotic during the last two years that any stabilizing influence will be welcomed in many quarters. One of the leading executives in the electrical manufacturing industry, who is in a position to have the most authoritative information on conditions generally, said to a representative of the ELECTRICAL WORLD regarding the effect of the prices on electrical manufacturing:

"The effect will be wholesome and encouraging to enterprise. It will offer a relief from a runaway condition into which we have drifted."

AMERICA MAY GAIN TRADE IN ENGLISH LAMP MARKET

Recent Action of Dutch Government in Taking Coal Tar from Glass Factories Likely to Be Felt by Holland Lamp Industry

Glass factories in Holland have been notified by the Dutch government's coal distribution bureau that no more coal tar can be supplied. As a consequence at least some, if not all, of the ovens must cease working very soon. Should this action result in the shut-down of a large number of glass factories, the effect upon the market for American incandescent lamps becomes apparent.

During the last two or three years, although Holland has scarcely been able to export her lamps except in one direction, the exports have increased considerably, the imports of Dutch incandescent lamps into the English market having reached a large total.

It is not unreasonable to suppose that the action of the Dutch government may result in lessening the output of the Dutch lamp factories. In this event England will undoubtedly be in the market for an increasing number of American-made lamps. American manufacturers are now in a

better position to supply this market than they were six months ago, but with the winter demands coming on and with the appeals from certain sections of the country, particularly the Far West and Middle West, for lamp stock, the manufacturers may be put to it to discover a way to supply all markets.

MOTOR DEMAND PUSHES DELIVERIES FURTHER BACK

It Is Estimated that Manufacturers Are Not Less than 150,000 Motors Behind, with Larger Sizes Particularly Hard to Obtain

Two years ago the electrical market began again to show signs of life, and then quickly it advanced into a boom market. One of the first lines to feel the quickened pulse of buying was motors, and ever since the late fall of 1915 deliveries on motors have been very tardy. To-day they are, on the whole, worse than they have ever been.

Inquiries into the condition of motor deliveries revealed an immense number of unfilled orders. In fact, it is now virtually certain that the manufacturers all together are no less than 150,000 motors behind in delivery.

In the larger sizes conditions are worst. There is a very active demand for motors of 500-hp. rating and larger, and it is well known that manufacturers are not able to keep pace with requirements.

There are indications that before the beginning of 1918 higher prices will be placed on motors. With the exception of an advance by one concern on very small motors a few days ago, prices have remained steady for some months.

It is still possible for buyers to meet their requirements if speed and make are not specified. Every week a number of motors, first of one size and then another, come on the market, and there is, therefore, a fair stock of miscellaneous equipment available.

Second-hand houses and speculators, foreseeing this condition last year and early this year, placed orders for future delivery, and these motors are now coming on the market. They are, however, being taken up very rapidly.

Stock in fractional horsepower sizes has long since ceased to exist. One large manufacturer has gone out of the open market and finds his hands full just supplying old customers. The demand for small motor-driven equipment has greatly increased since war was declared, principally because of the labor problem. The scarcity of domestic help has opened up a wide sale for washing machines, mangles, dish-washers, sewing-machine motors, etc. Fan motors were sold out this year, and therefore an entire new stock must be turned out before the early spring of 1918.

WIRE UNAFFECTED BY COPPER AT 23.5 CENTS

Establishment of a Government Price for All Finds Market Temporarily Upset, with No Sales at Announced Figure

On Sept. 21 the government price of 23.5 cents a pound for copper was announced. This price is for all, government, Allies and private purchasers. For weeks and weeks those vitally interested have awaited this announcement, only to find themselves more at sea now that it has been made than they were formerly. The copper market is in a very excited condition, but almost no business is being

done. Certain it is that there have been no transactions at 23.5 cents. On Monday last there were some sales at 26 cents, but none was reported at a lower price. Those who have a supply of the red metal seem loath to part with it while the atmosphere of the market is so cloudy. Buyers, moreover, were probably for the most part bargain hunting, and it is doubtful if there will be any real inquiries for any considerable tonnage until the government clears up a great many points now in doubt.

As for copper wire, the announcement of the 23.5-cent price has made no difference. Base is still firm at 36 cents, with an occasional manufacturer quoting at 35 or 37 cents. The wire manufacturers have contracted for copper long ahead at prices in excess of the government price, and consequently it is not reasonable to suppose that wire base will soften any, provided, of course, that the demand is maintained.

Wire for the government is, of course, a different proposition. The price is merely the conversion price, since the government furnishes the producers with the raw copper.

Wire manufacturers will make no predictions regarding the future. At present they are at sea and, as far as is possible, are refraining from buying any raw material. It seems to be pretty generally felt, however, that irrespective of the government price the law of supply and demand will prevail, unless the government makes some ruling to the contrary.

The price of 23.5 cents seems sufficient to guarantee a reasonable profit to all producers so that there is no apparent reason for curtailing production. A recent study made of producers' costs showed the highest cost to be a fraction over 20 cents a pound.

Deliveries are much better on copper, but it is well known that a large volume of buying has been deferred pending the settlement of the government price situation.

METAL MARKET CONDITIONS

Trade Is Considerably Upset Owing to the Announcement of Government Prices

The outstanding features of the week in metals were the announcements from Washington fixing the price of copper at 23.5 cents and reducing the price of steel products in some instances as much as 70 per cent. The trade, however, is not clear as to how the situation will work out, and therefore temporarily is considerably upset. There is virtually no trading on private account. Some sales were reported of copper at 26 cents, but none was recorded at the announced price.

Lead is continuing to show weakness and is now quoted at 8 cents, a drop of 3 cents within a comparatively short time. Spelter was somewhat firmer, but all of the old metals showed an inclination to fall off.

In view of the government price of 23.5 cents for copper, no other market quotations are being made either for spot or for future delivery.

NEW YORK METAL MARKET PRICES

	Sept. 17			Sept. 24		
	£	s	d	£	s	d
Copper:						
London, standard spot.....	120	0	0	110	0	0
Prime Lake	27.00		to 27.75*	Govt. price	23.50	
Electrolytic	26.37½		to 26.75*	Govt. price	23.50	
Casting	26.25		to 26.62½*	Govt. price	23.50	
Wire base	32.00		to 33.00*		32.00 to 33.00*	
Lead, trust price.....		9.00			8.00	
Nickel, ingot		50.00			50.00	
Sheet zinc, f.o.b. smelter.....		19.00			19.00	
Spelter, spot		8.30			8.42½	
Fin. Straits		62.50			62.25	
Aluminum, 98 to 99 per cent.....	39.00		to 40.00*		39.00 to 40.00*	

OLD METALS

Heavy copper and wire.....	25.00	to 25.50	23.00 to 23.50
Brass, heavy	15.50	to 16.50	14.00 to 15.00
Brass, light	11.50	to 12.00	11.00 to 11.50
Lead, heavy	7.50	to 8.00	6.50 to 7.00
Zinc, old scrap	6.00	to 6.25	6.00 to 6.25

*Nominal.

THE WEEK IN TRADE

IN GENERAL, business is the same as ever, although there was noticeable activity during the week in certain of the heating appliances, particularly radiators. Prices are remaining firm.

The government announcements of copper and steel prices have had no apparent effect on the market as yet. It is generally felt that prices of electrical goods into which these metals enter in any appreciable degree will not soften as a result of the government's price. Raw materials have been purchased long ahead and these prices will be the controlling factors.

Collections, on the whole, are fairly good, although there is not a great deal of optimism in this respect to be discovered among the jobbing trade.

NEW YORK

Cool weather registered its effect upon heating appliance sales this week, and other seasonable goods sold well. While in certain quarters the lamp market appears to be oversold, there is still a large volume of business to be handled during the next three months.

Prices have been firm and have shown no indication to be swayed by government prices on copper or steel.

A diminishing number of small orders is being noticed by local jobbers, indicating the dull condition in the contracting field. Large orders, however, are being very well maintained in volume.

CABLE.—The United States government within the last week purchased 300,000 ft. of lead-armored cable for different naval bases. The shipments have begun and are almost completed.

TRANSFORMERS.—In transformers, large and small sizes, the demand far exceeds the supply. In not a few instances deliveries are delayed from four to six months. This congested condition is due mainly to the inability of the manufacturers to obtain raw material in sufficient quantity. When goods are in hand they are distributed on the allotment plan; that is to say, by giving to each customer what can be spared at the time. Prices are firm, with an advance threatened in the near future.

INSULATORS.—High-tension insulators for switch-board work are having a strong demand which manufacturers are having difficulty in meeting owing to the congestion that prevails, charged up to the raw-material market.

MOTORS.—Figures from different manufacturers indicate that they are now not less than 150,000 motors behind in deliveries, with larger sizes particularly hard to obtain.

SECOND-HAND MACHINERY.—There is an active demand for motors, transformers and generators at top-notch prices. Equipment is becoming very scarce, and it is now impossible to obtain immediate deliveries on certain sizes and types.

POLES.—Chestnut poles are becoming very scarce because of the blight. An effort to obtain 400 poles on one order is meeting with considerable difficulty. Army camp construction in this vicinity has called for large quantities of poles.

WIRE.—The government price of 23.5 cents has had no apparent effect on the wire market. Wire base is firm at 36 cents. The government price brought forth no business or inquiries for wire so far as could be learned early in the week. The market for code wire is still off because of the dearth of new building, but the demand for submarine, subway and underground cable is sufficient to keep factories running at top speed.

ELECTRIC HEATERS.—There has been a very brisk demand for small heaters, principally of the radiant type, during the past week as a result of the cool weather. A

sale was also recorded during the week for a number of large electric radiators for the hospital at Camp Upton.

HEATING PADS.—The retail season will not begin for another month, but pads are now just beginning to move in quantities to the retailers.

LAMPS.—In certain quarters the market appears to be oversold. Prices remain unchanged, but an early advance is being discussed in keeping with the outlook for raw materials.

CONDUIT.—Rigid conduit is none too plentiful in supply, with flexible on an easier basis. The market is firm, with local deliveries slightly in arrears. Buying is normal and prices are unchanged. Discounts are becoming more limited as prices become harder on raw material.

COLLECTIONS AND CREDITS.—With manufacturers collections are very good, but, nevertheless, the chronic "slow-pays" require prodding, especially at the close of the month. Discounts are variable, according to circumstances and confronting conditions. Credits with jobbers are tightening up and contractors are advised to follow a like course. Collections are fairly satisfactory in this branch of the trade with a number of the leading houses, but not so good generally speaking. There is a feeling that money is by no means in liberal supply, and contractors who are careless in their collections or are furnishing estimates loosely drawn in respect to cost of material will be in a rather precarious condition within six months, if not before that time.

DELIVERIES.—Pipe is in better supply than it has been during the last three or four months, and deliveries from the manufacturers to jobbers are normal. Flexible lamp cord is still behind four or five months. The rubber-wire people, especially on large-size cables, are back six months. Manufacturers of wiring devices in which porcelain enters, such as entrance switches, fuse blocks, etc., are behind on deliveries from one month to three. This is owing to strikes at the Trenton potteries. Batteries are normal in regard to factory shipments.

CHICAGO

The trend of the copper-wire market, following the fixing of the 23.5 cent base by the government, is being watched with interest by Chicago jobbers. Just after the price was announced the market was a little weak, but the following day it loomed up stronger than ever. The best opinion is that fixing the base will have little effect on the wire market. Some believe this is true because of prices of other materials entering into insulated wire. Others think buyers who have been holding off will come into the market and that supply and demand will control the prices.

The jobbing business as a whole for the last two weeks has been a trifle weak. The expectation is that things will pick up in about two weeks or a month when the real fall buying gets under way. Credits and collections remain fair.

LUMINOUS AND OPEN-COIL RADIATORS.—Fall business has not yet opened up, although there have been a few cold days.

CROSS-ARMS.—Shipments from the Far West are getting better in spite of predictions that they would get worse. Vigorous buying is expected.

GLASS INSULATORS.—Prices are steady. This is a class of goods which has not advanced in proportion to other construction material.

LINE HARDWARE.—Jobbers are long on stock and stand ready to make prompt shipments.

LAMPS.—Every one is behind on orders for smaller sizes. There appears to be little relief in sight.

SOOT CLEANERS.—Manufacturers report growing interest and increased volume of business, due to desire to operate plants efficiently and to cut power-house labor.

ROTARY PUMPS.—Some manufacturers of rotary pumping equipment are seriously affected by shortage in small turbine and motor equipment for driving their pumps. On account of their inability to get the driving equipment, deliveries on the pumps have been held up after their completion at the factory.

BOSTON

Trade continues active, although business outside government and closely related affairs appears to be slowing down a little. Central stations are feeling the effects of the draft especially in their sales departments, and in most cases little effort is being made to fill the vacant places. Contractors are very busy along industrial lines, notably in the Connecticut valley, where labor is particularly scarce. Some large residential wiring is being handled to advantage this fall. Electrical jobbers report credit conditions as rather slow. Many are hoping to get rid of stocks purchased at high price levels before lower prices set in as the result of government price regulation, but some jobbers feel that the latter will have little real effect on the market for some time. Little can be said in favor of better deliveries. In the telephone field the Massachusetts Public Service Commission has just condemned the war policy of the New England Telephone & Telegraph Company, which refuses new residential installations except in emergency cases. In its finding the board points out that there has been no national movement in this direction in Bell circles and cite the company's own evidence and recent advertising and sales of the Western Electric Company of electric household appliances as an indication that there has been no serious shortage of the raw material. Electrical manufacturing interests in the Connecticut valley report increasing volume of government business, a shortage of labor with openings increasing for women, a fair volume of pure industrial trade, considerable difficulty in obtaining raw materials, and little prospect of price reductions at present. Isolated plants are coming over to central station service at Boston.

ELECTRIC MOTORS.—A brisk demand still makes it difficult for manufacturers to stock up all along the line though odd sizes are plentiful for immediate delivery. Prices remain firm and are probably 40 per cent higher than eighteen months ago, on the average.

HEATING PADS.—Increased sales are reported, especially to elderly persons among retail buyers. These pads are being utilized on sleeping porches this fall to great advantage.

FLASHLIGHTS.—Military trade holds well, and 550 were sold recently in a single afternoon to guardsmen encamped on the Yale Field, New Haven, Conn. Shortened days will increase the normal commercial demand for these equipments.

ELECTRIC RADIATORS.—A brisk demand is noted. The failure of anthracite coal to go lower in price means heavier sales of these units in October and November. No price changes are noted.

TABLE APPLIANCES.—Manufacturers are shipping substantial lots to jobbers for the holiday trade, and the outlook for the latter appears excellent. The increasing difficulty of the servant problem is proving a strong factor in electric cooking developments.

METER-TESTING APPLIANCES.—A steady demand for fixed and portable sets is noted. Raw materials are rather scarce, and prices show little prospect of immediate change.

SEARCHLIGHTS.—Very heavy government orders are being handled.

ELECTRIC PLEASURE CARS.—Something of a boom is noted in this equipment in the Hartford district, due to the drafting of chauffeurs for the conscript army. Gasoline-car owners are planning in not a few cases to put up their engine-driven cars and buy electrics for easy operation. Deliveries are better than last year, though still somewhat slow.

INDUSTRIAL ELECTRIC TRUCKS.—These are increasing in popularity, and many inquiries are coming in to agents of standard makes. Dealers are very active in investigating factory operating problems.

PORTABLE LAMPS AND FIXTURES.—Trade is still rather quiet, but it is anticipated that the demand for portables will soon increase.

SMALL STEAM TURBINES.—Day and night work is the rule in the most representative factory production

Government orders are very active, notably for naval service. Some exemptions have been obtained from the federal authorities, so that the labor situation is somewhat better than in lines less closely related to the war. Prices continue high, and long deliveries still are the order of the day on these machines.

AUTOMATIC COAL-WEIGHING APPARATUS.—Demand is strong, raw materials and labor are difficult to obtain, and prices are firm, with pig iron at \$52 per ton against \$18 normally and steel 10 cents per pound against 2 cents prior to the war. Nothing can be expected in the way of lower prices at present.

ELECTRIC SWITCHES, CABINETS AND PANELS.—Heavy marine orders are being handled at the factories. Labor is scarce, even for light assembly work, and women are in demand as well as men. Prices hold firm. The volume of business is below that of last year. Some increase in factory facilities is noted under construction.

ATLANTA

Conditions have not changed materially since last week, all lines continuing strong. The erection of a number of shipbuilding plants for both wood and steel tonnage is contemplated at a few of the Southeastern ports. The plants of this nature now in operation and those under construction have stimulated the demand for electrical marine supplies, showing a marked increase in volume for the last few months.

In addition to the private interests, the government is planning some large extensions to docks on the South Atlantic seaboard which will call for considerable electrical equipment, but as these plans have not fully matured, nothing definite can be said at this time.

The Tennessee Coal & Iron Company, Birmingham, Ala., placed an order amounting to \$750,000 last week with a large manufacturer for electrical equipment.

Collections covering the Southeastern section appear to be holding up well.

FARM LIGHTING OUTFITS.—One manufacturer reports a very substantial business, and the volume of orders is increasing daily to a point where the factory is 800 to 1000 outfits behind. For this year to date these sets have advanced approximately 25 per cent over last year, causing an accelerated demand prior to each increase. Deliveries during the early part of this year were made in two weeks, but at this time no outfits can be secured in less than six to eight weeks. A further slowing up in deliveries is expected, as the government has taken over the new plant of one of the larger manufacturers for the purpose of turning out complete aeroplanes and ignition systems for the new Liberty air motors.

RIGID CONDUIT.—There is visible lessening in the demand for both the black enamel and galvanized products. A report from an authentic source indicates a slight weakness in this material, as the price has been shaded on large lots for two weeks' delivery. This reduction may be only local and temporary, as there is nothing in the wind that would lead to a general decline, unless the raw material situation has improved.

PANELBOARDS.—Business in the past week for these has been excellent, as evidenced by good orders placed in Atlanta and New Orleans. Shipments are being made in two to three weeks.

STAMPED-STEEL BOXES.—This line seems to be following closely the trend of rigid conduit, showing a corresponding dullness.

STEEL MILL MOTORS.—Considerable activity exists in this line, owing to the extensive plans that the mills have in view. Some of these plans have culminated to the extent of large immediate contracts.

METERS.—Several manufacturers report an advance of from 15 to 20 per cent on both direct-current and alternating-current types. This increase will not affect present outstanding meter contracts. Deliveries remain about the same.

SEATTLE

During the past week there has been a noticeable increase in demand for household appliances, particularly washing machines, electric irons, toasters and socket-device heaters. Heaters have just begun to move well and heavy sales are expected. Sales on domestic appliances and heaters are being pushed. The results obtained in suburban towns in this territory are very satisfactory. Anticipated demand for lamps is materializing and is double the available supply. Factories are making a strenuous effort to supply orders and are making some headway, though shipments are coming through very slowly and a shortage is feared. Prices remain firm with no intimation of increases. It is reported that the demand from the government for construction work under way at the navy yard at Bremerton is resulting in a remunerative business for local dealers. Orders are being placed for motors, generators, wiring devices, wire, fixtures, and an inter-telephone system for the hospital unit and cottages under way. The electrical wiring and fixture contract on the proposed nine-story million-dollar warehouse at Bremerton will be let in a short time.

Award of the contract for the construction and equipment of a steam auxiliary unit to Seattle's present municipal power plant on Lake Union will result in excellent machinery and equipment contracts for Seattle dealers, as will the award of the contract for the two-mile extension of Seattle's municipal street railway division.

Sales of machinery and equipment, including motors, large and small, generators, etc., were about the same as last week. A temporary decrease in demand from wooden shipyards, due to the strike, was offset by a slight increase in demand from lumber mills which are reopening. There were no particularly large sales during the week, but the volume was very satisfactory. The effect of the carpenters' strike was not noticed, mainly because of its short duration, about one week. Dealers were not alarmed to any extent as business from builders is inconsiderable owing to the minimum amount of building. Demand from steel shipyards is normal.

Ordering for future stocks is very light. Dealers will not load up with high-priced stocks. Reports from Portland state that dealers experienced a normal week with satisfactory demands from shipyards and mills. Building is very light. Tacoma is exceptionally lively because of cantonment work and building. In Spokane building is light and other activities are normal. Credits and collections in Seattle were pleasing.

Conditions in the lumber industry in the Pacific Northwest show marked improvement. Lumber production in a week increased 60,841,213 ft. at 149 mills, notwithstanding sectional agitation by labor organizations against the so-called ten-hour day. Lumber business booked for strictly local trade established a new record in the industry, with a total of 9,389,763 ft. The Metal Trades Council, representing steel shipyard workers in Seattle, may call a strike immediately. Press dispatches from Portland dated Sept. 23 state that 5600 employees of steel shipbuilding plants were to go out on Sept. 24.

SAN FRANCISCO

Business has been fair during the past week. The demand for heating appliances shows an increase. Dealers are commencing to stock up for holiday trade. The advance in prices on Sept. 15 makes little difference in demand. Vacuum cleaners are selling well, and the demand for washing machines continues. Sales of electric ranges are slowing up, the season being about over; however, the fall season has been very satisfactory. The strike of metal workers has indirectly slowed up business in industrial lines somewhat. The activity of the electrical trade generally has been affected by the unsettled condition existing in San Francisco due in part to the strike and in part to preparations for the departure of drafted men the latter part of the week. Collections are holding up to normal fairly well, though they are not quite so good as was the case during the previous week.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor		List, per 1000 Ft.
B. & S. Size		
No. 14 solid		\$61.00
No. 12 solid		71.00
No. 10 solid		90.00
No. 8 solid		106.00
No. 6 solid		145.00
No. 10 stranded		95.00
No. 8 stranded		115.00
No. 6 stranded		160.00
No. 4 stranded		205.00
No. 2 stranded		266.00
No. 1 stranded		315.00

Twin-Conductor		List, per 1000 Ft.
No. 14 solid		104.00
No. 12 solid		135.00
No. 10 solid		185.00
No. 8 stranded		235.00
No. 6 stranded		370.00
No. 4 stranded		575.00

NET PRICE PER 1000 FT.—NEW YORK

Single-Conductor		Net Price
No. 14 solid:		
Less than coil		\$61.00
Coil to 1000 ft.		59.17
No. 12 solid:		
Less than coil		71.00
Coil to 1000 ft.		68.87

Twin-Conductor		Net Price
No. 14 solid:		
Less than coil		\$104.00
Coil to 1000 ft.		80.00
No. 12 solid:		
Less than coil		135.00
Coil to 1000 ft.		130.95

DISCOUNT—CHICAGO

Single-Conductor		Discount
Less than coil		+10%
Coil to 1000 ft.		-10%

Twin-Conductor		Discount
Less than coil		+10%
Coil to 1000 ft.		-10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10% to +10%
1/5 to std. pkg.	10% to 20%
Std. pkg.	34% to 44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	12% to +20%
1/5 to std. pkg.	20% to list
Std. pkg.	30% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 50	.35	.35
50 to barrel	.31 to .3175	.32 to .3275
Barrel lots	.28 to .2875	.29 to .2975

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 30	.35	.35
50 to barrel	.3175	.3275
Barrel lots	.2875	.2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. Per Coil	List, Per 100 Ft.
5/16	250	\$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25-50	35.00
2	25-50	45.00
2 1/2	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip	\$75.00 \$69.75
3/8-in. double strip	75.00 72.00
1/2-in. single strip	100.00 93.00
1/2-in. double strip	100.00 96.00

NET PER 1000 FT.—CHICAGO

Less Than Coil	Coil to 100 Ft.
3/8-in. single strip	\$75.00 \$63.75
3/8-in. double strip	78.75 71.25
1/2-in. single strip	100.00 85.00
1/2-in. double strip	105.00 85.00-95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32	\$0.05 1/2	1	\$0.25
1/4	.06	1 1/4	.33
3/8	.09	1 1/2	.40
1/2	.12	1 3/4	.47
5/8	.15	2	.55
3/4	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$55.00	\$24.50
1/4-in.—	60.00	27.00
		23.50

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$36.67-\$55.00	\$27.50 \$23.10-\$24.75
1/4-in.—	\$40.00-\$60.00	\$30.00 \$25.20-\$27.00

CONDUIT, COUPLINGS AND ELBOWS RIGID IRON

Size, In.	Conduit, List per Foot
1 1/4	\$0.08 1/2
1 1/2	.08 1/2
1 3/4	.08 1/2
2	.11 1/2
2 1/2	.17
3	.23
3 1/2	.27 1/2
4	.37
4 1/2	.58 1/2
5	.76 1/2

Couplings, List	Elbows, List
1/4	\$0.05 \$0.19
3/8	.06 .19
1/2	.07 .19
3/4	.10 .25
1	.13 .37
1 1/4	.17 .45
1 1/2	.21 .60
2	.28 1.10
2 1/2	.40 1.80
3	.60 4.80

DISCOUNT—NEW YORK

1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	6% 8%
2500 to 5000 lb.	9% 11%
(For galvanized deduct six points from above discounts.)	

DISCOUNT—CHICAGO

1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	3.8% 5.8%
2500-5000 lb.	6.8% 8.8%
(For galvanized deduct six points from above discounts.)	

FLAT IRONS

NEW YORK

List price	\$5.00
Discount	30%

CHICAGO

Net	\$3.75 net \$4.50 net
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FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	\$0.10
35-amp. to 60-amp.	100	.15
65-amp. to 100-amp.	50	.20
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.00
450-amp. to 600-amp.	10	5.00
600-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	\$0.10
35-amp. to 60-amp.	100	.15
65-amp. to 100-amp.	50	1.00
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	5.00
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.75
1/5 to std. pkg.	4.50
Standard package, 500. List, each.	\$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500. List, each.	\$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B	100	\$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulbs, 3 1/8 in. frosted:		
15-watt—G	25	.50
25-watt—G	25	.50
40-watt—G	25	.50
Round bulbs, 3 1/2 in. frosted:		
60-watt—G	30	.72
Round bulbs, 4 1/8 in. frosted:		
100-watt—G	35	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$34.88
Coil to 1000 ft.	26.52

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$36.88 to \$37.20
Coil to 1000 ft.	27.66 to 27.90

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100.	\$20.00 to \$29.00
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CHICAGO

Net per 100.	\$24.00 to \$38.35
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OUTLET BOXES

Nos.	List, per 100.
101—A, A1 1/2, 4 S.C., 6200, 320.	\$30.00
102—B.A., 6200 S.E., 300, A.X., 1 1/2, 4 S.	30.00
103—C.A., 9, 4 R., B 1 1/2.	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list.	List	List
\$10.00 to \$50.00 list.	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list.	40%	35%
\$10.00 to \$50.00 list.	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$20.00
1/5 to std. pkg.	15.00
Standard package, 2200. List per 1000.	\$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80 to \$20.54
1/5 to std. pkg.	13.00 to 19.24
Standard package, 2200. List per 1000.	\$20.

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net	Std. Pkg.	3500 Std. Pkg.	4000
5 1/2 N.C.—Solid Nail-it—N.C.				
Less than 1/5 std. pkg.	\$24.30			
1/5 to std. pkg.	12.15			

CHICAGO

	Per 1000 Net	Std. Pkg.	3500 Std. Pkg.	4000
5 1/2 N.C.—Solid Nail-it—N.C.				
Less than 1/5 std. pkg.	\$11.85 to \$18.00	\$20.75 to \$30.75		
1/5 to std. pkg.	9.00 to 11.10	16.30 to 24.20		

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/2-in. cap key and push sockets	500	\$0.33
1/4-in. cap keyless socket.	500	.30
1/4-in. cap pull socket.	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No. Fuse

High Grade:	List
30-amp. S. P. S. T.	\$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

Less than \$10 list.	Plus 5% to 5%
\$10 to \$25 list.	11% to 16%
\$25 to \$50 list.	14% to 24%

DISCOUNT—CHICAGO

Less than \$10 list.	+5%
\$10 to \$25 list.	11% to 16%
\$25 to \$50 list.	14% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp., three-point	100	.54
10-amp., three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

	List, Each
Union and Similar	
No. 155	\$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list.	List	
\$2.00 to \$10.00 list.	20%	
\$10.00 to \$50.00 list.	30%	

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list.	25% to 50%	15% to 40%
\$2.00 to \$10.00 list.	25% to 50%	15% to 40%
\$10.00 to \$50.00 list.	34% to 64%	25% to 42%

TOASTERS, UPRIGHT

NEW YORK

List price	\$6.00
Discount	30%

CHICAGO

Net price	\$3.38 net to \$3.75 net
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WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

No. 18, less than full spools.	\$0.52
No. 18, full spools.	0.48

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	\$0.065 to \$0.6885
No. 18, full spools.	0.5285 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No.			
14	\$18.00	\$14.00	\$11.25
12	27.93	23.94	19.85
10	39.20	33.60	28.00
8	55.44	47.52	39.60
6	87.78	75.24	62.70

CHICAGO

	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No.			
14	\$18.00	\$16.00	\$14.00
12	28.63	24.54	22.50
10	34.44-40.28	31.57-34.44	28.70-31.57
8	48.84	44.77	40.70-44.77
6	70.24-70.80	63.85-64.00	57.47-57.60

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 10 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$40.25
25 to 50 lb.	39.25
50 to 100 lb.	38.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	\$42.00 to \$43.50
25 to 50 lb.	41.00 to 42.50
50 to 100 lb.	40.00 to 41.50

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Hand-Operated Fire Extinguisher

The Fire Gun Manufacturing Company, 17 Battery Place, New York City, has developed a fire gun which it claims is a positive double-acting liquid pump, which will throw extinguishing fluid from 30 ft. to 40 ft. (9.1 m. to 12.2 m.). It is claimed that this gun will expel the entire quantity of fluid with less labor than is necessary to empty similar devices, as it requires about one-half the number of strokes. Both in and out strokes operate. The fluid used as the extinguishing agent is a non-conductor of electricity, is non-freezing, and will not injure the finest fabric or delicate machinery, it is claimed. This gun is made in two sizes, the smaller having a capacity of nearly 1½ qts. (1.1 l.), designed especially for automobile use, and the larger having a capacity of nearly 1¾ qts. (1.6 l.) for household, factory and fire department use.

Motor-Generator Sets

Two rubber-manufacturing companies in Ohio have each recently installed two three-wire direct-current motor-generator sets that in construction are a departure from the usual practice. Instead of being of the old four-bearing, three-unit type or the two-unit type with a three-wire generator as one of the units, these sets consist of three units with only two bearings. These sets, which were designed and built by the Crocker-Wheeler Company, Ampere, N. J., consist of a 845-kva., 2200-volt, 60-cycle, three-phase synchronous motor driving two 250-kw., 125-volt, compound-wound interpole generators.



SET CONSISTS OF THREE UNITS WITH TWO BEARINGS

As compared with the old four-bearing, three-unit construction, these two-bearing units are much simpler in construction and have the following advantages as pointed out by the manufacturer. The absence of outboard bearings makes the brushes more accessible for adjustment and the unit

can be assembled, dismantled and cleaned more readily. Perfect bearing alignment can also be obtained with greater ease, as self-aligning bearings are used. The machines can hence be erected with less labor. Because of the shorter length of the set less floor space is required. Couplings, which in some cases constitute a weak link, are eliminated.

Light-Directing Shades for Street-Lighting Fixtures

Two new light-directing shades have been added to the Novalux street-lighting fixtures made by the General Electric Company of Schenectady, N. Y. A 20-in. (50.8-cm.) radial wave dome reflector, recently developed, has a large hand-hole to enable the socket and lamp to be easily removed as a unit. This dome not only adds to the appearance of the reflector, but it provides reflecting surface for every ray of light above the horizontal. The interior is white-enameled, even above the socket,



BAND REFRACTOR FOR STREET LIGHTING

so that the only light lost is the light cut off by the lamp base—a negligible percentage. An additional feature of this reflector pointed out is the fact that the edge of the rim is turned over and then enameled. This rolled edge prevents splitting of the enamel during handling or operation, and, according to the manufacturer, has the additional advantage of making the reflector absolutely impervious to rust.

The band refractor is a development of the prismatic refractor which was placed on the market a few months ago. It consists of two clear-glass bands, one of which fits snugly inside of the other. The joints are sealed to make a weather-proof union. The inner part is girdled on its outer surface by horizontal prisms which refract the light from the source at an angle of 10 deg. below the horizontal. The outer part has vertical diffusing prisms on its inner surface for the purpose of spreading the light rays transversely and making the refractor luminous over its entire surface. The two prismatic surfaces come close together when the parts are sealed, and the inner and outer surfaces of the complete refractor are entirely smooth.

Secondary Wire Rack

The wire rack shown herewith is lighter form of the No. 350 Peirce secondary rack made by Hubbard & Company of Pittsburgh, Pa. This rack is designed to carry No. 3 B. & S. gag



LIGHT WIRE RACK

and lighter wire secondary mains or poles and service wires on buildings as well as work which does not require the strength of the heavy rack. This rack is similar to the original rack using spool insulators and steel brackets.

Changeable Sign That Harmonizes with Surroundings

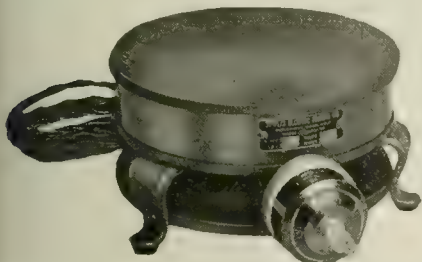
A changeable-letter indoor electric sign that can be made to harmonize with the color and architectural characteristics of any store surroundings is being manufactured by the Viking Sign Company, Inc., 527 Fifth Avenue, New York City. The sign in its simplest form consists of an oblong box equipped with one or more standard electric bulbs. The face carries interchangeable molded glass letters, permitting the formation of any desired name or sentence.

The glass letters are mounted in metal plates which slide snugly in the grooves forming the front edge of the box. There is a second groove directly behind the letter groove in which color screens may be placed when it is desired that the letters shall radiate colors other than natural white. Aside from novel effects, the color feature has the advantage of permitting the sign to be made to harmonize with an fabrics or wearing apparel displayed near the sign or in contrast or harmony with any interior color scheme.

In order to make the sign fit in with the architectural features of store and display windows the box may be fitted with various types of decoration and pedestals. The signs are normally furnished in statuary bronze color, although special colors are furnished on order. The outfits are completely equipped with lamps and plugs, and the manufacturer calls attention to the fact that the electrical features have been approved by the Underwriters Laboratories.

Small Hot Plate

Electric stoves in which the heating unit consists of coiled wire of nickel chromium, which is suspended in circular grooves in the casting of the top plate, are made by the Simplex Electric Heating Company of Cambridge, Mass.



HEATING ELEMENT IS ENTIRELY INCLOSED

The stove shown in the accompanying illustration is an 8-in. (20.3-cm.) disk stove arranged for three heats and has a maximum wattage of 1200. The coil is supported at intervals with mica. It is entirely inclosed and, it is pointed out, the heat generated in the wire radiates directly to the stove casting without having to force itself through heavy insulating material. Attention is also called to another advantage of this method, which is that the manufacturers are able to use a much greater length of resistance wire and a relatively greater thickness. This, it is claimed, helps in strength and durability.

Motorless Flasher

The motorless flasher made by the Betts & Betts Corporation, 511 West Forty-second Street, New York City, has a circular box containing a glass tube from which the air has been exhausted. A puddle of mercury floats in the tube, and in each end as well as the center there is a platinum leading-in wire. A rocking arm is operated by resistance wires, these heating and cooling continually while the flasher is in operation. The rocking arm is attached to the metal case containing the tube, which is thus tilted back and forth, either "making" and "breaking" a circuit or alternating two circuits as the case may be. Since there is no oxygen in the tube, the maker points out there is no deterioration in the contact surface.

Vertical-Type Electric Broiler

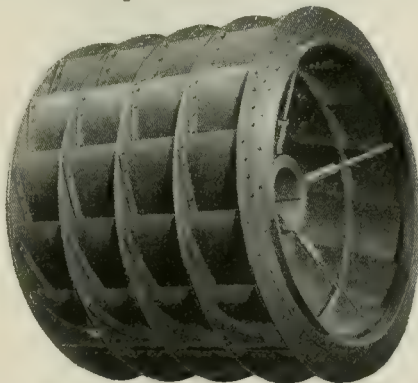
For hotels, restaurants, clubs, etc., where there is a large demand for broiled meats, the Hughes Electric Heating Company, 5660 West Taylor Street, Chicago, recommends its vertical-type three-compartment electric broiler. This broiler has an angle-iron frame and legs and is finished in black enamel. All walls are heavily insulated to conserve the heat. Each broiling compartment has two burners, one on each side, controlled by separate three-heat switches. By this arrangement both sides of the meat are broiled at

one time. In the two and three compartment types two or three kinds of meat or fish—or both—can be broiled at once without an interchange of odors. The broilers are made in 5, 10 and 15-kw. sizes. The resistance wire used is a composition of 80 per cent nickel and 20 per cent chromium.

High-Speed Forced-Draft Fan

The B. F. Sturtevant Company, Hyde Park, Boston, Mass., has developed a fan especially for high-speed forced-draft work which, it is said, has a very high efficiency maintained over a wide range of volumes. Particular attention is called to the heavy supporting annular rings carrying the blades. These rings are always of one piece, cut from a solid sheet, thereby avoiding the weakness of an acetylene well or the inefficiency of a riveted joint. Two substantial cast semi-steel hubs are riveted to the center plate. These hubs are shaped to conform to the natural-flow lines of the entering air.

The shaft is a steel forging of liberal proportions ground to the exact size. The fan impeller on its own shaft is



HEAVY SUPPORTING ANNULAR RINGS CARRY THE BLADES

given a careful running balance, insuring satisfactory operation, it is said.

The housing is constructed of heavy steel plate securely braced by a rigid angle-iron frame. The scroll sheet is bolted to this frame in such a way that portions of it are readily removable for cleaning or inspection. The outlet is approximately square and provided with a suitable angle-iron frame for convenient connection to the discharge duct. The cut-off is from 3 in. (7.6 cm.) to 5 in. (12.7 cm.) from the impeller, according to the size of the fan and is formed by a sheet rounded to a smooth curve or large radius. The inlet pieces are conical and are bound with heavy steel half rounds to protect the extending cones from damage. These cones are readily removable from the side sheet, and through the openings left by their removal the impeller may be put in place or removed. Inside of the housing the inlet cones are provided with a groove formed of angle-irons in which runs a flange on the impeller, as indicated in the accompanying picture. This method of packing increases the fan efficiency and practically eliminates

the annoying "blow-back" through the fan inlet, it is claimed.

Particular attention has been paid in the design of this fan to secure as quiet operation as may be possible with a high-speed fan. The comparatively large distance between the fan impeller and the cut-off, together with the shape of this cut-off, eliminates one of the most serious causes of noise. The number and proportions of blades and the angle at which they are placed has given a very quiet-running impeller. The inlet packing, by preventing the eddy which usually occurs at the inlet side, still further decreases the noise. Such noise as the instrument does make is of low pitch and not disagreeable.

Hair Dryer and Waver

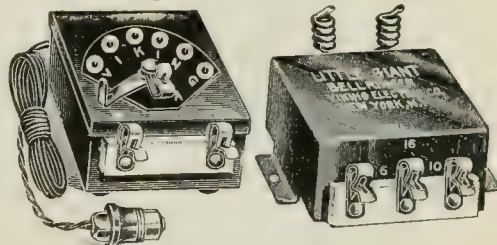
The Pelouze Manufacturing Company, 242 East Ohio Street, Chicago, has developed a combination curler and electrically heated comb. By slipping the comb attachment over the curling iron a heating effect is obtained, which, according to the manufacturer, has a tonic effect upon the hair and scalp. A special regulating device is included to prevent the temperature reaching a point that would burn the hair.

Bell-Ringing and Toy Transformers

The Viking Electric Company, 150 Chambers Street, New York City, has recently placed upon the market a line of bell-ringing and toy transformers, to be known as its "Little Giant" line.

With the three secondary voltages of 6-10-16, this bell ringer enables the electrician to determine readily the voltage that will overcome line losses and deliver the required voltages and current at the bell. The windings and core are embedded in a special insulating compound and contained within a sheet-iron case. The supporting ears are a part of the main case (not the transformer back), eliminating any danger to the transformer when being installed.

The primary cleat is provided on the inside with bosses through which the lead wires pass. The soldered joints

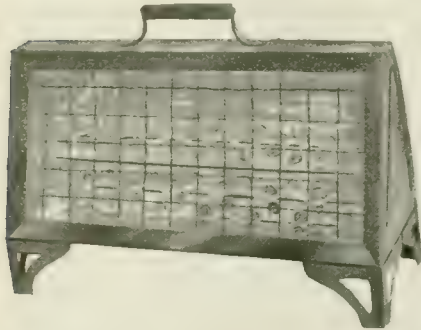


TRANSFORMERS EQUIPPED WITH SPRING CLIPS

are made on the other sides of these bosses. The secondary cleat is provided with recesses into which are set Fahnestock spring clips for terminals. These clips are riveted solidly through the cleat. This prevents the terminals from becoming loosened and causing loose connections.

Small Electric Radiator

Radiators in which the heating unit is a coiled wire suspended on supports in front of a highly polished reflector, shaped to reflect at different angles, have been developed by the Simplex Electric Heating Company of Cambridge, Mass. The appliance is 16½ in.



RADIATOR CONSUMES 600 WATTS

(42 cm.) long, 12 in. (30.5 cm.) high and 6½ in. (16.5 cm.) wide, and weighs 5.5 lb. (2.5 kg.). The casing is made of sheet metal and finished in black. The radiator is of the lamp-socket type and consumes 600 watts.

Washing Machine with Swinging Washer

An electric washing machine provided with a swinging wringer and known as the "No. 2" is being marketed by the Easiest Way Manufacturing Company of Sandusky, Ohio. This manufacturer calls attention to the fact that with this wringer the clothes may be turned from the washing machine to rinse water, from rinse water to bluing water, and from there to the basket, without moving the machine. One lever controls both wringer and washer. Both wringing and washing operations may be carried on at the same time. All gears and revolving mechanism are completely protected. A folding steel bench is supplied with this outfit without extra cost.

Rustproofing for Electrical Machines

The Parker Rustproof Company of America owns basic American patents on a new rustproofing process that consists primarily of changing the surface of iron and steel articles to basic phosphates of iron. Ferrous and ferric phosphates are insoluble and stable in atmosphere, and if chemically bonded to the metal article, offer a protection that serves to keep it from rusting.

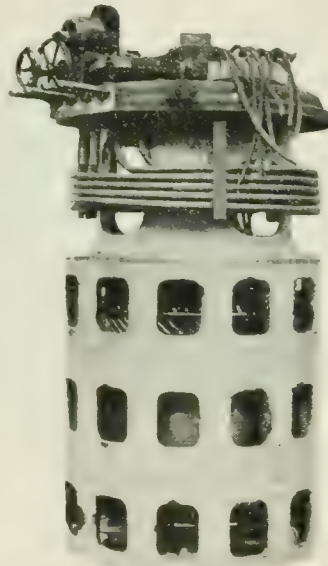
The articles to be "processed" are cleaned much the same as for electroplating. They are then immersed in a bath at 210 deg. or 212 deg. Fahr. (98.9 deg. or 100 deg. C.). This bath contains ferrous and ferric phosphates and some manganese dioxide. The article is left in the solution until hydrogen ceases to be liberated at its surface. The article is then removed from

the bath, air-dried and finished with a heavy mineral oil or any other desired finish, such as japanning, painting, etc. The Parker company claims that articles finished in this fashion do not rust even though the japan or other covering should crack.

High-Voltage Feeder-Voltage Regulator

In the accompanying illustration is shown a high-voltage induction-type feeder-voltage regulator made by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. This machine is rated at 160 kva., three-phase, 50 cycles, 11,000 volts, for 10 per cent regulation on 1600-kva., three-phase circuits. It is equipped with a motor and relays for full automatic operation.

This regulator has the same general mechanical designs as standard polyphase regulators for 2300 volts, special attention being given to coil insulation, in which mica is plentifully used. The coil ventilation is carefully worked out,



HIGH-VOLTAGE REGULATOR EQUIPPED WITH MOTOR AND RELAYS

and by the use of steel rings around the ends the coils are rigidly braced against magnetic shock from short circuits. When it is considered that the secondary windings are connected in series with the feeder circuit and must, therefore, receive all current or voltage surges on that circuit, the requirements for high-quality insulation and extra-strong bracing, properly applied, become apparent.

This unit is so constructed that the complete stator core and coils, as well as the rotor, may easily be removed from the tank for inspection and repairs. As an example of the extreme care taken in the design, the manufacturer cites the method of reducing vibration, with its resulting wear and noise, in case the bearings wear at one side, causing inequality in the air gap. To overcome this the windings are built with four coils per phase.

Electric Glue Pot

A dry-heat electric glue pot in which it is claimed that the consumption of electricity is kept down to a minimum because the insulation prevents loss of radiation and waste of energy has been placed on the market by the Mabey Electric & Manufacturing Company of Indianapolis, Ind. The heat-retaining jacket is constructed of heavy ingot iron, finished in black enamel with copper glue cup and wiping rod. Each glue pot is supplied with a 6-ft. (1.83-m.) cord, plug and a three-heat switch for 110 volts.

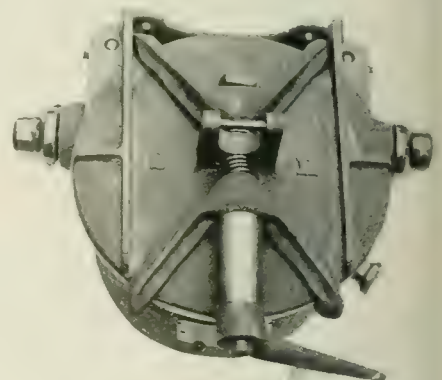
Oil Compression Subway and Overhead Cut-Out

A re-fusable cut-out embodying several improvements in electrical and mechanical arrangements is being manufactured by Schweitzer & Herz, 4327 Kenmore Avenue, Chicago. The Chem-electric Company, Chicago, and the G. & W. Electric Specialty Company, Chicago, are sole distributors.

The fusible link, which for its renewal requires no other tool than a screwdriver, and which, even in the largest size, costs less than 15 cents, is mounted between two blocks of refractory material held under compression. These blocks are suitably mounted on the removable plug member, which further carries contact plates for engagement with the clips mounted on the stationary member, where the line terminals are also installed. These parts are all held under oil in a case of metal capable of withstanding pressure.

In the operation of the cut-out the advantage of this construction is obvious in that the arc formed by the blowing of the fuse is quickly snuffed out if it ever does form. Usually the fuse is separated by the action of the compression blocks on softening; that is, just before the arc would otherwise form.

Each cut-out is equipped with a separable bracket, which is first



CUT-OUT HAS FUSABLE LINK

mounted on the cross-arm or in the manhole, after which the cut-out is slipped over the two projecting studs on the bracket.

This cut-out is for use on 2000-4000 volt circuits of currents from 10 amp. to 200 amp.

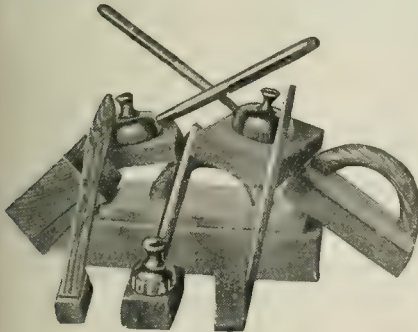
Control Equipment for Enameling Ovens

The standard form of control apparatus for enameling and japanning ovens and kindred work made by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., consists of magnet switches or contactors mounted on slate bases, which in turn are mounted on a pipe frame. These are grouped in any number for the control of an oven of any size.

The magnet switches can be operated only by opening and closing the magnet circuit. This is accomplished in two general ways—hand control by push-buttons or automatically by means of a thermostat. The push-button station consists of a two-button station with "on" and "off" buttons. The thermostat control is accomplished by means of a control instrument designed to maintain automatically the temperature of the oven within certain limits. This instrument is of the pressure-gage type, the pressure being produced by the expansion and contraction of mercury or a gas in a steel capillary when subjected to heat. Instead of the gage reading pounds pressure, it is calibrated to read temperature. It may be set so as to maintain the temperature practically constant, continuously and entirely automatically throughout the operating period. With an increase in temperature to a predetermined value, the thermostat actuates a relay which in turn operates the magnet switches, causing them to open. As soon as the temperature decreases to a predetermined value, the thermostat again actuates the relay to cause the magnet switches to close.

Commutator Resurfacer

The Ideal Commutator Dresser Company, 812 Hartford Building, Chicago, is marketing a commutator resurfacer. This device consists essentially of an artificial stone attached to a convenient handle. The stone is applied to the commutator to be resurfaced, with the machine operating either idle or under load. The stone cuts down high



VARIOUS STANDARD TYPES OF RESURFACERS

mica ridges and bars and smooths out grooves and low spots, but does not collect the copper dust. The stones are made in a variety of sizes, the smallest standard size being 2 in. by 1 in. by 1 in. (5.08 cm. by 2.54 cm. by 2.54 cm.) and the largest standard size being 14

in. by 8 in. by 2 in. (35.6 cm. by 20.3 cm. by 5.08 cm.). Several different shapes with different styles of handles are shown in the illustration herewith.

Portable Vapor-Proof Lamp Guard

A safety vapor-proof portable lamp guard that is designed to meet the requirements of garages or places where gases or inflammable materials may be used is being made by the McGill Manufacturing Company, 22 Oak Street, Valparaiso, Ind. A heavy steel frame, strong handle, handy grip hook and vapor-proof receptacle are the features pointed out for this guard. This apparatus takes a 25-watt standard tungsten lamp and is heavily tinned.

Bell-Alarm Signal-Contact Attachments

Many operators desire to have a bell or other signal circuit closed by a manually operated circuit-breaker when it trips on overload so as to attract the



METHOD OF MOUNTING SIGNAL ATTACHMENT

attendant's attention. A bell-alarm signal-contact attachment is being made by the Westinghouse Electric & Manufacturing Company for accomplishing this purpose. The breaker can be tripped manually without actuating this attachment, which can be mounted directly on all automatic overload trip coverplates of manually operated panel-mounting or remote-control oil circuit breakers.

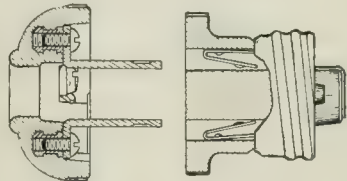
Solderless Connector

The Columbia Metal Box Company, 224 East 144th Street, New York City, is making a connector designed to be used as a substitute for soldered joints in junction boxes, conduit fittings, cleat wiring, in the bodies of lighting fixtures and behind shallow plates on ornamental wall brackets.

Fixtures can be removed at any time without cutting the wiring as in the case of soldered joints. This connector has been approved by the National Board of Fire Underwriters for a capacity of 17 amp. for fixture work, and for motor leads up to 4 hp.

Interchangeable Plugs and Receptacles

The Arrow Electric Company, Hartford, Conn., is manufacturing a complete and interchangeable line of "standard" plugs and receptacles. The attachment plug is separable. The



SPRINGS ARE REINFORCED

plug body is threaded for Edison base outlets and the plug cap acts as an adapter for thirteen different body parts.

All the springs in these plugs and receptacles are reinforced. The manufacturer points out that this insures a perfect contact, no matter how often the plug is inserted or withdrawn.

Electrically Operated Churns

A motor-driven churn is one of the new products of the Dazey Churn & Manufacturing Company, St. Louis, Mo. The motor is mounted on a framework above the churn proper and disconnected by a belt with a counter shaft at the base of the churn. A 1/6-hp. Morse motor is used for this outfit. A reduction pulley is used for speed adjustment, which enables the operator to set the speed at any desired value and to stop the churn without stopping the motor.

Electric Heaters for Small Rooms

The S. P. Stove Company, Inc., of Wilmette, Ill., has developed an electric heater for office, bedroom and bathroom use. This heater is made in a round or flat shape, the round one being shown herewith. The energy consump-



CONVENIENT ELECTRIC HEATER

tion is for either 660 watts or 1300 watts. The resistance unit is within the entire metal surface of the flat and round heater, so that both sides of the flat heater and the inside and outside of the round one are heated uniformly, it is claimed.

Trade Publications

CHAIN DRIVES.—"Casings for Link-Belt Silent Chain Drives" is the title of book No. 342, now being distributed by the Link-Belt Company of Chicago.

LAMPS.—The Westinghouse Lamp Company of New York has prepared a bulletin for agents and purchasers, giving engineering data about incandescent lamps.

CONCRETE MIXER.—The Blaw-Knox Company of Pittsburgh, Pa., is distributing a folder descriptive of its "Blaw-Ransomixer," in which its many advantages are pointed out.

ELECTRIC SUPPLIES.—The Mohawk Electrical Supply Company of Syracuse, N. Y., is distributing a bulletin in which it lists the lines of various manufactures which it is handling.

DISCONNECTING SWITCHES.—The Pringle Electric Manufacturing Company of Philadelphia has prepared bulletin No. 101, descriptive of its disconnecting switches equipped with locks.

GRAPHIC METERS.—The Esterline Company of Indianapolis, Ind., is distributing a bulletin descriptive of the largest graphic meter in the world for the largest station in the world.

AUTOMATIC SYSTEMS.—B. R. Scheerer of Johnson City, Tenn., has prepared a leaflet descriptive of the Scheerer automatic system for use in power plants and on electric-drive installations.

PORTABLE ELEVATORS.—The New York Revolving Portable Elevator Company of Jersey City, N. J., has prepared a booklet entitled "A Steel Giant," in which is described the method of installing overhead motors.

LOCOMOTIVES.—The heavy traction department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing reprint No. 53, descriptive of gears and side rods of electric locomotives on American railroads.

ELECTRIC HOISTS.—In book No. 246 the Link-Belt Company of Chicago describes its electric hoists. The book includes the leading features of the Link-Belt hoist, uses to which these hoists can be put, table of lifting capacities, direct-current and alternating-current hoists, etc.

OIL FUSE CUT-OUTS.—Oil fuse cut-outs for 2500 volts to 13,000 volts are illustrated and described in catalog No. 2, now being distributed by the D. & W. Fuse Company of Providence, R. I. This bulletin describes the pole type, subway type, and also heavy-service cut-outs for use up to 13,000 volts.

COMBINED FUSE AND SWITCH.—W. N. Matthews & Brother, Inc., St. Louis, Mo., has prepared a folder with suggestions for installing its type BF Matthews fuse switch. This company has also prepared a folder with directions for utilizing its hold-fast adjuster, a fixture that may be used in any position.

SYNCHRONOUS MOTORS.—The Electric Machinery Company of Minneapolis, Minn., has prepared bulletin No. 168, descriptive of its synchronous motors. This bulletin compares induction motors with synchronous motors. It describes how these motors are used in driving paper-mill machinery, rock crushers, rubber mills, fans and blowers and high-pressure pumps.

TURBINE PUMPS.—The Worthington Pump & Machinery Corporation of New York City has prepared a bulletin descriptive of the Worthington pump for high-pressure service. This bulletin describes the principle of operation, characteristics of turbine pumps, hydraulic balance, double volute pump, two-stage centrifugal pump, method of drive and field of application.

TROLLEY WIRE.—The Bridgeport Brass Company, of Bridgeport, Conn., is distributing bulletin No. 10, descriptive of its "Phono-electric" trolley wire. This bulletin gives the history of this wire, its characteristics, the reason why it is best for congested city traffic routes, on curves, general city use, suburban railways, interurban railways, heavy electrification, and other services. Photographs showing the busiest streets in the large cities of this country and others are given.

SYNCHRONOUS MOTORS.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., is distributing circular No. 1570, descriptive of synchronous motors for power-factor correction, by Nicholas Stuhl. The fundamental principles underlying power factor and its control are discussed and establish for those not versed in technical calculation. A simple graphical solution for all the prob-

lems of power-factor correction likely to arise in ordinary practice is given. Illustrations show some of the installations in which Westinghouse condensers have successfully improved the operating conditions.

Trade Notes

THE CROCKER-WHEELER COMPANY, Ampere, N. J., is erecting a new five-story reinforced concrete manufacturing building, 100 ft. by 200 ft., at an approximate cost of \$163,000.

W. D. SMITH, formerly connected with the New York office of the Robbins & Myers Company, has been elected secretary of the American Thermostat Company of New York City.

PHILIP K. CONDIT, formerly export manager of the Western Electric Company, has been appointed assistant director of the bureau of export licenses and placed in charge of the New York office at 11 Broadway.

THE DIEHL MANUFACTURING COMPANY, Elizabeth, N. J., has passed, through majority stock ownership, into the hands of F. S. Sells, recently of England. The Diehl company was formerly controlled by interests in Milwaukee.

THE ROBBINS & MYERS COMPANY has completed arrangements whereby the company will buy coffee in wholesale lots for retail to employees at cost price. The company announces that if the plan is successful similar activities will take place in other commod-ties.

WOODMANSEE & DAVIDSON, INC., Continental and Commercial Bank Building, Chicago, has changed its name to Woodmansee-Davidson Engineering Company. The address of the Milwaukee office has been changed from Wells Building to First National Bank Building.

FRANK L. PATTERSON & COMPANY and **BENJ. F. KELLEY & SONS,** water heating engineers and manufacturers of heaters, announce a combination of their interests under the name of the Patterson-Kelley Company, Inc., 26 Cortlandt Street, New York City.

C. D. POWELL of the general engineering department of the Westinghouse Electric & Manufacturing Company has resigned and accepted the position of manager of works of the Scientific Products Company of Steubenville, Ohio. The factory is at New Cumberland, W. Va.

THE CAPITAL ELECTRIC COMPANY has changed its name to the Geyser Electric Company, with offices at 321-323 North Shelton Street, Chicago. The company manufactures Geyser electric washers. The company announces no change beyond that of name has taken place.

THE ROBBINS & MYERS COMPANY of Springfield, Ohio, is making changes in its factory whereby space formerly utilized for storage will be taken up by new manufacturing departments. The new arrangements provide necessary space for further growth of existing departments.

JOHN H. BARKER announces the opening of an office at 95 Liberty Street, New York City, for the sale of electrical equipment for factories. Mr. Barker represents Roth Brothers & Company of Chicago, carrying a general line of motors and generators. Mr. Barker was connected with the Diehl Manufacturing Company for more than eight years as manager of its New York office, and as general sales manager.

THE ELECTRIC FURNACE CONSTRUCTION COMPANY, Philadelphia, Pa., announces that Frank W. Brooke, who was originally connected with the Gronwall Dixon furnace at Detroit and latterly as metallurgist for the Ludlum Steel Works and the Ludlum Electric Furnace Company, is joining its staff as director. Mr. Brooke will be responsible for the construction and running of the Greaves-Etchells furnaces. He will be assisted in the erection and installation by G. W. Ketter.

THE BRADFORD-ACKERMANN CORPORATION, Forty-second Street Building, New York City, announces that it has been appointed the Eastern sales agent for Young Brothers Company, Detroit, Mich. The sale of Young ovens for jappanning and drying purposes will in the future be handled by this Eastern office for the New England States, New York, New Jersey, Maryland, Delaware and eastern Pennsylvania. An engineering department will likewise be available for manufacturers in the East who are interested in quick drying and baking processes, and special oven designs will be offered to meet various requirements.

New Incorporations

THE FULDA (Ind.) FUEL & LIGHT COMPANY has been incorporated with a capital stock of \$2,100 by Alex. Snider and others.

THE LUCASVILLE (Ohio) LIGHT & POWER COMPANY has been incorporated with a capital stock of \$2,500 by Austin Taylor and others.

THE CISCO (Ill.) ELECTRIC COMPANY has been chartered with a capital stock of \$2,500 by W. S. Armsworth, E. Armsworth and E. Salisbury.

THE PHILO (Ill.) LIGHT, HEAT & POWER COMPANY has been incorporated with a capital stock of \$5,000 by John B. Carson, Davis E. Godfrey and O. B. Carson.

THE JENNINGS (OKLA.) ICE & LIGHT COMPANY has been incorporated with a capital stock of \$20,000 by C. H. McElroy and B. A. McFarland, both of Jennings, and B. Bailey of Okmulgee.

THE H. & H. ELECTRIC COMPANY of Mount Kisco, N. Y., has been incorporated with a capital stock of \$1,000 by John C. Hansen, L. Hansen and H. Houlberg. The company proposes to do a general contracting business.

THE ALABAMA STORAGE BATTERY COMPANY of Birmingham, Ala., has been chartered with a capital stock of \$6,000. The officers are: H. W. Matthews, president; Fred Sintes, vice-president, and C. R. Matthews, secretary and treasurer.

THE DAVIS ELECTRIC COMPANY, 54 Clinton Street, Newark, N. J., has been incorporated by C. E. Davis, R. Van Seggeren of Newark, and A. E. Davis of Irvington, N. J. The company is capitalized at \$50,000 and proposes to deal in electrical goods.

THE EASTERN CONNECTICUT POWER COMPANY has filed a certificate of incorporation with the Secretary of State. The company is capitalized at \$1,500,000 and proposes to generate and distribute electricity and to acquire electrical plants.

THE DELISSER ENGINEERING CORPORATION of New York, N. Y., has been chartered with a capital stock of \$10,000 by M. and A. Delisser and J. C. L. Rogge, 50 Broad Street, New York, N. Y. The company proposes to do a general electrical engineering business.

THE GROTON (N. Y.) ELECTRIC POWER CORPORATION has been incorporated by J. B. Carey, O. E. Wasser and I. J. Magee, 622 West 113th Street, New York City. The company is capitalized at \$20,000 and proposes to generate and distribute electricity for lamps, heaters and motors.

THE VAPOR HEATER CORPORATION has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$1,000,000 to manufacture oil, vapor gas and electric heating devices of all kinds. The incorporators are: C. L. Rimlinger, W. S. Randall and C. M. Egner of Wilmington, Del.

THE LOESCHER TANNING COMPANY of Lee, Me., has been incorporated with a capital stock of \$400,000 for the purpose of generating and distributing electricity in the town of Lee and the adjoining town of Springfield. The officers are: Harris N. Merrill of Winn, president; Harvey L. Haskell of Lee, treasurer, and M. L. Merrill of Winn, clerk.

THE ANIMATED BULLETIN COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$100,000 for the purpose of manufacturing electrical and other advertising devices. The incorporators are: Richard M. Craig of San Antonio, Tex.; Frank W. Arford and Charles A. Murphy of Chicago, Ill.

THE DEGNON AQUEDUCT CONSTRUCTION CORPORATION of Queens, N. Y., has been incorporated by R. F. Gustin, 68 Hunters Point Avenue, Queens, Long Island City; C. A. Baker and H. F. Karst, 52 Broadway, New York City. The company is capitalized at \$25,000 and proposes to construct electric and other railways and do a general contracting business.

THE AUTOMATIC CONTROLLER & MANUFACTURING COMPANY of Ogden, Utah, has been incorporated with a capital stock of \$100,000 to manufacture electrical and other machinery. The company will take over the patents granted to Cleveland Redfield. The officers are: Cleveland Redfield, president; J. W. O'Brien, vice-president; William J. Stone, secretary; Thomas Q. Whitehill, treasurer.

New England States

PRESQUE ISLE, ME.—The Gould Electric Company of Presque Isle has applied to the Public Utilities Commission for permission to issue 5993 shares of capital stock at \$100 per share, the proceeds to be used for the purchase of the property of the Maine & New Brunswick Electrical Power Company.

WHITE RIVER JUNCTION, VT.—The Mascoma Electric Light & Power Company of White River Junction has changed its name to the Grafton County Electric Light & Power Company.

ADAMSDALE, MASS.—The Attleboro (Mass.) Steam & Electric Company has applied for permission to extend its electric transmission line from South Attleboro into Adamsdale to furnish electrical service to the residents in this village.

FALL RIVER, MASS.—The War Department has granted the petition of the Fall River Electric Light Company to erect its wires across the Taunton River to connect the local switchboard with the transmission system of the New England Power Company.

GREAT BARRINGTON, MASS.—The Great Barrington Electric Light Company is erecting a new electric transmission line from the Furnace power station to the mill of the Rising Paper Company, which has contracted for electrical service.

MELVILLE, R. I.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 8 for construction of two wood-frame double buildings, including plumbing, lighting and heating systems, at the United States naval coal depot, Melville station. Drawings and specifications (No. 2565) can be obtained on application to the above bureau or the commandant of the naval station, Narragansett Bay.

SHELTON, CONN.—Contract has been awarded by Sidney Blumenthal & Co. for the construction of a new boiler house, 27 ft. by 150 ft., at their plant to Thompson, Binger & Co., 280 Mad son Avenue, New York, to cost about \$35,000.

Middle Atlantic States

BINGHAMTON, N. Y.—Operations have begun at the new plant of the Binghamton Light, Heat & Power Company. The plant has taken over a portion of the load of the old plant, about 600 kw., and will carry the entire load upon completion of the new substation and the 30,000-volt transmission line now in course of construction. Foundations for the towers are nearly completed.

BROOKLYN, N. Y.—Bids will be received by the New York Municipal Railway Corporation, 85 Clinton Street, Brooklyn, until Oct. 8 for erection of third-rail and appurtenances on the Culver line. Plans and further information may be obtained at the office of the chief engineer, Room 602, 85 Clinton Street, Brooklyn, N. Y.

BUFFALO, N. Y.—The American Radiator Company is planning to install new Greaves-Etchells 6-ton electric furnaces at its plant.

BUFFALO, N. Y.—Plans have been filed by the Buffalo General Electric Company for the erection of an addition to its power plant on River Road.

CANASERAGA, N. Y.—The Canaseraga Heat, Light & Power Company has petitioned the Public Service Commission for permission to construct an electric plant in the village of Canaseraga and for authority to issue capital stock.

CANTON, N. Y.—The St. Lawrence Transmission Company of Potsdam has petitioned the Public Service Commission for permission to construct an electric plant and furnish electricity in part of the town of Canton and for approval of a franchise received from the town.

HORNELL, N. Y.—Preparations are being made by the Hornell Electric Company to replace the arc lamps now in use with high-candlepower incandescent lamps throughout the city, with the exception of the business section, where curb lamps will be used.

LA SALLE, N. Y.—The Village Council has contracted with the Niagara Falls (N. Y.) Gas & Electric Light Company to install and maintain 20 tungsten street lamps of 60 cp., north of the railroad tracks.

LITTLE FALLS, N. Y.—The contract for electric-lighting fixtures in the new City Hall has been awarded to the Electric Shop & Garage, Inc., of Little Falls, at \$4,675.

NEW YORK, N. Y.—Arrangements have been made by the Bronx International Ex-

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

position, Inc., for the construction of a new transformer department at its building on 177th Street.

NEW YORK, N. Y.—The Interborough Rapid Transit Company is contemplating the construction of a new transformer station on property recently acquired on Jerome Avenue, at a cost of about \$26,000.

NEW YORK, N. Y.—The Interborough Rapid Transit Company, 165 Broadway, has acquired property at 113 East Eighteenth Street, adjoining its power plant, on which the company, it is understood, will build an extension.

PALMYRA, N. Y.—The clearing away of the remains of the old power plant at the barge canal locks has been completed and work of building the new structure, to stand west of where the old station was located, will begin at once. Not much can be done before next spring, but the preliminary work is under way. W. F. Maas & Son of Rochester are contractors.

ROCHESTER, N. Y.—Plans have been filed by George Keith, 155 Exchange Street, for the construction of a power house, 25 ft. by 48 ft., to cost about \$10,000. Contract for construction has been awarded to A. F. Friederich & Sons Company, Lake Avenue, Rochester.

SLOATSBURG, N. Y.—The Ramapo Finishing Corporation has awarded contract for the construction of a power house, 75 ft. by 150 ft., one story, to J. M. Rooney, 65 Brookside Avenue, Nyack. Charles H. Tenney & Company, 201 Devonshire Street, Boston, Mass., are engineers.

BAYONNE, N. J.—Plans have been prepared by the Board of City Commissioners for the installation of an electric-lighting system in the Park House, City Park and West Fifteenth Street.

ESSEX FALLS, N. J.—The Borough Council has awarded the Public Service Electric Company a contract for lighting the streets of the borough for a period of five years.

GLOUCESTER, N. J.—The City Council has granted the Delaware & Atlantic Telegraph & Telephone Company a fifty-year franchise to install and operate underground and aerial lines in different sections of the city.

HASBROUCK HEIGHTS, N. J.—Plans have been filed by the New York Telephone Company of New York City for the erection of a two-story addition to the local exchange, to cost about \$9,000. F. Milani of Hasbrouck Heights has the contract.

HOPEWELL, N. J.—The Public Service Electric Company has submitted a bid to the Borough Council for furnishing electricity to maintain the proposed improved street-lighting system.

JERSEY CITY, N. J.—The Board of Freeholders has awarded the Public Service Electric Company a contract for lighting the county institutions, roads and parks for a period of five years.

NEWARK, N. J.—Bids will be received by the Common Council until Oct. 2 for the installation of electric equipment in the proposed new fire house on Sanford Avenue. A. Archbald is City Clerk.

NEWTON, N. J.—Plans have been prepared by Andrew Kidd, Jr., engineer, 96 Liberty Street, New York City, for an addition to the power house, 50 ft. by 50 ft., one story, of the Sussex Print Works on Sparta Avenue.

PERTH AMBOY, N. J.—Plans are being considered by the J. C. Pardee Works for the installation of a new gas producer plant to replace the plant recently destroyed by fire. The company manufactures steel billets and bars.

PERTH AMBOY, N. J.—Plans are being considered by the Board of Aldermen for improvements to the commercial lighting system. A new generating unit and other equipment it is reported, will be installed at the municipal lighting plant at once.

PLAINFIELD, N. J.—The Niles-Bement-Pond Company is planning to build a power house at the Pond works in Plainfield, estimates for which have been received.

TRENTON, N. J.—The Public Service Electric Company is considering extensive improvements to its system in Liberty Street, from Adeline Street to Olden Avenue.

TRENTON, N. J.—Preparations are being made by the Public Service Electric Com-

pany for improving the lighting system in Stockton Street. The company has recently completed the installation of a new underground conduit system.

BOYERTOWN, PA.—Arrangements are being made by the Boyertown Electric Company for improvements to its electric transmission lines from Boyertown to Bally.

ERIE, PA.—Contract has been awarded by the Union Iron Works, Cascade Street, for the construction of a new power house and boiler room, 58 ft. by 90 ft., to Constable Brothers, Fifth and Sassafras Streets, Erie, at a cost of about \$15,000.

MCKEE'S ROCKS, PA.—The Pittsburgh Railways Company is planning to erect a new substation at Island Avenue and Boquet Street.

PHILADELPHIA, PA.—The Pennsylvania Chemical Company is planning to erect a new engine room, 46 ft. by 48 ft., at its Washington Avenue plant, to cost about \$20,000. Contract for construction of building has been awarded to the Nickson-Dugan Corporation, Bailey Building, Philadelphia.

PITTSBURGH, PA.—Extensive improvements, it is reported, are contemplated by the Pittsburgh, Mars & Butler Railway Company, to cost about \$1,250,000.

READING, PA.—The Metropolitan Edison Electric Company has secured a contract from the Narrow Fabric Works to furnish energy to the amount of 150 hp. at its factory in Wyomissing. The power company is making improvements to its substation on Seventh Street, including the installation of a new booster set for voltage control and a 1500-kw. rotary converter, the latter to be used exclusively for railway service.

READING, PA.—The Reading Transit & Light Company, the United Traction Company, the Front & Fifth Street Railway Company, all of Reading; the Boyertown & Pottstown Railway Company, the Birdsboro Street Railway Company, and the Reading & Womelsdorf Railway Company, all of which are connecting lines of the Reading & Transit Company, have been consolidated under the name of the Reading Transit & Light Company. The new company, through ownership or lease, will operate the street railway system in and about the cities of Lebanon and Reading, and extending from the latter to Philadelphia.

SCHUYLKILL HAVEN, PA.—The Town Council is considering improvements to the municipal electric-light plant, including the installation of a new boiler, involving an expenditure of between \$4,000 and \$5,000.

SUNBURY, PA.—The Borough Council has adopted a resolution to install a municipal electric-light plant.

FREDERICK, MD.—The Hagerstown & Frederick Railway Company is planning the erection of a 33,000,000-volt transmission line from Security to Waynesboro, via Smithburg and Ringgold, which will supply energy to the Chambersburg, Gettysburg & Waynesboro Railway. The Waynesboro Electric Light & Power Company will erect the line from Waynesboro to the state line, a short distance north of Ringgold, and the railway company will build the line from its plant to the Mason and Dixon line and connect with the Waynesboro line there. It is expected that the Waynesboro plant will close down soon after the transmission line is completed.

BLUEFIELD, W. VA.—The Norfolk & Western Railway Company has awarded a contract to the Union Switch & Signal Company of Swissvale for the necessary material for extension of the signaling system on its electrified division near Welch, Va.

FAIRMONT, W. VA.—Improvements to the municipal water-works system involving an expenditure of \$40,000 within the next two years are under consideration by the water commission. The plans provide for increasing the supply to 6,000,000 gal. per 24 hours and construction of earth reservoir with concrete lining. Electrically driven, four-stage centrifugal pump and filtration system may be installed. Plans are not yet completed. Ira P. Smith is water commissioner.

RALEIGH, W. VA.—The Chesapeake & Ohio Railroad Company is contemplating the construction of a new power house, to cost about \$20,000, at its local works. F. I. Cabell of Richmond, Va., is chief engineer.

GLENLYN, VA.—Contract has been awarded by the Appalachian Power Company of Bluefield, W. Va., for the construction of a steam-driven electric generating plant on New River, between the Virginian and the Norfolk & Western Railways, to C. W. Hancock & Son, Lynchburg. The proposed plant will have a generating capacity of 100,000 kw. The equipment will include an 18,750-kw. steam turbine, three 1200-hp. boilers, etc. The cost of the proposed plant is estimated at \$1,000,000.

NORFOLK, VA.—The Virginia Railway & Power Company is planning to build a one-story brick and concrete substation, to cost about \$2,500.

NORTON, VA.—Improvements are being made to the local power house of the Old Dominion Power Company, including the installation of additional boilers and other machinery, which will double the output of the plant.

PETERSBURG, VA.—The Petersburg & Appomattox Railway Company, which is building a line to Camp Lee is planning to extend the line through the camp to Prince George Court House.

RICHMOND, VA.—Contract has been awarded to P. G. White & Sons, Merchants' Bank Building, Richmond, for the construction of an addition to the municipal electric-light plant to cost about \$10,000.

North Central States

BAY CITY, MICH.—Plans have been completed by the Kuhlman Electric Company for additions to its plant.

DETOUR, MICH.—The contract for construction of electric-light plant in Detour has been awarded to C. W. Needham of the Needham Electric Company of Escanaba, which will include the installation of street lamps and wiring a large number of business places and residences.

GRAND RAPIDS, MICH.—The Clipper Belt Lacer Company is constructing a power house, to cost about \$8,000.

AKRON, OHIO.—The City Council has granted the Northern Ohio Traction & Light Company permission to build extensions to its lines in Akron.

AKRON, OHIO.—The Northern Ohio Traction Company is contemplating the erection of a high-tension transmission line from its power plant in Tuscarawas Street W. through the west park and thence to the transforming station of the Central Power Company at Waco. The company proposes to install two more stations of the same size at the plant in Tuscarawas Street W.

CINCINNATI, OHIO.—Preparations are being made by the National Lead Company, 659 Freeman Avenue, Cincinnati, for the construction of a new power plant, 100 ft. by 60 ft., on the site of a portion of the old plant.

CINCINNATI, OHIO.—Plans are being prepared by Stegner & Hughes, architects, for the construction of a power plant, 30 ft. by 58 ft., one story, for the Sayers & Scoville Company on the C. H. & D. Railroad, in the West End.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, Cleveland, Ohio, until Oct. 3 for one power type coal crusher for the Division of Water. Specifications may be obtained at the office of the commissioner of water.

CLEVELAND, OHIO.—The Westinghouse Electric & Manufacturing Company, it is reported, will erect a malleable iron foundry, 160 ft. by 260 ft., in connection with its gray iron foundry. The proposed plant will be equipped with two air furnaces and other equipment, including annealing ovens and molding machines, none of which has been purchased. A second building, to be used as a machine shop, will also be erected.

COLUMBUS, OHIO.—Petitions are being circulated by the Municipal Utilities League of Columbus, Ohio, for the submission of a bond issue to the voters at the November election, the proceeds to be used for the construction of a municipal telephone plant, to cost about \$300,000.

COLUMBUS, OHIO.—The contract for the construction of the power plant on the Ohio University campus has been awarded to E. H. Latham of Columbus, at about \$55,000. M. P. Streets of Columbus has secured the contract for building the tunnel and stack. The cost of the plant complete is estimated at about \$200,000. Plans are now being prepared for the erection of a Chemistry Building, which will also be erected on the college campus and will cost about \$200,000. J. N. Bradford is architect.

ELYRIA, OHIO.—The capital stock of Elyria Telephone Company has been increased from \$200,000 to \$350,000.

GALION, OHIO.—The plant of the Galion (Ohio) Dynamic Motor Truck Company has been purchased by the Lakewood Engineering Company of Cleveland, which, it is understood, will use it for the manufacture of storage battery trucks and trailers, with a four-wheel steer and four-wheel drive. Plans, it is said, are being prepared for an extension to the plant.

SALEM, OHIO.—The Youngstown & Suburban Railway Company is remodeling a light plant which it recently purchased

in Salem to furnish energy to operate its car line. Equipment is now being installed in the plant and substations.

TOLEDO, OHIO.—Henry L. Doherty & Company of New York, N. Y., it is reported, are considering the construction of an electric railway from Toledo, Ohio, to Fort Wayne, Ind., via Watervliet, Grand Rapids, Napoleon, Defiance and other cities.

YOUNGSTOWN, OHIO.—Extensive improvements are contemplated by the Youngstown & Suburban Railway Company to its electric railway connecting Youngstown and Leetonia, and also the construction of a branch from Columbiana to East Palestine. The company is also considering the erection of a power plant at the southern extremity of its line and new substations along the railway. The construction of the proposed power plant will necessitate an enlargement of the substation at car barns and other changes and improvements.

HARRODSBURG, KY.—The pumping plant of the municipal water-works system, with the exception of boilers, was destroyed by fire on Sept. 13.

ORANGEVILLE, IND.—Plans are being considered for the construction of a dam across Lost River to develop power to operate an electric-light and power plant in Orangeville. Post office address, Orangeville, R. F. from Orleans.

CHICAGO, ILL.—The Western Electric Company is reported to be considering the construction of a new factory at 4537-39 West Twenty-second Street, Chicago, to cost about \$30,000. Walter R. Kattelle is architect.

CHICAGO, ILL.—Meltreger & Company, 1718 Washburn Avenue, Chicago, Ill., it is reported, would like to receive prices on arc lamps, Cooper Hewitt lamps and flaming-arc lamps. The company is also in the market for arc machines, generators, transformers, belting and equipment for complete plants.

PERU, ILL.—The City Council has decided to install a new pumping engine and a small generator in the municipal water and light plant, to cost about \$7,940.

GRAND RAPIDS, WIS.—The contract for the installation of an ornamental lighting system in Grand Rapids has been awarded to the Natick Electric Company at \$8,049.

LAKE GENEVA, WIS.—The Water and Light Commission is planning to install electrically-operated pumping equipment at the waterworks station, to cost about \$6,200. The equipment will consist of one deep-well pump, with a capacity of 700 gal. per minute, and two horizontal pumps of 500 gal. capacity per minute, to be equipped with electric motors.

MILWAUKEE, WIS.—The Park Board is contemplating installing lighting systems in Humboldt Kosciusko, Mitchell and Washington Parks similar to that in Lake Park. D. B. Starkey is president of Park Commissioners.

MILWAUKEE, WIS.—The Cutler-Hammer Manufacturing Company of Milwaukee, it is understood, will soon begin work on the construction of the second unit of its new plant at Twelfth Street and St. Paul Avenue, which will eventually cost about \$1,250,000, and which provides for replacement of all buildings comprising the present plant. Each unit will be 50 ft. by 200 ft., seven stories and basement, of reinforced concrete. A. W. Berresford is vice-president and general manager.

SHAWANO, WIS.—The DeLos Engineering & Construction Company of Prairie du Chien has been awarded the contract for additions and improvements to the municipal electric-light plant and waterworks system. The work will include the erection of a new power house, 66 ft. by 115 ft. New equipment, consisting of a new engine and generator and two electrically-driven pumps, will be installed there.

STATE SANATORIUM, MINN.—Bids will be received by the Minnesota State Board of Control, State Capitol Building, St. Paul, until Oct. 4 for complete installation of underground heating distribution system, heating systems for cottages and power plant equipment for the Minnesota State Sanatorium, State Sanatorium. Copies of plans and specifications may be seen at the Builders' Exchanges of St. Paul, Minneapolis and Duluth, the office of the State Board of Control and the office of the superintendent of the institution. Extra copies may be obtained at the office of Charles L. Pillsbury Company, engineers, St. Paul and Minneapolis, upon deposit of \$25.

WALKER, MINN.—Energy for operating the local system will be supplied from the steam plant at Akeley. M. D. Stoner and T. H. Crosswell who own and operate the Cuyanna Range Power Company, which supplies electrical service in Akeley, Deerwood, Pillager, Brainerd and other places in this part of the State, have been granted

a 15-year franchise and will erect an electric transmission line to Walker to furnish electricity in Nevis, Akeley, Walker and other towns.

DES MOINES, IOWA.—Property owners on Sixth Avenue, from Grand Avenue to School Street, have petitioned the City Council to install electroliners. The petitioners agree to furnish the standards if the city will furnish electricity for the lamps as provided under the metropolitan lighting system ordinance.

DUBUQUE, IOWA.—The Board of County Supervisors has granted the Eastern Iowa Electric Company a franchise to erect electric transmission lines over the county roads to furnish electrical service in the towns of New Wine, Luxemburg and Holy Cross for a period of 20 years.

MARSHALLTOWN, IOWA.—The City Council has called a special election to be held Oct. 15 to submit the proposal to sell the municipal electric-light plant to the Iowa Railway & Light Company.

STRAWBERRY POINT, IOWA.—The Town Council has called an election to submit to the voters the proposal to sell the municipal electric-light and power plant for not less than \$30,000 and granting to the purchaser a 25-year franchise to operate power plant and to distribute electricity generated outside of the town limits.

CREIGHTON, NEB.—The Nebraska Electric Company of Cedar Rapids, Iowa, it is reported, has purchased a small water-power at Creighton, which it proposes to develop at once.

DUNBAR, NEB.—At an election held recently the proposal to issue \$7,000 in bonds for the installation of a municipal electric-light plant was carried.

ALDEN, KAN.—A committee has been appointed to make investigations relative to the installation of an electric-light plant in Alden.

BELOIT, KAN.—The City Council is considering a proposal submitted by the Concordia Electric Light Company to furnish electricity in Beloit.

KANSAS CITY, KAN.—The Kansas City Light & Power Company has announced that plans are under way for the construction of a large electric power plant, to cost when completed approximately \$10,000,000. The initial cost will be about \$4,000,000. The site is bounded by Scott Avenue, Euclid Avenue and Kansas City Southern Railway tracks and the Missouri River, in what is known as the East Bottoms. The main building will be 600 ft. long and 266 ft. wide, with a pump house separate. Contracts have been awarded to the General Electric Company of Schenectady, N. Y., for two 20,000-kw. turbines. Plans are being prepared by Sargent & Lundy of Chicago, Ill., consulting engineers, who will have supervision of the construction of the plant.

LURAY, KAN.—The City Council has recently purchased the local electric-light plant, owned by M. L. Bratton, to be owned and operated by the municipality. Extensions and improvements will be made to the plant, including the installation of a larger engine.

PROTECTION, KAN.—The local electric-light plant was destroyed by fire on Sept. 13, causing a loss of about \$25,000. Bonds have been voted for a new plant.

RIVERTON, KAN.—The construction of a new substation and other improvements to its local system, it is reported, are under consideration by the Empire District Electric Company of Joplin, Mo. This is said to be the first step to make Baxter Springs the supply station for furnishing electricity for the mines south and southwest of the city. The company is replacing three old engines with new motors and a transformer is being installed to transform energy from the plant at Riverton to Baxter Springs.

Southern States

RALEIGH, N. C.—All water powers (five sites) of the Yadkin and Pedee Rivers between Badin, N. C., and Cheraw S. C., have been acquired by the Carolina Power & Light Company. The five sites are irrespective of Blewetts Falls, already developed and furnishing energy in cities and towns in North and South Carolina. The company has acquired 27,000 hp. at a plant on Wateree River in South Carolina and is erecting an electric transmission system to connect with its present lines. The company furnishes electricity in Marion, Florence, Darlington, Mullens and other cities in eastern South Carolina, between North Carolina and Somerville as far as Cheraw. Steam plants are operated in these places. Many electrical installations, it is understood, are contemplated in connection with this project.

REIDSVILLE, N. C.—The Town Commissioners have accepted the proposal of the

Southern Public Utilities Company of Raleigh, subject to the approval of the voters, for the purchase of the municipal electric-light plant, at \$30,000.

SPARTANBURG, S. C.—The South Carolina Light, Power & Railways Company is contemplating extending its system to Camp Wadsworth.

BRUNSWICK, GA.—Plans have been prepared by the United States Maritime Corporation for the construction of six shipways, large drydock, small drydock; 1800 ft. of dock for rigging, fitting and repairing vessel foundry, woodworking plant, steel fabricating mill, power house, machine shop, storage warehouse for materials, etc. Thomas Hampton, 502 Union Savings Bank Building, Washington, D. C., is vice-president.

CLARKESVILLE, GA.—The Council has awarded the Wofford Shoals Light & Power Company of Cornelia a contract for furnishing electricity in Clarkesville. The company has leased the equipment of the Georgia Railway & Power Company and will erect a transmission line from Clarkesville to connect with the line at Habersham Mills.

DUBLIN, GA.—Plans are being considered by local business men for extension to the ornamental lighting system.

CLEARWATER, FLA.—The Republic Real Estate & Construction Company is reported to be contemplating the construction of an electric-light plant in Clearwater. J. Bornstein is president.

PENSACOLA, FLA.—The Pensacola Fertilizer & Oil Company, recently incorporated with a capital stock of \$250,000, is planning to establish a menhaden fishery plant, including facilities to manufacture fertilizer and oil. The company will erect a factory building, scrap shed and two commissary buildings. The equipment will include three engines, two 150-hp. boilers, four 12,500-gal. oil tanks, two water tanks, oil and water pumps, electric-light plant, dryers, menhaden fish-handling machinery, etc. C. H. Munger, 21 Spruce Street, New York, N. Y., is representative.

BIRMINGHAM, ALA.—Plans are being considered by the Birmingham Railway, Light & Power Company for double-tracking its line on Nineteenth Street.

BIRMINGHAM, ALA.—The McClary-Jemison Machinery Company of Birmingham, it is reported, would like to receive prices on a 200-kw. to 225-kw., 250-volt direct-current generator and engine, complete with switchboard.

MAGEE, MISS.—Preparations are being made for the installation of an electric-light plant, sewer-disposal and water-works systems at the Mississippi State Tuberculosis Sanatorium, for which, it is understood, bids will soon be asked. B. Price, Empire Building, Birmingham, Ala., is architect.

OSARK, ARK.—Improvements are contemplated by the Citizens' Service Company to its local plant involving an expenditure of about \$150,000.

LAKE CHARLES, LA.—Preparations are being made for the installation of an electric-light and power plant at the Lake Charles aviation field, to cost about \$100,000. Electricity for operating the system will be supplied by the Lake Charles Railway, Light & Water Works Company, which will erect a 13,000-volt transmission line to the camp, 13 miles distant.

NEW ORLEANS, LA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 8 for furnishing and installing one 10-ton bridge crane in the pattern and machine shop at the naval station at New Orleans. Specifications (No. 2541) may be obtained at the above bureau or from the commandant of the naval station named.

BLACKWELL, OKLA.—The municipal electric-light plant was recently struck by lightning. A new engine was wrecked, causing a loss of about \$15,000.

MIAMI, OKLA.—An election will be called to submit to the voters the proposal to issue \$45,000 in bonds for improvements and extensions to the municipal electric-light plant and water-works system.

DALLAS, TEX.—A 200-hp. engine is being installed in the court house power plant, at a cost of about \$14,000. The power plant will furnish electricity for lamps and motors for the court house and jail buildings and for lighting the Oak Cliff viaduct and the Commerce Street bridge.

DALLAS, TEX.—The Dallas Southwestern Traction Company has been granted a franchise by the Commissioners' Court to build an interurban electric railway between Dallas and Irving. The proposed railway will eventually be extended to Cleburne, a distance of 60 miles. Contract for construction of the road has been awarded to the Creek Construction Company of Supula, Okla.

Pacific and Mountain States

ARLINGTON, WASH.—Work will begin immediately by the Washington Coast Utilities Company to rebuild its steam-driven power plant in Arlington, which was recently destroyed by fire. The new plant will be erected on the site of the old station.

ANACORTES, WASH.—A petition signed by taxpayers, merchants and manufacturers has been presented to the City Council asking that steps be taken immediately to have the street-lighting service resumed on the basis as it existed at the time of its discontinuance in October, 1916.

INDEX, WASH.—Bids will be received by R. W. Wilcox, Town Clerk, Index, until Oct. 1 for furnishing electrical equipment for a hydro-electric plant, as follows: One 100-kva. 2400-volt alternator, one 3-kw. 125-volt exciter, one switchboard and one automatic voltage regulator. Specifications may be obtained from G. N. Miller & Son, 531 Burke Building, Seattle, Wash., engineers. The Council has awarded contract for waterwheel to the United Iron Works of Oakland, Cal., for \$1,110.

SEATTLE, WASH.—The Council has passed the ordinance authorizing an issue of bonds for the purchase of the Loyal Heights line owned by Harry W. Treat, in Ballard, or the paralleling of that line. The engineering department has estimated the cost of extending the city's Division A from its present terminus at Thirteenth Avenue West and Thorndike Avenue across Ballard Bridge to Leary Avenue and Market Street at \$28,542. For this extension the Council has authorized a loan of \$25,000 from the light fund. The cost of the extension from Market Street and Leary Avenue north to the city limits, along the streets occupied by the Loyal Heights line, is estimated at about \$100,000.

SKYKOMISH, WASH.—Plans are being prepared by G. N. Miller & Son, 531 Burke Building, Seattle, for the construction of a municipal electric-light plant in Skykomish, to cost about \$7,000.

ASTORIA, ORE.—The question of extending the street car line to the McEachern Ship Company's yards and to the plant of the Astoria Pulp & Paper Company, at a cost of about \$20,000, is under consideration.

BARSTOW, CAL.—Work will begin at once by the Southern Sierras Power Company on the erection of a new electric transmission line west from Barstow, a distance of 41 miles, at a cost of about \$115,000.

BAY POINT, CAL.—Preparations, it is reported, are being made by the Pacific Electric Metals Company for the construction of an electric smelter in Bay Point. C. D. Clark of Stockton is president of the company.

HORNBROOK, CAL.—The Hazel Mining Company, which formerly operated the Gladstone Mine at French Gulch, has arranged for development of a group of gold properties in the vicinity of Hornbrook. Electric power equipment is to be installed at once. I. O. Jillson of Redding is reported interested.

LIVINGSTON, CAL.—An election will be held to vote on the proposal to form a lighting district in Livingston.

LOS ANGELES, CAL.—An extension from Redlands to Yucaipa, a distance of 13 miles, is under consideration by the Pacific Electric Railway Company.

LOS ANGELES, CAL.—In a decision handed down by the State Supreme Court the city of Los Angeles has won its contest for exclusive power rights in the Owens River project reversing the lower court, which had granted these rights to the Silver Lake Power & Irrigation Company.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company has applied to the State Railroad Commission for permission to issue \$1,000,000 in bonds. The company announces an expenditure of \$687,000 this year, of which \$284,000 will be used for the extension of its electric transmission lines to San Juan Capistrano to connect with the hydroelectric power line of the Southern California Edison Company of Los Angeles.

SEBASTOPOL, CAL.—Plans have been presented to the Board of Trustees by the Pacific Gas & Electric Company for remodeling the local street-lighting system.

BLACKFOOT, IDAHO.—The City Council has entered into a new contract with the Idaho Power Company for new street-lighting service, which will greatly increase the street illumination.

SILVER CITY, IDAHO.—The Idaho Power Company of Boise, it is reported, contemplates an extension of its electric transmission lines to the Deming Mines. Surveys, it is understood, will begin at once

and construction work will begin as soon as possible.

BUTTE, MONT.—The City Council has adopted a resolution declaring its intention of creating a special improvement district, No. 247, for the installation of an electric-lighting system, consisting of 75 lamp standards, on Montana Street, from Galena Street to Second Street, to cost about \$7,984.

Canada

PRINCETON, B. C.—The Canada Copper Company is planning to open up a large mine near Princeton. Electricity to operate the mine will be supplied by the West Kootenay Power & Light Company. Copper and other products will be smelted and refined by the Consolidated Mining & Smelting Company at Trail.

WINNIPEG, MAN.—Tenders will be received at the office of M. Peterson, secretary of board of control, Winnipeg, until Oct. 3 for furnishing at Lac du Bonnet cast-iron pipe and specials, valves and accessories, vitrified clay pipe and cable clips. Specifications may be obtained at the office of the City Light and Power Department, 54 King Street, Winnipeg.

ANNAPOLIS, ROYAL, N. S.—Plans have been submitted to the Town Council by Booker & McKechnie, Davidson Building, Halifax, for the construction of a dam at Grand Lake; spillway, 100 ft. long and 25 ft. deep.

AMHERTSBURG, ONT.—The Brunner Mond Company, which is building a power plant in Amherstburg, at a cost of \$250,000, is planning to erect a power house at Canard River.

BLENHEIM, ONT.—The Town Council has decided to dispose of the old power house and contents.

BRADFORD, ONT.—At an election to be held Oct. 6 a by-law authorizing the sale of \$15,600 in debentures for the installation of a distributing system for hydroelectric power will be submitted to the ratepayers.

DUNDAS, ONT.—The Niles-Bement-Pond Company, it is reported, has awarded contract for an addition, 75 ft. by 450 ft., to its local plant. The cost is estimated at about \$250,000.

JORDAN HARBOR, ONT.—The general contract for construction of power house for the Provincial Government Department of Public Works has been awarded to the Toms Contracting Company, Kent Building, Toronto.

LONDON, ONT.—Bids are being received by the London Art Woodwork Company for the construction of a factory and boiler house, to cost about \$15,000. Watt & Blackwell, Bank of Toronto Building, are architects.

NEW TORONTO, ONT.—The Power and Water Commission has approved the plans of the Hydro-Electric Commission in changing the distribution system so that the township and New Toronto would each have a separate substation.

STRATFORD, ONT.—Work will soon begin on the installation of equipment in the substation of the Hydro-Electric Commission in Stratford.

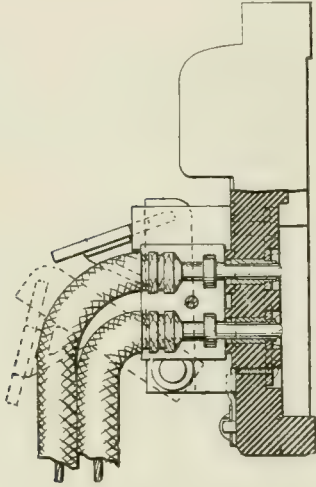
BEDFORD, QUE.—The Bedford Electric Light Company is reported to be planning the construction of a dam across Pike River. The work, it is said, will be done by day labor.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Oct. 6 for furnishing sheet copper, sheet lead, hose clamps, gongs, pulleys, post-hole diggers, cable clips, range boilers, etc. Blanks and information relating to this circular (No. 1171) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Oct. 11 for furnishing boiler tubes, bronze, sheet copper, sheet brass, copper tubing, brass tubing, electric cable and wire, Monel metal, steam capstan windlass, steering engine, steering stand, gypsy switchboard, transformers, electric attachments and fixtures, etc. Blanks and further information relating to this circular (No. 1170) may be obtained from the above office or from the offices of the assistant purchasing agents 24 State Street, New York, N. Y.; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

- 1,240,176. AUTOMOBILE INDICATOR; Horace Claude, Clarkstown, Ontario, and Ovila Lacombe, Ottawa, Ontario, Canada. App. filed June 22, 1916. Improvements.
- 1,240,184. ELECTRIC RAILROAD; Thomas M. Erickson, Chicago, Ill. App. filed Nov. 13, 1916. Relates to means controlled by the operator of a car for throwing a switch in such a railroad so that the car will run in either direction at the will of the operator.



1,240,363—Meter-Testing-Switch Construction

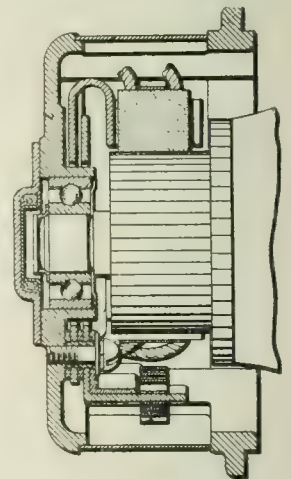
- 1,240,186. SPRING TERMINAL CONNECTION; Ernest B. Fahnestock, Brooklyn, N. Y. App. filed Feb. 24, 1913. For use more especially in connecting a high-tension cable to the post of a spark plug on the combustion engine of a motor vehicle.
- 1,240,188. ELECTRICAL CONDUIT BUSHING; Charles W. Finley, Battle Creek, Mich. App. filed March 6, 1916. Improved means for closing the conduit with a removable cap.
- 1,240,206. OSCILLATION GENERATOR; Raymond A. Heising, East Orange, N. J. App. filed Oct. 12, 1915. Makes use of a mechanical contact-making means whereby power is supplied to an oscillating circuit by means of a high-voltage direct-current generator at those times during the cycle at which the difference of the voltage between the generator terminals and that across the oscillation circuit is small.
- 1,240,239. BATTERY CASE; Marcus H. Mof-fett, Lakewood, Ohio. App. filed March 23, 1914. Shipping case which is adapted to be used as a holder for the battery during use.
- 1,240,280. STORAGE BATTERY; David H. Wilson, Paterson, N. J. App. filed Feb. 3, 1917. Better distribution of a current of heavy amperage over the surfaces of a battery plate having low-resistance leading-in conductors.
- 1,240,294. SYSTEM FOR GENERATING HIGH-FREQUENCY CURRENTS; Riccardo Arno, Milan, Italy. App. filed Jan. 26, 1914. Improvements.
- 1,240,309. SWITCH; George C. Carhart and Stephen L. Young, Syracuse, N. Y. App. filed March 8, 1917. For controlling automobile or gas-engine ignition.
- 1,240,314. OIL SWITCH; Herbert W. Cheney, Milwaukee, Wis. App. filed Sept. 16, 1910. Can be safely employed in circuits of exceedingly high voltages and large amperages without any danger of the arcs causing injury to the operator or to any of the apparatus.
- 1,240,328. METHOD AND APPARATUS FOR LOCATING ORE BODIES; Reginald A. Fessenden, Brookline, Mass. App. filed Jan. 15, 1917. Improvement.
- 1,240,330. INSULATOR AND SUPPORT THEREFOR; Louis Fort, Jersey City, N. J. App. filed Feb. 16, 1912. Provides a separable insulating member which may be utilized with a separable bracket member, giving great facility for applying and adjusting the device to the conductor.
- 1,240,348. ENGINE STARTING DEVICE; Charles F. Kettering, Dayton, Ohio. App. filed Sept. 19, 1912. Improvements.
- 1,240,363. METER-TESTING-SWITCH CONSTRUCTION; Clarence D. Platt, Bridgeport, Conn. App. filed Dec. 4, 1916. Meter-connecting plugs may be inserted into the switch-base sockets before opening the circuit through the switch and without disturbing the electrical condition in the branch line.

Record of Electrical Patents

Notes on United States Patents
issued on September 18, 1917

- 1,240,364. INCLOSED SWITCH CONSTRUCTION; Clarence D. Platt, Bridgeport, Conn. App. filed March 3, 1917. Fuses may be inserted and replaced by the householder or ordinary user without the possibility of contact with the switch mechanism.
- 1,240,380. TRAFFIC-DIRECTION SIGNAL FOR VEHICLES; Charles A. Singer, St. Louis, Mo. App. filed Sept. 27, 1915. Improvement.
- 1,240,410. ELECTRICAL MASSAGE APPARATUS; Theodore Bollin, Okmulgee, Okla. App. filed April 25, 1916. Improvements.
- 1,240,431. FILLING VALVE; Lewis S. Evans, Pittsburgh, Pa. App. filed April 1, 1914. Relates to valve mechanism for filling measured quantities of fluid or semi-fluid materials into containers.
- 1,240,442. CIRCUIT BREAKER; William S. Harley, Milwaukee, Wis. App. filed May 18, 1914. Pneumatic means for breaking an electric circuit.
- 1,240,448. IMPLEMENT FOR WINDING ARMATURES; William T. Hensley, Bound Brook, N. J. App. filed May 24, 1912. Capable of winding on several wires at a time, and means are provided for feeding the said wires and keeping them from becoming tangled or disarranged.
- 1,240,449. ELECTRICALLY HEATED VALVE; Claude J. Hinshaw and Roy L. Gable, Shelbyville, Ind. App. filed April 12, 1917. For internal combustion engines.
- 1,240,457. ELECTRIC RESISTANCE DEVICE; William H. Keller, Norton, Va. App. filed June 2, 1915. Reflexed portions of the grid are all of the same length.
- 1,240,458. SIGNAL LAMP; Harold S. Kirtledge, Chicago, Ill. App. filed June 4, 1915. Motor vehicles.
- 1,240,459. ELECTRIC SWITCH; Charles J. Klein, Milwaukee, Wis. App. filed June 12, 1911. Provides improved means for attaching the switch to a support.
- 1,240,460. ELECTRIC FURNACE; David R. Knapp, Pottsville, Pa. App. filed Feb. 19, 1916. Bottom and walls may be repaired without completely discharging the liquid metal.
- 1,240,471. ELECTROMAGNETIC DEVICE; Daniel D. Miller, New York, N. Y. App. filed March 4, 1915. Relay which will be slow both in responding and in releasing.
- 1,240,490. COMPOSITION CONTAINING ALUMINA AND ZIRCONIA; Lewis E. Saunders and Ray H. White, Niagara Falls, N. Y. App. filed Feb. 12, 1917. Also useful as a refractory.
- 1,240,491. ALUMINOUS ABRASIVE AND METHOD OF PREPARING THE SAME; Lewis E. Saunders and Ray H. White, Niagara Falls, N. Y. App. filed Feb. 12, 1917. Methods of making such abrasives.
- 1,240,574. CURRENT JACK FOR ELECTRICAL METERS; Frank R. Innes, Detroit, Mich. App. filed Sept. 18, 1915. Improvement.
- 1,240,584. ARTICULATED METAL SHELL FOR AN ELECTRIC HOT PAD; Henry D. Laraway and Bjarne Falkenberg, Ontario, Cal. App. filed Sept. 6, 1916. Entirely inclosed in an articulated metal shell which can be bent into various curvatures so that it can be applied to various portions of the body.
- 1,240,585. BRUSH MOUNTING FOR ELECTRIC MOTORS OR GENERATORS; Thomas L. Lee, Rochester, N. Y. App. filed April 10, 1916. Particularly for use in an electric motor or generator of the inclosed type.
- 1,240,590. GOVERNOR FOR REGULATING THE OVERCHARGE FOR STORAGE BATTERIES; Perry Okey, Columbus, Ohio. App. filed Oct. 11, 1916. Combination of a generator and storage battery with an ampere-hour meter, which latter co-operates with a structure whereby the battery is periodically given an overcharge although the ampere-hour meter registers merely a full charge.

- 1,240,623. MOTOR-CONTROL SYSTEM; Carl P. Taylor, Roanoke, Va. App. filed Nov. 21, 1913. Motor will be dynamically braked without carrying the braking current through the commutator.
- 1,240,628. ARC-LIGHT ELECTRODE; Knut Tornberg, Lynn, Mass. App. filed March 13, 1916. To operate with direct current as lower cathodes in conjunction with non-consuming upper anodes.
- 1,240,637. ADVERTISING KIOSK; George W. Williamson, Petaluma, Cal. App. filed Feb. 24, 1917. Electrically controlled changeable exhibitors.
- 1,240,647. ELECTRICAL SIGNAL; Edward Balbach, Springfield, Ohio. App. filed Sept. 21, 1916. On automobiles.
- 1,240,700. INCANDESCENT TUNGSTEN LAMP; Ernest Friederich, Berlin, Germany. App. filed June 11, 1913. Blackening of the bulb wall is prevented by means of a gaseous atmosphere.
- 1,240,707. ELECTRIC LIGHTING FOR GAS STOVES; Frederick C. Gutenberg, Sacramento, Cal. Improvements.
- 1,240,710. POWER-FACTOR METER; Chester I. Hall, Fort Wayne, Ind. App. filed Dec. 5, 1914. Curve drawing.
- 1,240,711. TALKING MACHINE; Chester I. Hall, Fort Wayne, Ind. App. filed May 15, 1915. Comprises a rotatable circular member for supporting a disk record and an electric motor so arranged that its driving force is applied to the outer periphery of the member.
- 1,240,721. AUXILIARY SPARK GAP; Frank F. Hultgreen, Berkeley, Cal. App. filed Nov. 1, 1915. Provides a small, compact, neat device which is readily attached to existing spark plugs.
- 1,240,723. TIME-LIMIT RELAY; Ernest H. Jacobs, Schenectady, N. Y. App. filed Aug. 22, 1914. Improvements.
- 1,240,725. ENGINE APPLIANCE; John W. Jepson, Depew, N. Y. App. filed Aug. 13, 1912. Engine may be easily started with the employment of a minimum amount of energy.
- 1,240,726. ENGINE STARTING ARRANGEMENT; John W. Jepson, Depew, N. Y. App. filed Feb. 25, 1913. By means of an electric motor of minimum size, yet which will produce the necessary torque at starting and still be capable of operating at sufficient speed to start the engine effectively in all cases.
- 1,240,738. BRUSH MOUNTING; Earle P. Lee and Thomas L. Lee, Rochester, N. Y. App. filed Aug. 14, 1916. Relates to means by which the brushes of an electric motor or generator are guided and supported in engagement with the commutator.
- 1,240,770. ELECTRIC LIGHT APPARATUS; Nicola Papa, Utica, N. Y. App. filed March 14, 1916. Improvements.



1,240,738—Brush Mounting

- 1,240,771. ELECTRIC HEATING UNIT; Leon F. Parkhurst, Pittsfield, Mass. App. filed March 28, 1916. Improvements.
- 1,240,772. VAPOR-ELECTRIC DEVICE; Harry F. Perkins, Schenectady, N. Y. App. filed April 14, 1915. Particularly applicable to metal-walled, high-powered mercury-arc rectifiers.
- 1,240,795. FUSE DEVICE; Edmund O. Schweitzer, Chicago, Ill. App. filed Nov. 3, 1913. Especially fuse devices for extra-high-potential work.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN

Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, OCTOBER 6, 1917

No. 14

Priority in Corporate Financing

PRIORITY in financing, though not now enforced by law or by specific agreement among bankers, is in effect tacitly accepted with respect to the second Liberty Loan. When the government moves toward the strong boxes of investors other seekers after capital give it a broad untrammelled right-of-way. The second Liberty Loan is at present the admitted star investment offering of the market. It is the best, it is entitled to generous recognition as the premier security. More than that, it is the means to express faith in our government, to testify to our confidence in the cause and strength of our armed forces.

But with the second large government loan "put away," corporate financial needs will again have a rightful place on the program. Corporate financing raises no objection to the priority given to government requirements, but it still of necessity demands some place in the banking layout. To get along for a time without borrowing is essential under conditions of war; to get along permanently without capital expenditures is impossible for the public utility which meets the ever-expanding needs of its community.

No official indications that a financing priority board would be created have been heard, but in banking circles there is some discussion of the advantage of such an organization. Bankers know that they have to conserve the precious capital whose economic function is so altered by the fact of war. Whether by government action or by informal counsel of controlling bankers it appears that applications for new capital will be subject to extremely close scrutiny. Bankers will say something more than: "Is the security good?" "Will it sell?" "At what price will the public take it?" They will be apt to ask whether the expenditure proposed is economically justifiable, whether it will help to win the war.

This question of priority in financing is vital for utilities. It affects particularly the electric central station industry because of the unusually large rate of annual growth of that industry, the public nature of its indispensable service, and the great proportion of its output which energizes industries mobilized in the war against the German government. Central station capital needs are associated too intimately with the true public interest to be set aside lightly for other industries remotely connected with the war or wholly detached from the war. Likewise is the central station too effective in the conservation of energy and fuel to have its claims coolly disregarded in favor of any spendthrift user of coal.

Frank L. Dame, in the interview published in this issue, puts earnest emphasis on the logical position of electric utilities when and if priority shall become an acute issue. The ELECTRICAL WORLD urges that central station managers give careful consideration to the clear claims of such properties to just acknowledgment after government necessities are met. They conserve capital, they conserve fuel. By giving consideration to this well in advance of the time when the imperative issue is raised the companies will fortify themselves. It is not the managers who need to be convinced of the effective economy of the central station; it is the public authorities who do not always give full weight to business arguments. Central station managers know how economically valuable their plants are, but they should prepare to let outsiders know. The central station position and financial welfare will be protected by prompt and vigorous measures.

A Warning as to Coal

IN THE issue of Feb. 3 and frequently since that time the ELECTRICAL WORLD pictured the cost and scarcity of coal as a dark menace to successful central station operation. Price has been harnessed by the national government. Though still high, it is under some control; it will not run amuck. But scarcity still looms threateningly before the industry.

In February, when the need of coal was felt acutely by many properties, we showed that while companies realized that they would have to pay more this year than last year, it was not price so much as uncertainties of delivery that worried them. In the following month we called attention again to the coal problem and to the long-established principle of ample reserve supply which governs most operators. But this accepted policy of management many companies have been unable to follow because the market has been bare of coal. In another issue soon afterward we again gave heed to the issue raised by the unprecedented conditions in coal production and demand.

Taking up the question of transportation specifically on June 23, we showed that the consumer who did not receive coal over a comparatively straight line and in large quantities could get it only with great difficulty and at enormously enhanced prices. Subsequently, as the result of a systematic personal inquiry made by the ELECTRICAL WORLD in Central Western states, it was decided that our obligation to our readers required us to state the facts as we found them. We described the outlook for the winter of 1917-18 as both serious and dangerous. In addition to a series of articles, there

have been published in more recent issues editorials again pointing to the shortage of fuel and the necessarily resultant hardships.

During the greater part of this period coal production was without regulation, price was whatever could be obtained, distribution was not directed by a stern hand meting justice to all classes of needy consumers. Into chaos the government stepped with the intent to restore order. No one will predict accurately just what the eventual result of the radical action by the government will be on price, supply and demand. For the old-time free play of supply and demand we are substituting arbitrary prices. It may take months, it may take years to strike the right balance between these influences which shall encourage output, yield a fair return and provide equal distribution facilities for all consumers. It is conceivable that government control will prove less efficient as an economic influence than the unhampered stimulus of commercialism. In the meanwhile the consumer will be uncomfortable, if the operation of his industry is not put in actual peril.

This array of conclusions from our studies, extending over months, is brought forward at this time because there is still the opportunity for some companies to resort to strong steps. The difficulties of last winter, the shortages of spring and summer, are accentuated for many unfortunate companies as we advance toward winter. If possible, get coal in storage as a precaution against the increasing obstacles which cold weather will put in the way of transportation. And use every possible means of conserving fuel.

Testing Current Transformers

IN DIRECT-CURRENT practice when a very strong current has to be measured it is optional either to employ a special ammeter constructed and calibrated for the strength of current to be expected or to employ an ammeter of lower range and a suitable shunt of known multiplying power. In alternating-current practice similar alternatives present themselves, except that it is preferable to employ, instead of a shunt, a special current transformer with its primary winding in the main circuit and its secondary winding in the lower-range ammeter circuit. Such current transformers possess a complex multiplying power; *i.e.*, a numerical ratio and an angle of phase displacement. For the purposes of simple current measurement the phase displacement is of no consequence, but for the purposes of power measurement the consequences may be serious. When using a wattmeter with a current transformer on a load of low power factor the error due to a small phase defect in the transformer may be very appreciable. It is therefore important to know the phase defect, as well as the numerical ratio, of the multiplying power in such a transformer, under the particular conditions of service to which it is applied.

There are various known methods of measuring in a laboratory the ratio and the phase of a current transformer. Such measurements require care. In the ar-

ticle which we print this week Dr. F. B. Silsbee describes a new method which has particular advantage when a number of such current transformers have to be measured in succession and when a standard current transformer is available the constants of which are already known.

It is interesting to note that one of the precautions which have to be taken in making the test is that the secondary windings of the standard and tested current transformers must be so connected as to aid or mutually short-circuit each other. In the case of voltage transformers or ordinary constant-potential transformers for power distribution, their secondary windings when connected must, on the contrary, oppose each other so as to avoid short circuit. The unpardonable sin in connecting voltage transformers is to make a short circuit while the unpardonable sin in connecting current transformers is to avoid making a short circuit. This shows that there are transformers and transformers, also that it is necessary to have a clear understanding as to the species which is being used and as to the treatment proper in any particular case. The methods described in the article have the advantage of requiring very simple auxiliary apparatus and of possessing a relatively high degree of inherent precision.

Another Step in Conservation

IN THESE days the installation of a new hydroelectric plant should be a subject of congratulation. For a long time things were at such a pass that no new plant attracted much attention unless of extraordinary capacity or voltage. A few thousand kilowatts at anything less than 100,000 volts would not cause the raising of an eyebrow. To-day any well-planned and successful water-power development able to reinforce an existing station or furnish power where none was had before deserves a welcome. The new plant at Hiram, Maine, described in our columns this week, possesses in addition some interesting features from an engineering standpoint. The Hiram development is on the Saco River, already well known as a source of much useful power, and is designed to furnish additional resources to the Cumberland Power & Light Company of Portland. Portland has had hydroelectric power for twenty years past, and as need has arisen new plants have been installed to reinforce the supply. The hydraulic situation was in some respects a rather interesting one, as the unusual good head of 75 feet (22.9 m.) was made available by the construction of a dam less than 400 feet (121.9 m.) long across the river. Moreover, the situation was such that hydroelectric power could be successfully utilized in building the large permanent works, a temporary installation of a 250-hp. belt-driven generator being used to supply the hoisting, stone-crushing and concrete-mixing plants and a variety of miscellaneous requirements. Sand and crushed stone were available almost on the spot, and also clay for the bricks used in the power house. One interesting item of the construction was the device used for closing the dam by means

of three reinforced-concrete slabs cast on the dam itself above corresponding temporary openings and slid into place at the proper moment. Another somewhat unusual feature of the installation is the use for this fairly considerable head of a wooden-stave penstock leading to the power house. Only the first section of this is now in commission, containing one 3000-kva. generator driven by a vertical-shaft turbine mounted with some interesting special devices to secure the best possible outflow from the wheel. Another feature of the installation to which attention deserves to be called is the use of an outdoor substation, at which a few years ago engineers would have looked askance, considering the winter climate of the Pine Tree State. The world does move, however, and the days of costly and elaborate substation structures seem to be numbered. The transmission line to the existing system of the company is only about 18 miles (28.9 km.) long and is at present worked at 28,000 volts with 66,000 volts in contemplation. The line, however, deserves commendation for the judicious use of A-frames, which seem to be working their way into the favor they deserve. Altogether, the plant is an interesting one, besides being another efficient stroke for coal conservation.

Economies in Distribution

THE central station manager has faced for some time the problem of meeting new demands on his plant with rates already established and with continual increase in the prices of material and labor. War now has added to his problems by making deliveries uncertain and sometimes very distant. It has greatly hastened the time when readjustments are imperative. The man handling and operating distribution systems therefore faces the proposition of handling the increased load, due to natural growth and to the speeding up of industry on account of the war, with practically the same distribution plant.

The immediate result of this condition will be the necessity of analyzing what is available, of taking inventory, so to speak, of all distribution material installed or on hand; and the success or failure of meeting the emergency will be in large part due to the effectiveness with which this study can be made. Some of

the things that will have to be done are shifting copper from one location to another in order to increase its effectiveness, using boosters and additional regulators to maintain the pressure on overloaded circuits, increasing the size of primary and secondary networks—in other words, operating at greater saturation. Also there will be need of more inspection and maintenance work in order to keep the distribution plant in as good condition as possible to avoid shut-downs, which will become more and more costly as throw-over facilities are diminished. The whole system will have to be run nearer the danger point and will therefore need a great deal more attention to cope successfully with these necessities, and a basic knowledge of conditions both practically and theoretically will be necessary.

P. O. Reyneau in this issue sets forth eight principles which should be followed in bringing a distribution system to its best operating point, and this set of rules is so sound in principle and practice that we earnestly commend it to our readers. Simple ring primaries with feeders enough to prevent the overloading of any one of them, the abolition of the smaller transformers whenever possible, and the banking of those which it seems temporarily expedient to retain; the placing of transformers so as to avoid unnecessarily long secondaries, the supply of good capacity in large and efficient units, and the removal of dead and unnecessary wires both primary and secondary—these are all things which have been repeatedly tried out successfully. The usefulness of the expedients needs no argument; the main trouble is that the principles are not as a rule adequately applied. The result of thorough work is to get better regulation, often with less material, a more reliable service, considerably higher distribution efficiency with lessened standby losses, and a system altogether more satisfactory in its working characteristics. Mr. Reyneau gives some interesting details of the way in which a standardization of voltage was worked out and of the results which are already apparent. The mere facts that a more uniform and simpler distribution is secured with less copper, fewer transformers, much less core loss and a considerable increase in working capacity bear sufficient evidence of the skill and judgment with which the change was carried out.

THE third installment of the series on the rehabilitation of the Ashley Street station of the St. Louis central station company will be presented in the next issue of the ELECTRICAL WORLD and will dwell on the rearrangements which have been made in the building and equipment to permit doubling the boiler capacity and serving 60,000 kw. more of turbine equipment. Another feature of the issue will be an article on the experience of a Kansas and a Connecticut company with iron-wire transmission, setting forth the trouble which has been experienced with charging currents in the first case and the steps which were taken by the Eastern company to secure the approval of the Connecticut commission for using iron wire for certain extensions. The concluding article in

The Coming Issues

the series devoted to street lighting for small towns and cities will outline the points to be observed in negotiations and contracts between municipalities and lighting companies. In the first issue of November will be started a series of articles on industrial motor and control applications which should be of value to consulting engineers, central station power sales engineers, and electrical engineers with industrial plants. These articles will deal with the engineering problems involved in selecting and laying out apparatus, operating and maintaining the equipment in the motor-driven industrial plants that are found throughout the United States or at least in large sections thereof. In the same issue the coal situation will be discussed.

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Features of Hiram Falls (Me.) Development

Beginning of 20,000-Kva. Water-Power Development on Saco River by the Cumberland County Power & Light Company—Special Dam and Draft-Tube Construction and Details of Outdoor Transformer and Switch Structure

THE Cumberland County Power & Light Company of Portland, Me., recently placed in service a new generating plant on the Saco River at Hiram Falls which marks the beginning of a 20,000-kva. development at this point. The first section of the plant contains a 3000-kva. unit. Other units can be added, however, by extending the power house and installing further penstock facilities, as the electrical design of the station provides for systematic increase in capacity. In the construction of the plant a temporary hydroelectric station on the river at Hiram was utilized for power supply, local materials were used in the manufacture of bricks and concrete, and an excellent record was made in building speed. Noteworthy features of the installation include a provision for lowering hinged flashboards by cable operations, the use of a White hydracone, the first of its kind in the world to be installed for increasing the efficiency of water utilization, and the provision of an outdoor switching and transformer station through which the plant connects with the Cumberland County company's transmission system.

The plant is situated about 30 miles (48.3 km.) northwest of Portland and about 1.5 miles (2.4 km.) north of the West Baldwin station of the Maine Central Railroad. The dam was built across the river in a natural gorge about half-way down the falls and is of reinforced concrete with a spillway 290 ft. (88.4 m.) long and a total length of 380 ft. (115.8 m.) The maximum height is 20 ft. (6.1 m.), but the average height is about 10 ft. (3 m.) The intake is 25 ft. (7.6 m.) wide and

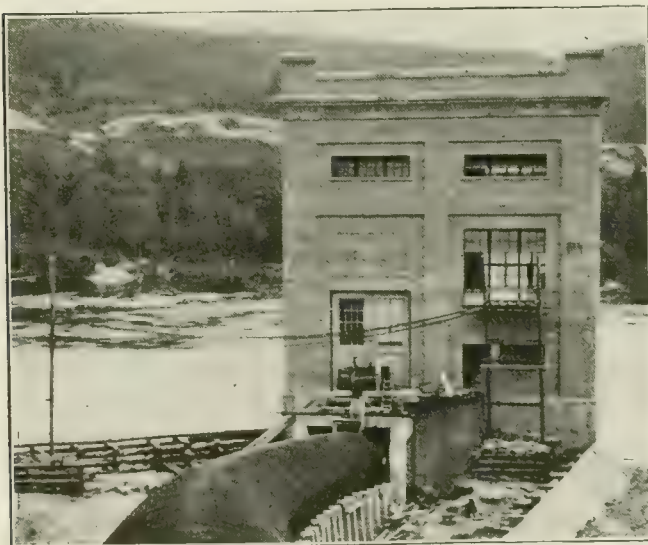


FIG. 1—WOOD-STAVE PENSTOCK JOINED WITH STATION BY STEEL THIMBLE

the headgate, which is of reinforced concrete, is hoisted by chain blocks, hung from a supporting gallow's frame. Water flowing over the spillway falls onto broken rocks in the bed of the stream below the dam and thence continues to a deep pool where the currents are absorbed.

An air pipe is provided at the back of the dam to prevent the wavering of the curtain of falling water often seen on dams without this construction.

The spillway is equipped with sixty-three flashboards 5 ft. 6 in. (1.67 m.) high and built of 2-in. (5.1 cm.)

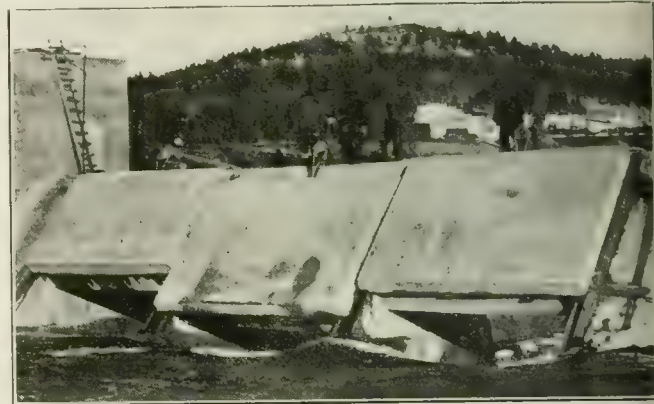


FIG. 2—REINFORCED-CONCRETE SLABS FOR CLOSING DAM

plank bolted to channel irons, those over the higher sections of the dam being arranged so that they can be lowered from the shore by a $\frac{1}{2}$ -in. cable (1.27 cm.) which actuates a series of trip levers that permit the channel-iron braces holding the flashboards to drop over the downstream face, the flashboards thus falling upon the top of the dam seriatim. This arrangement could not be used where the back of the dam was less than 7 ft. (2.1 m.) high, on account of the length of the supporting struts which hold the boards in position. Flashboards are lifted into position by hooking the struts into a cable carrier which was used in building the dam and which remains a permanent fixture of the installation.

The headgate, which is about 12 ft. (3.7 m.) square and weighs about 12 tons (10.9 t.), is operated by two 8-ton (7.3-t.) Maris hoists. Although it was the intention of the designing engineer to use bars of curved horizontal cross-section at the intake screens to reduce the loss of head due to friction, flat-bar racks were used because of the demands of the war on the steel industry.

HYDROELECTRIC POWER AND LOCAL MATERIALS USED IN CONSTRUCTION

Water power was utilized to an unusual degree in the construction of the Hiram station, a 250-hp., 220-volt alternating-current generator, belt-driven by a horizontal waterwheel being used to supply lighting service and operate the following motor-driven equipment: Derrick (30 hp.), cableway (37 hp.), stone crusher (38 hp.), concrete mixer (15 hp.); carpenter-shop tools (10 hp.), blacksmith-shop tools (5 hp.) and pumps (25 hp.) A steam plant was used for operating a compressor, no motor of the desired size being available at the time

Conditions for obtaining suitable concrete at the site were unusually good. A sand pit was opened within 100 ft. (30.5 m.) of the mixer. Rock was taken from the excavated material and also from a pit near the crusher. The power-house walls are of brick of a light cement

deck of the dam by gravity, closing the openings. Two layers of single-ply roofing paper, greased between layers, were used to separate the slabs from the concrete deck of the dam itself, so that no adhesion occurred.

DETAILS OF PENSTOCK CONSTRUCTION.

From a point near the intake a penstock of Douglas fir, 11 ft. (3.4 m.) in diameter and about 440 ft. (13.4 m.) long, carries the water to the power house. The penstock is built of planks about 3 in. (7.6 cm.) thick, reinforced externally by $\frac{3}{4}$ -in. (19 mm.) iron hoops spaced in general 2.5 in. (3.8 cm.) apart at the lower end of the run, the planks being $5\frac{1}{2}$ in. (14 cm.) wide. The penstock is carried on reinforced-concrete saddles spaced 7 ft. (2.1 m.) apart. A short portion of the penstock at the intake is of reinforced concrete and is connected with the wooden main body by a steel thimble cast inside. A similar thimble is provided at the power-house end, where the penstock enters the wheel intake. The saddles are 8 in. (20.3 cm.) thick. On the river side of the penstock a bulkhead was left near the power-house to protect the saddles from water and ice.

The first section of the power plant consists of a unit about 47 ft. (14.3 m.) long by 41 ft. (12.5 m.) wide. The penstock introduces water at the low velocity of 4 ft. (1.2 m.) per second into the casing of a 4000-hp. Allis-Chalmers vertical waterwheel operating under 75 ft. (22.9 m.) head, including flashboards, and directly connected to a 3000-kva. generator delivering three-phase energy at 2300 volts to the station buses. The

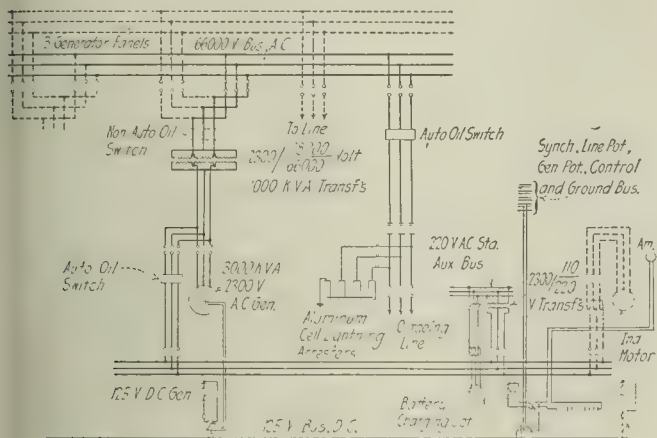


FIG. 3—SWITCHING ARRANGEMENTS IN HIRAM FALLS STATION

color pressed on the premises, the clay being taken from an adjoining bank. These conditions reduced the cost of material transportation considerably, although it was necessary to build a road into the site in order to handle machinery and other heavy supplies by motor truck and team.

An unusually interesting method of closing the dam was applied at Hiram. Three temporary openings were

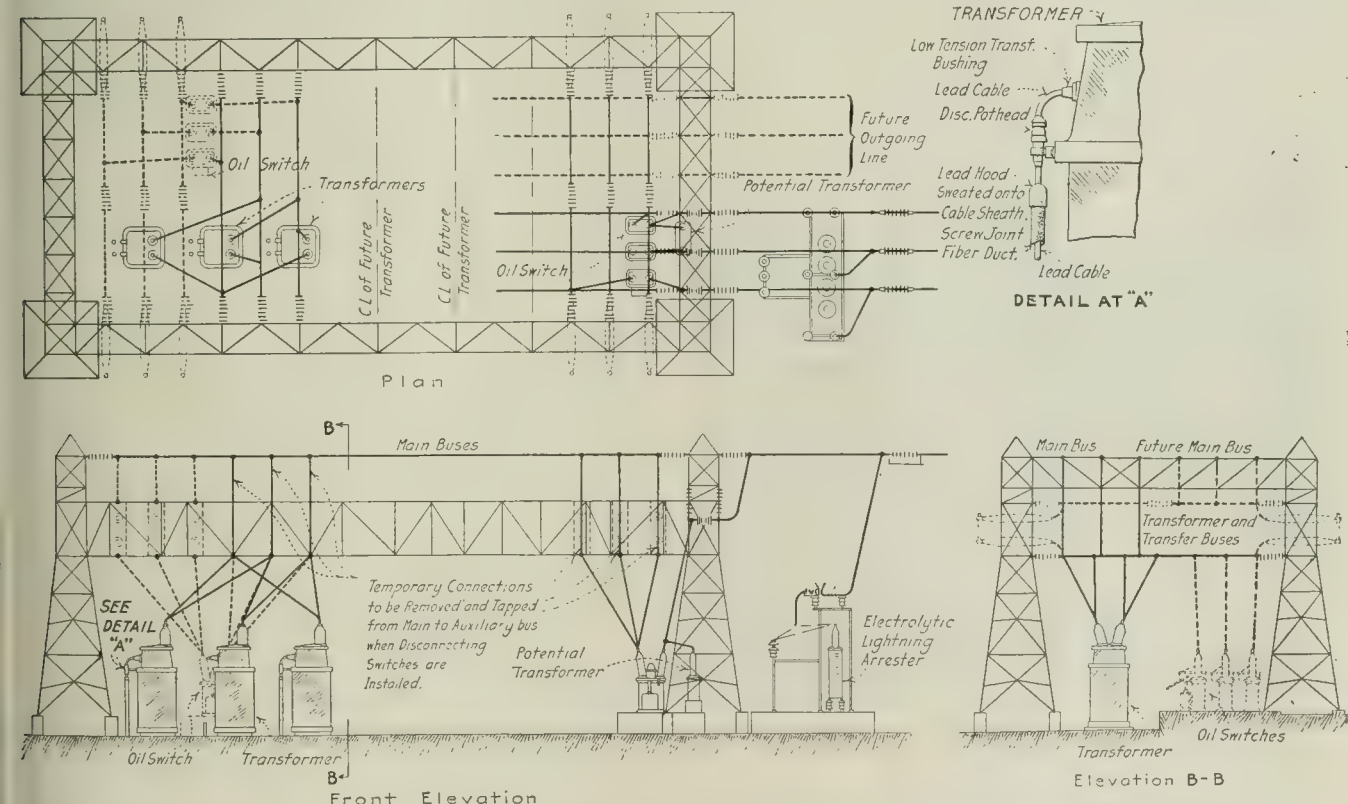


FIG. 4—OUTDOOR STATION ARRANGED FOR FUTURE GROWTH AND WHICH WILL BE EQUIPPED WITH POST-TYPE DISCONNECTING SWITCHES

left at the base of the dam, through which water flowed until the last section was being constructed. Reinforced-concrete slabs were cast on the deck of the dam above the openings and held in place by stop timbers. On cutting these loose, the slabs slid down the

minimum flow of the river at the Hiram station is about 380 cu. ft. (10.7 cu. m.) per second. The flow of water from the penstock into the wheel casing is controlled by a butterfly valve gear-driven by a 3-hp., 125-volt Allis-Chalmers induction motor, equipped with a

Cutler-Hammer solenoid brake to insure dead-beat action in starting or stopping at any desired point in the valve travel. When the butterfly valve is closed it is possible to work comfortably in the penstock, even if absolute tightness is not obtained.

The generator is provided with a direct-connected 35-kw., 125-volt exciter mounted on the top of the generator shaft. The field switch is mounted near the machine, on the floor, to save copper in wiring. Instead of employing the usual draft-tube design, the unit is fitted with a White hydracone regainer which the designing engineers of the plant hope will increase the efficiency of the waterwheel about 2 per cent above an 89 per cent base named in the contract. A bonus is provided for increases in efficiency above the base.

The hydracone regainer consists of a specially shaped discharge chamber with reinforced-concrete slabs disposed horizontally and vertically in such a manner as to secure the most efficient disposal of the water leaving the wheel. The utmost care was taken in pouring the concrete to secure anti-friction surfaces, dimensions being worked to $1/64$ in. (0.397 mm.). The wheel is provided with a patented steel-plate scroll case and cast-iron pit lining. The hydracone chamber is 26 ft. 6 in. (8.07 m.) wide at the bottom, and a space of 22 in. (55.9 cm.) is left between the top of the concrete table and the bottom of the wheel foundation concrete, a space of 4 ft. 11 in. (1.5 m.) maximum being provided between the underside of the slab and the bottom of the chamber. The latter is inclined through about half its length to insure more rapid disposal of water, and discharges into the river below the low-water elevation. King William plaster, greased and spread on laths, was used in forming the curved surface of the hydracone inlet upon which the concrete was poured. The wheel is equipped with an automatic relief valve installed in the basement and connected with the governor to provide for direct discharge of water into the

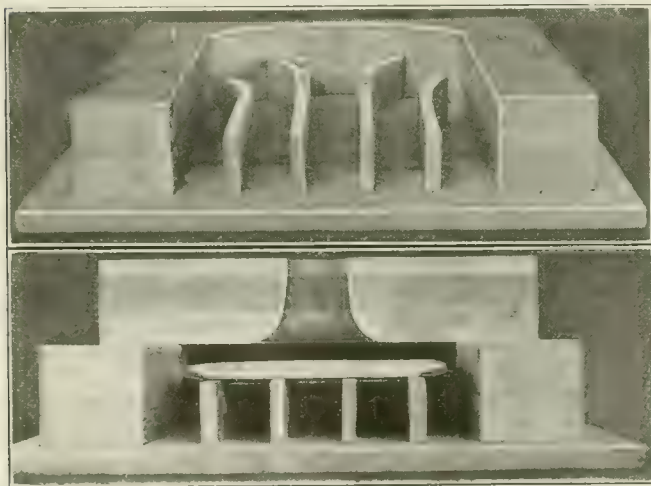


FIG. 5—MODEL OF HYDRACONE USED TO INCREASE TURBINE EFFICIENCY

river from the wheel unit in emergencies or in case inspection of the hydracone is to be made.

The switchboard gallery is about 12 ft. (3.7 m.) above the operating room floor and contains a bench and vertical board, from which the entire plant and outdoor substation are controlled. The wiring arrangements of the station and the construction of the outdoor substation are indicated in accompanying diagrams. From

the generator leads are carried through disconnecting switches to the primaries of a bank of three 1000-kva. oil-cooled Westinghouse transformers, which raise the pressure from 2300 volts to 38,000 volts and which are designed for future service at 66,000 volts. The transformers are mounted on concrete bases below a bus structure carried by multiple-disk strain insulators attached to a rectangular bridge of structural steel 82 ft. (25 m.) long and 37 ft. (11.3 m.) wide. Oil switches are provided between the generator and the transformer bank and between the transformers and the outgoing line, but they are non-automatic.

Inside the station and immediately under the switchboard gallery is a 2300-volt station bus, with which the generator is connected through an automatic oil switch, on each side of which are disconnectors. Local lighting and power service is taken from this bus in the usual manner, through step-down transformers. These services include a 2-kw. General Electric motor-generator for charging a United States Lighting Company storage battery of sixty cells used in emergency lighting and in the operation of relays and oil-switch solenoids. Two field rheostats are provided, one for hand operation and another for use with a Tirrill regulator mounted on the switchboard. The battery is installed in a separate room in the basement a reinforced-concrete door and ample porthole ventilation being provided.

At present only one set of high-tension buses is installed on the bridge structure outside the station. Connections are made therewith by overhead leads, but ultimately they will be placed underground. When the installation is complete there will be two sets of 66,000-volt buses, arranged for connection to two outgoing lines as shown. Either line can then be connected with either bus. The line switches provided will be 66,000-volt automatic Westinghouse type GA solenoid-operated units. Future generators will be connected to the buses through corresponding transformer banks. Provision is also made for joining the high-tension bus through a bus-tie switch. All the oil switches are controlled from the station benchboard, which is equipped with dummy buses and a full complement of indicating and recording instruments. Potential transformers designed for 66,000-volt service are mounted on concrete bases below the bridge structure, and the oil switches are correspondingly supported. Four Westinghouse type AK aluminum-cell lightning arresters are mounted on a concrete platform just below the outgoing line, the latter being provided with strain-type disconnecting switches so that the station may be completely shut off from the rest of the system. A standard spacing of 15 ft. (4.5 m.) is provided between high-tension conduc-

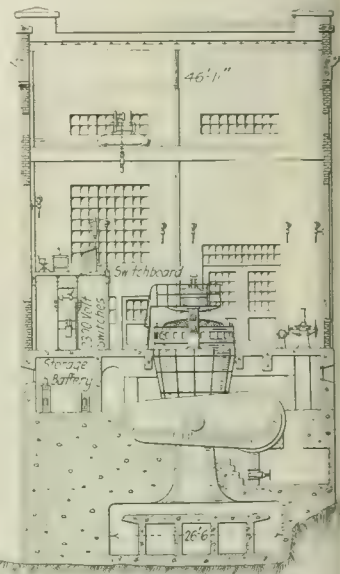


FIG. 6—RELATIVE POSITIONS OF STATION EQUIPMENT

tors. The overhead structure is about 35 ft. (10.7 m.) high and is designed for extension northward in the direction of the transmission line when future units and lines are added. All buses are of No. 2/0 hard-drawn copper, the insulators being of the eight-disk suspension type throughout the substation. When the extension is made the present line-switching equipment will be moved from its present position to the end of the new structure.

The transmission line extends from Hiram to the Bonny Eagle station of the Cumberland County company, a distance of about 18 miles (30 km.) The line is composed of Blaw steel towers, the standard tower, being an A-frame erected to a height of 54 ft. 6 in. (16.7 m.) above ground and having a spacing averaging 400 ft. (121.9 m.) on straight runs. Four-posted towers are used at angles in the line and at every mile

(1.6 km.) in tangent line. The vertical spacing between conductors is 6 ft. 9 in. (1.9 m.). A ground wire of 5/8-in. (15.9 mm.) stranded steel is carried along the tower tops throughout the line and the standard insulators are of the six-disk suspension type, seven-disk units being used at strain points. The line wire is No. 2 copper and the towers are anchored by galvanized-iron anchors. The line traverses a private right-of-way with a standard width of 100 ft. (30.5 m.) and carries a circuit of steel telephone wire mounted on 20,000-volt insulators.

The cost of the line was \$6,500 per mile. The Hiram station, costing about \$500,000 for the initial development, was designed by J. A. Leonard, W. G. Elliott being superintendent of construction. G. C. Estill is chief engineer of the Cumberland County Power & Light Company.

Making System Adequate for Increased Loads

Principles Observed in Remodeling a Large Distribution System That Permitted Use of Less Material—How Service Interruptions Were Minimized During Changes

BY P. O. REYNEAU

Distribution Engineer Detroit Edison Company

OWING to the great increase in load which has made over-excitation of its generators necessary and to the use of two secondary voltages which required carrying in stock two voltages of lamps, the Detroit electric service company recently remodeled its entire single-phase distribution system. Before doing so 120 volts was selected as the standard secondary voltage to overcome the objections mentioned, to avoid reducing the capacity of the lines, and to permit using the most modern part of the existing installation. Old-type transformers were eliminated where possible to reduce the core losses and changes made to better the distribution conditions. To obtain the secondary voltage selected 2200/127-254-volt transformers were purchased and energized at slightly below rated voltage to obtain 120 volts on the secondary side. This type of transformer was also preferable because similar units were already in service in other parts of the system. By operating the transformers in the manner just mentioned it was possible to realize a saving in core loss greater than the increase in copper loss which would result when the units are operated at full load. Furthermore, lower bus pressure is required to maintain the desired voltage at the feeding points.

The distribution system under consideration was composed of about seventy single-phase lighting circuits fed from different substations through automatic oil switches and 200,000-circ. mil cables connected to overhead feeders, some No. 4/0, others No. 0. Each feeder runs to a point as near as practicable to the center of load of the circuit it feeds, where it is tied in to the primary mains at what is termed the feeding point. The primary mains are arranged as much as possible in primary networks or ring mains with branches wherever necessary to reach transformers. Three-wire secondaries are used throughout and the

secondaries of adjacent transformers are banked together wherever possible, so that from two to about ten transformers will operate on the same secondary mains. In some places, however, owing to physical conditions, the transformers are not banked.

EIGHT PRINCIPLES GUIDED CHANGES

In remodeling the system it was the object to obtain the best possible distribution conditions both as to operation and as to cost, using the existing overhead wire layout with small additions or changes where necessary. Among the principles which were observed in changing each circuit were the following:

1. The primary pressure should be as uniform as possible throughout the circuit. This condition is best obtained by locating the feeding point so that the load will be divided about evenly in every direction and by making closed rings in the primary network.

2. Provision should be made so far as possible to facilitate the subdivision of the territory fed by the circuit when the load becomes too large for one circuit. The aim is to keep the current on any feeder below 200 amp. Provision should also be made so far as possible for throw-over connection from one circuit feeder to another in case of trouble and wherever convenient for dividing the load of one circuit among the adjacent circuits. Such an arrangement will enable maintaining service in case of trouble if the loads on the circuits are kept between 150 amp. and 175 amp.

3. The primary-wire network should be made as simple as possible. This condition will permit a saving in wire and also make it easier to locate trouble when it occurs. All primary wire that is not working should be taken down. It is considered that it is of greater value in the warehouse than on the line.

4. An attempt should be made to reduce the total

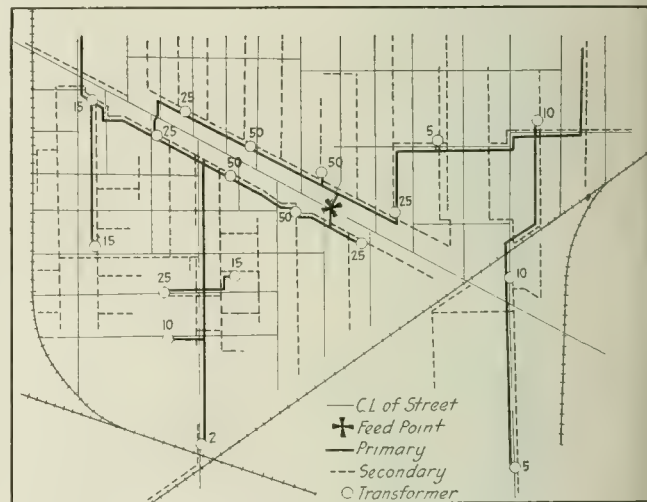
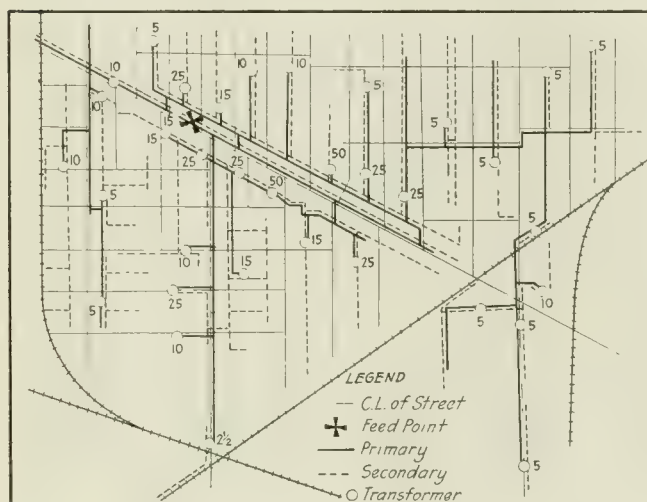
number of transformers by replacing the smaller sizes with a less number of larger sizes. This can be done by proper banking. The benefits derived are many—such as carrying a larger total load with a smaller total transformer capacity, reducing the cost of tests and inspection, using larger and more rugged fuses, and reducing the total core loss.

5. The transformers should be placed on the line in such a way that no heavy load, such as a theater, apartment house, factory, etc., will be carried a long distance on the secondary. When the transformers are banked these heavy loads have to be taken into consideration in locating the transformers in the bank. Generally it can be assumed, as it is shown on load tests, that for any particular class of residence district the load density on the secondary will be very nearly uniform, so that transformers can be placed at equal distances

physical conditions of the lines and the district fed by the circuit always constitute a vital consideration and that all the above requirements must be modified to fit them.

BETTER DISTRIBUTION WITH LESS MATERIAL IN SOME CASES

Bearing in mind the principles mentioned, the actual work of remodeling the distribution system was carried out briefly as follows: A map of the circuit in question was obtained and corrected as to wire and transformer locations. Load tests were made at each transformer to determine the load on the transformer and also to determine the portion of that load which goes in each direction from the transformer on the secondary mains. Tests made in this way were used in determining the proper size and also the proper location of transformers



FIGS. 1 AND 2—A TYPICAL CIRCUIT IN THE SYSTEM BEFORE AND AFTER IMPROVEMENT

apart in the banks and made to carry about the same load.

6. Larger transformer capacity should be provided in each bank than is obtained from the tests on the transformers that were installed originally, first, to provide additional capacity in anticipation of increase of load and, second, to provide continuous service should one transformer fail and the load be thrown on the other transformers. The transformers should be fused on the primary and secondary sides so that a disabled transformer will always be cut off from the lines. Banking of transformers on the secondary side can only be successful where inspection and tests are provided regularly, because the failure of one unit in a bank of overloaded transformers will generally cause all the fuses on the other transformers to burn out, thereby making the trouble embrace a much larger territory than if the transformers were operating independently. Transformers should also be installed so that the future growth of the district can be taken care of by increasing the size without changing the location of the transformer.

7. The secondary wires should be taken down whenever they are not necessary and new wire should be installed to complete banks and reduce thereby the number of transformers necessary. The wire should be changed from one size to another wherever it can be proved that such a change is economical.

8. Finally it should be remembered that the actual

as near as possible to the center of the load. The overhead system of the circuit was inspected thoroughly in order to determine the nature and location of the load, and also the possibility of installing additional wire. With the information collected a new map was drawn in which the primary system was simplified as much as possible to meet the conditions. Provision was made to take down the wire not working, and the secondary was so arranged in banks as to provide the best handling of the load with the least expenditure. The same map was used in issuing orders for the work of rehabilitation.

The maps shown herewith (Figs. 1 and 2) are similar to those which were used for the work previously mentioned and show the actual conditions on a particular circuit before and after the replacement of transformers and improvement of the distribution. The example is more or less typical, though it has been found that no two circuits presented exactly the same problem. It should probably be mentioned in connection with the maps that a considerable portion of the distribution is located in public alleys, the positions of which are indicated approximately by the position of the lines on the map.

The improvement brought about by the changes on this circuit may best be shown by statistics. The number of transformers taken down was thirty-five. The number of transformers installed was eighteen. The total capacity of the transformers before the change

was 492 kw. The total capacity of the transformers installed was 412 kw. The maximum load on the circuit at the time the change was made was about 350 kw. About 5600 lb. (2540 kg.) of copper wire was installed in making the change and about 8500 lb. (3855 kg.) was taken down. Such a reduction in total capacity is rather an unusual thing, as is also the large reduction in the number of transformers. It is due to the fact that this circuit was greatly over-transformed in some sections while the transformers in other locations were overloaded. This condition naturally arises where the gradual growth has been taken care of in the most convenient way at the time but where no work is done on the circuit as a whole with the idea of general improvement. This circuit is also peculiar in that a heavy load is concentrated along one street, making it possible to use large transformers in a bank and work them more nearly up to rated capacity than is possible with the smaller units. The transformers along the main street are so placed that when the load increases the 25-kw. transformers may be replaced by 50-kw. transformers without too great a voltage drop in the secondary mains. It should be evident from inspection of the final arrangement that while the transformer capacity was

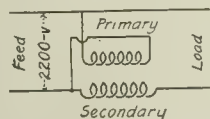


FIG. 3—CONNECTIONS FOR USING A STANDARD TRANSFORMER AS A BUCK

greater before the change the extra capacity was not available to pick up the increase of load as it was too far from the center of load.

HOW INTERRUPTIONS WERE MINIMIZED

The routine of the work in the field was somewhat complicated on account of the fact that it was desired to avoid any unnecessary interruptions to the service. The work of stringing new wire and hanging transformers in new locations was all done before the actual cut-over was made. The only interruptions therefore were those resulting from cutting the bucking coils in and out, which required about a half minute to a minute at a time, and the interruptions due to changing a transformer which was not in a bank. The "bucks" were handled as follows: A section of primary was cut off so as to have but one feed. Then a 2200-110/220-volt transformer connected as a 10 per cent "buck" was inserted in the line. This arrangement reduced the voltage and left the secondary voltage of all the transformers on that branch 10 per cent lower than normal (from 110 to about 100 volts). Then the transformers were replaced with transformers with a ratio of eight and two-thirds to one, which brought the voltage up to 110 on the secondaries. This work being done in the daytime, there were practically no instances of customers complaining of low voltage during the operation and the actual interruptions were so short that they were usually not noticed. Small enough portions of each circuit were cut over at one time to permit all the transformers in it to be changed in one day. Then the following day a new "buck" was connected so as to include a still larger portion of the circuit and the old buck was removed. This operation was repeated until

the whole circuit had been changed over to the new ratio transformers, at which time the voltage was adjusted on the feeder to meet the new conditions and the "bucks" were removed.

THE "BUCK" AND ITS ADVANTAGES

It should be noted that it took considerable investigation to decide what kind of apparatus should be used to obtain the local lowering of the voltage that is shown to be necessary by the above considerations. A standard transformer connected as a "buck" was found the most satisfactory thing to use, all things being considered. The transformer connections were made inside of the case and the three required leads alone were brought out and labeled in large letters on the case just below the bushings. It was naturally essential that these leads be connected to the circuit in the proper sequence in order to avoid serious accidents.

The advantage of the "buck" can be summed up as follows: Standard equipment can be used instead of purchasing special apparatus that would be of no value when the work is completed; the time required for cutting the lines in and out is very short, making interruptions a minimum; no adjustments are required, and the simplicity of the method makes mistakes practically impossible.

In conclusion, the wholesale change that was necessary in the single-phase distribution system was made an occasion to study the factors that would bring about the most economical and satisfactory distribution by making use of the existing conditions and changing them only where a change could be proven economical. Each circuit, after the changes outlined had been made, was left more simple, more flexible and more economical to operate. In each circuit considerably more wire (in actual weight of copper) was taken down than installed. The number of transformers installed was from 20 to 50 per cent less than those taken down. The total transformer rating is from 5 to 25 per cent more than formerly existed, which will allow for a growth in load of from 30 to 60 per cent. The total core loss of the circuit is from one-half to one-third that which existed before the change.

Increasing Stability of Generators

By the invention of Paul Amsler of Baden, Switzerland, in patent No. 1,220,486, the knee of the characteristic curve of direct-current machinery is lowered. A certain proportion of the laminæ forming the pole are of greater length than the remainder and project into the air gap formed between the pole and the armature. The result of this is that the flux density is much greater in the projecting teeth than in the pole body and may be magnetically saturated at comparatively low voltages. It is, of course, not necessary that the highly saturated iron parts of small cross-section be placed in the pole shoe. They may, if desired, be placed in the armature core of the laminæ. In both cases thin teeth are produced, the thickness of which is comparatively a small fraction of the width of the slots, as calculations have shown that the teeth must be very thin and fine. Instead of providing projecting laminæ the armature or poles may be solid and provided with turned grooves, thus obtaining the same effect.

Street Lighting for Business Districts

Principles Involved in Spacing and in Selection of Lamps and Accessories for Ornamental Systems in Small Cities and Towns, with a Discussion of the Relative Merits of Series and Multiple Distribution

BY JAMES R. CRAVATH

In this article, the sixth in the series on street lighting for small cities and towns, the lighting of business districts is taken up. In previous articles the general principles, the lighting units and types of posts available and residence-street lighting have been discussed.

FOR the principal retail business streets the first thing to be decided is whether ornamental lighting to the degree now common on business streets in the more progressive cities is to be used or whether the lighting is to be altogether utilitarian, leaving special lighting to the efforts of individual merchants in show windows.

PRINCIPLES OF SPACING

If a special ornamental effect is wanted, as is usually the case, this effect usually cannot be produced within a small city unless lamps are spaced not more than 150 ft. (45.72 m.) apart along any one curb line (two per 75 lineal feet, or 22.8 m. of street), and preferably somewhat less, even down to 90 ft. or 100 ft. (27 m. to 30 m.). As a general rule, in small cities and towns the length of street to be specially lighted will be only from one to three or four blocks on any particular street. Therefore, to produce a pleasing effect at night with such short stretches lamps must be placed a short distance apart (Fig. 6) in order to get a sufficient number in view at once to produce any great amount of ornamental effect. Such streets can undoubtedly be

but one stretch of main business street the effect may be very impressive from an ornamental and artistic standpoint, but in small stretches it is almost sure to be disappointing to the local people most interested. For the present at least, short spacing for poles must be the method of which use is made.

DESIRABLE HEIGHTS

Lamp heights of 16 ft. to 22 ft. (5 m. to 7 m.) would be desirable in this class of work from the standpoint of glare alone, but posts of this height render the construction costs too heavy generally for short spacing in small cities. On streets where it is not possible to remove the overhead wires to alleys or place them underground such heights would further be objectionable by bringing lamp levels up to those of the lowest overhead wires.

On the other hand, it should always be remembered that height is desirable, and that posts only 9 ft. or 10 ft. (2.74 m. or 3.05 m.) high to the lamp center, which have very frequently been used, are not only bad from an illumination standpoint, but may cheapen the general appearance of an installation much more than the money saved in the construction makes worth while.

At the present time it is easy to obtain posts of either pressed steel, cast iron or concrete which will give a lamp height of 14 ft. (4.27 m.) or higher.

If the business-street lighting is to be purely utili-



FIG. 1—SINGLE-BALL TYPE OF GLOBE INSTALLED WITH OPPOSITE METHOD OF SPACING

well lighted as far as quantity of illumination is concerned by the use of posts 20 ft. to 30 ft. (6 m. to 9 m.) high, spaced about two to a block where the blocks are not very long, or in other words 150 ft. to 250 ft. (46 m. to 76 m.) apart. On important thoroughfares in large cities where extensive lengths of streets can be so equipped with high posts and in smaller cities having



FIG. 2—PENDENT-TYPE BRACKET WITH WOOD POLES AND OVERHEAD DISTRIBUTION

tarian, without any particular advertising or esthetic effect, the treatment should be similar to that of the most thickly settled residence streets described in the last article. Lamps suspended two to a block, 20 ft. to 25 ft. (6.1 m. to 7.6 m.) high, and preferably equipped with refractors for increasing illumination midway between lamps, will give fairly good results,

although hardly comparable with ornamental lighting in which frequently spaced posts are used.

CHOOSING THE LAMPS AND GLOBES

For close spacing in small cities the magnetite arc is likely to be a larger unit than a city or mercantile pocketbook can afford. The gas-filled tungsten lamp

trum, so that the lamp filament appears as a dull red glow, are not advisable from an esthetic standpoint.

Styles change in ornamental lamp posts as in everything else. When ornamental business-street lighting was first introduced on Pacific Coast city streets clusters of three, four and five lamps were most commonly adopted. The simplicity of designs having a plain globe



FIGS. 3 TO 6—TYPICAL INSTALLATIONS WITH MODIFICATIONS OF ONE-GLOBE UNIT

is therefore about the only suitable unit for the smaller towns. For cities of 30,000 to 50,000 inhabitants the magnetite arc in its ornamental form should be taken into account. However, for the majority of such cities tungsten lamps of 2500 lumens are the largest that can be considered. As explained in the last article on residence-street lighting, when lamps as large as 4000 lumens of the tungsten gas-filled type are up for consideration the magnetite arc comes in as a competitor, and each case should be figured upon its merits. If there is enough of the ornamental lighting on business streets to load one magnetite arc rectifier-transformer outfit, it may be quite possible that the magnetite arc will be the preferable unit. If, on the other hand, there is not enough such lighting to do this, or if it is more expedient to operate the business-street lighting from existing circuits, either constant potential or constant current, the gas-filled tungsten lamp will be the best.

For all closely spaced posts in business-street ornamental lighting a good diffusing globe is preferable to any of the refracting or reflecting accessories at present on the market. The diffusing globe will give sufficient uniformity and a more pleasing general effect as well as deliver more of the total light upon the surface of the street. The ideal in diffusing-globe equipment for this work is a glass with a low absorption which either renders the position of the lamp filament indistinct or sufficiently diffuses the direct light from the filament so that it is not annoying. Opal glasses of the type that filter out the violet end of the spec-

at the post head and the fact that large lamps are more efficient light producers than a number of smaller ones combined caused a strong tendency toward the use of the single-ball globe at the post top, as in Fig. 1. The sales efforts of one of the largest electrical manufacturing companies have been successful in directing the one-lamp idea to a type of post head and globe like that shown in Figs. 3 to 6.

On streets where there are electric railway poles or where the necessity of having electric service wires makes it impossible to do away with overhead wires the plan of using ornamental steel poles with brackets for ornamental lamps, as in Fig. 5, is very common. The appearance is hardly to be compared with a street where there are no overhead wires, but it is one of the best ways out of a difficult situation. Of course, there is considerable latitude in the type of bracket which may be employed in certain cases. To some people pendent brackets appear more logical from a design standpoint. One method of securing a certain amount of ornamental lighting on a street where the overhead lines could not be moved is shown in Fig. 2. The arrangement of putting ornamental brackets on existing wooden poles is believed to have been better in this case than using iron or concrete ornamental posts in addition to the wood poles.

OPPOSITE VERSUS STAGGERED POSITION

The general question of placing ornamental lamp posts opposite each other (Fig. 4) or staggered (Fig. 6) comes up in nearly every installation. In the last

analysis this is largely a matter of first cost. In laying out the location of lamp posts for such a system obviously the matter of general symmetry and uniformity must always be kept in mind. If four lamp posts are placed at each street crossing, one on each corner, symmetry of arrangement practically demands that lamp posts be placed opposite each other on the rest of the street, otherwise there is an awkward break in passing from the staggered arrangement between street corners to the opposite arrangement at corners. If only two lamp posts are to be placed at each street crossing, they can be placed on diagonally opposite corners and fit in very well with the staggered arrangement of posts on the rest of the street. A fair degree of uniformity in placing is always desirable, so that if there is not enough money available to place lamps along each curb a distance apart not much in excess of the distance apart at street crossings it is better to adopt the staggered arrangement. For example, if lamps can be placed not over 50 ft. to 75 ft. (15 m. to 23 m.) apart along each curb and four at each crossing, the opposite lamp arrangement is best. If the 75-ft. (23-m.) spacing is exceeded, the desirability of the staggered lamp arrangement increases with the distance apart. As to the general appearance of the two plans at night, there is really not much difference, and very few casual observers could tell whether lamps were spaced opposite or staggered, because the general impression is simply that of two rows of lights, as in Fig. 6.

SERIES VERSUS MULTIPLE DISTRIBUTION

Nearly every installation of this kind presents the problem of whether series or multiple distribution is best. Aside from the question of total construction costs, which involves many elements, the principal consideration is that of convenience in switching. As constant-potential service is available practically everywhere in a business district from the regular commercial service circuits, it is easy to obtain service in each block and light each block of such lamps as a separate unit from a centrally located service switch for that block. The turning on and off, however, must either be undertaken by a watchman employed by the merchants, the city or the company, or else a time switch must be installed to do this work. In many cases this can be done by a city patrolman at practically no expense. If a separate circuit has to be run from the central station or substation to supply this business-district lighting, it is usually more economical to do this on the series system than on a multiple system.

Another alternative is to have a separate series loop for this lighting operated from a series circuit devoted to other lighting and to have a loop switch at some point in the business district where it can be operated by a night watchman. This may be the most economical thing in some cases, but as a general rule if switching has to be done by watchmen the most economical system is to supply each block from a constant-potential system at low voltage.

In figuring the relative construction costs of the two systems the following points must be considered: If the series system is used, the common and best practice of to-day is to use single-conductor, lead-covered, steel-taped cable of No. 6 or No. 8 B. & S. The mag-

netic reluctance of this steel tape seems to be too high to increase seriously the voltage required for the line. In some cases this cable is buried in a trench cut in the concrete sidewalk. In other cases a trench is cut in the street paving just outside the curb. Sometimes there is a ledge under the edge of the sidewalk which slightly overhangs the curb, permitting the cable to be fastened up in a concealed position under this ledge. In many other cases there is space under the sidewalk connected with the basements of buildings and the cable can be pulled through this space. Of course, if there is a dirt parkway the trench work becomes an extremely easy matter.

If the system is multiple, common practice is to use iron-pipe conduit run in the same locations as the series cable just described. The conductors in this conduit may be ordinary rubber-covered wire as used for interior work, but on account of the uncertainties of keeping the conduit dry a lead covering on this wire is considered best practice and is generally to be recommended. Of course, in locations where a dry conduit seems assured the lead covering is an unnecessary expense.

The trench work for the two systems will manifestly be about the same, except that the series system will usually require the crossing of streets with the cable at many points which would not be necessary with the multiple system because the multiple system would usually be fed from the middle of a block each way. As far as the distribution goes, therefore, the cost of the conductors, conduits and trench work as a whole should be figured up as against the similar items for the multiple system.

The cost of getting the service down from the overhead lines with both systems should be calculated. In the case of the series system a pothead and lightning arrester must be installed at each transition from overhead to underground. This should be balanced against the cost of the service connections and switch box with the multiple system.

It very often happens that ornamental systems of this kind are installed one block at a time as property owners require. It is therefore found in some cases that a multiple system offers a flexibility in this respect not obtainable with a series system at the same expense. In one case in the writer's practice the series system worked out the best for the installation of a considerable number of lamps over a large district where all of the installation was to be made at once. After the lay-out had been revised, the lamps spaced at somewhat shorter intervals and the necessity of installing the system one block at a time considered, the multiple system worked out the best.

The cost of the wiring and the sockets at each post is considerably less with the multiple system. The high voltage of the series system requires high-voltage wiring to the lamp sockets unless compensating transformers are used in the base of the pole.

In cases where the switching can be done by patrolmen and yet the series system of distribution is found to be most economical after figuring the total cost of installation, an oil switch mounted high on a pole and operated by a rope or lever from below can be used to loop in or out the ornamental lighting system, provided that the ornamental lighting circuit ends at the pole where it begins.

Improved Method of Testing Current Transformers

Ratio and Phase Angle Can Be Determined in Terms of Constants of Previously Calibrated Standard Transformers of Same Nominal Ratio—Method More Sensitive Than Absolute Method

BY FRANCIS B. SILSBEE

SEVERAL precise laboratory methods are now available for the determination of the ratio and phase angle of current transformers,¹ but they all require a considerable amount of special apparatus such as carefully calibrated non-inductive shunts and very sensitive alternating-current detectors. Therefore they are not suited for use under shop or central-station conditions.

The task of comparing the constants of one transformer with those of a second transformer taken as a standard is much less difficult, and can be done with a more rugged instrument such as a commercial pivoted wattmeter. A method for such a comparison of two voltage transformers has been published by Brooks², and other methods applicable to either voltage or current transformers by Agnew³ and by Knopp⁴. The method developed in this paper is somewhat analogous to the first of these and will be found rather more rapid than the second.

The general principle of the method consists in connecting the standard and unknown transformers in series, aiding on both primary and secondary, and then providing an additional circuit connected across the secondaries which serves to carry and measure the vector difference of the secondary currents. Though there are many possible methods based on this general arrangement, the one described here as the null method will be found perhaps the most accurate and convenient. The deflection method admits of many variations in detail and requires less special apparatus but is more subject to error.

NULL METHOD

The connections for the null method are given in Fig. 1. *ABCD* is a slide wire of about 0.2 ohm total resistance. *M* is a variable mutual inductance of about 600 microhenries maximum, the primary of which can carry 5 amp. without excessive heating; *r*₁ is a resistance of about 30 ohms, preferably, capable of being set at several other values down to 2 ohms. As the value of *r*₁ appears in the denominator in the equation given later, it is convenient to have the total resistance between *F* and *C*, including the resistance of the secondary winding of *M*, an exact integer for each setting of *r*₁. *M*, *r*₁ and *r*₂ need be calibrated only to the per cent accuracy which is desired in the difference of the ratios, i.e., to about 1 per cent.

The detector shown in the figure is a separately ex-

cited electro-dynamometer instrument. A commercial wattmeter preferably of low current range may be adapted for this work by bringing out taps directly from the moving coil without using any of the series resistance. The moving coil is connected as shown and the current coil excited by its full rated current in either of two phases, which preferably are in quadrature, through the double-throw switch *G*. Any other form of alternating-current detector sensitive to 0.00005 amp. might be used.⁵

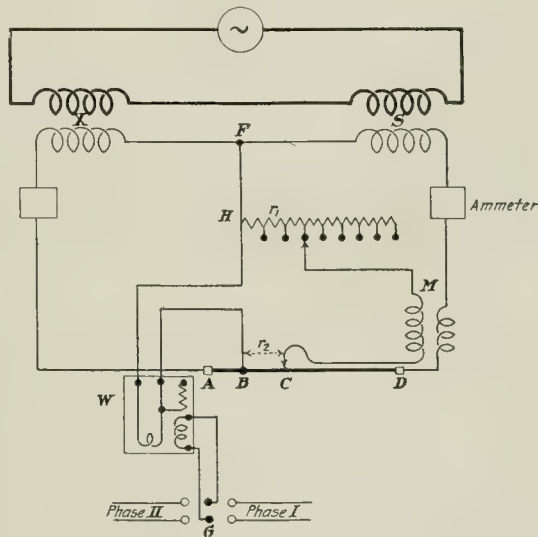


FIG. 1—CONNECTIONS FOR CONDUCTING NULL METHOD, WHICH IS MOST ACCURATE

As a precaution a 10-amp. ammeter should be connected in parallel with the detector, so that the transformers will not be damaged if they have inadvertently been connected in opposition instead of aiding. If this ammeter shows no appreciable current, the polarity of the transformers is correct and the ammeter should then be disconnected.

The procedure is to adjust the position of the slider *C* and the value of the mutual inductance *M* until no deflection is obtained on closing *G* in either direction. When a balance is thus obtained all of the differential current *I* is flowing through *r*₁, and the difference of potential between points *B* and *F* is zero. From this relation the differences in the ratios and phase angles of the two transformers may be computed.

If *R*_s and *R*_x are the ratios of the transformers *S* and *X* respectively, and α_s and α_x are the corresponding phase angles, then we have for the case where the slider *C* is to the right of *B* (Fig. 1): $R_x/R_s = 1 + a - b^2/2 - bc$ and $\tan(\alpha_x - \alpha_s) = b + ac$.

For the case where *C* is on the same side of *B* as transformer *X*, then $R_x/R_s = 1 - a + a^2 - b^2/2 - bc$,

⁵A new type of vibration galvanometer has recently been developed by Agnew which is very well suited for this work. A description of this sensitive yet rugged instrument is to be published shortly in the *Bulletin* of the Bureau of Standards.

¹Agnew and Fitch, *Bulletin* of the Bureau of Standards, No. 6, p. 281, 1909; "Reprint No. 130," *ELECTRICAL WORLD*, Vol. 54, p. 1042, 1909; E. Orlich, E. T. Z., Vol. 30, pp. 435, 466, 1909; L. T. Robinson, *Trans. A. I. E. E.*, Vol. 28, p. 1005, 1909; F. A. Laws, *ELECTRICAL WORLD*, Vol. 55, p. 223, 1910; Sharp and Crawford, *Trans. A. I. E. E.*, Vol. 29, p. 1517, 1910; Agnew and Silsbee, *Trans. A. I. E. E.*, Vol. 31, p. 1635, 1912; Schering and Alberti, *Archiv für Elektrotechnik*, Vol. 2, p. 263, 1914.

²H. B. Brooks, *Bulletin* of the Bureau of Standards, No. 10, p. 419, 1914; "Scientific Paper No. 217," *ELECTRICAL WORLD*, Vol. 62, p. 898, 1913.

³P. G. Agnew, *Bulletin* of the Bureau of Standards, No. 11, p. 347, 1914; "Scientific Paper," No. 233.

⁴O. C. Knopp, *ELECTRICAL WORLD*, Vol. 67, p. 92, 1916.

$\tan (\alpha_x - \alpha_s) = b - ac - ab$, where $a = r_2/r_1$, $b = \omega M/r_1$, $c = \omega L_1/r_1$, and $\omega = 2\pi \times \text{frequency}$.

r_1 = the total resistance between C and F through M and r_1 (Fig. 1) in ohms,

r_2 = the resistance of the slide wire between B and C in ohms,

L_1 = the self-inductance of the secondary coil of the mutual inductance M in henries,

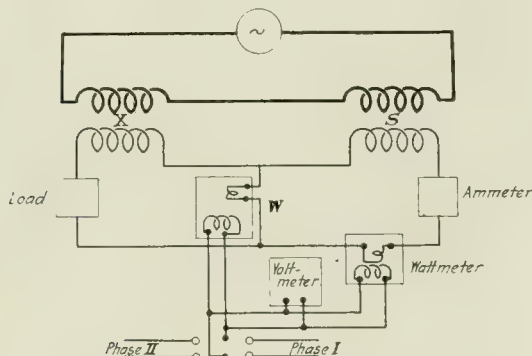


FIG. 2—DEFLECTION METHOD SET-UP, SUITABLE WHERE VARIABLE INDUCTANCE AND BRIDGE ARE NOT AVAILABLE

M = the value of the mutual inductance in henries. (This is to be taken as positive if α_x is greater than α_s as shown by the test described below.)

The second order terms are usually very small, and for an accuracy of 0.1 per cent in either case $R_x = R_s (1 \pm a)$, $\alpha_x = \alpha_s + 3438b$, if the angles are expressed in minutes.

If the balance is obtained with the slider between B and D (Fig. 1), then (provided the second order terms are less than a) the standard transformer is supplying the greater secondary current and consequently has the smaller ratio. The question which secondary current leads the primary current by the greater angle can best be determined once for all by adding some resistance to the load on transformer X . This will always make I_x lead more than before, and if the value of M required for a balance is increased, then I_x was leading originally and M and b are to be taken as positive with this connection of the mutual inductance.

This method is particularly convenient if the standard transformer has the greater ratio, as it is then possible to make the test without introducing any load whatever into the secondary of the unknown transformer.

DEFLECTION METHOD

In cases where a variable mutual inductance and slide wire are not available, but a polyphase supply is at hand, the deflection method (the connections for which are shown in Fig. 2) may be used. The detector W in this method must be of the dynamometer type and arranged so that one coil may be supplied from two circuits, one giving a current in phase with the current in the transformers and the other giving a current having a known phase relation, preferably quadrature, with the former. The instrument thus serves to measure the two components of the difference in secondary current of the two transformers. If D_i and D_q are the deflections in divisions observed with the excitation in phase and in quadrature respectively, $R_x/R_s = 1 + KD_i/I_s$, $\tan (\alpha_x - \alpha_s) = KD_q/I_s$ approximately, where k is the constant of the instrument in amperes per division. If the wattmeter is excited by passing a current

I_o through its current coil, $K = k/I_o R_v$, where k is the constant in watts per division for a given range and R_v is the resistance of the voltage circuit of the same range. If the wattmeter is excited by applying a voltage E_o to the voltage circuit, then $K = k/E_o$.

In case the second phase available as a source of excitation is not in quadrature with the first, but gives an exciting current which lags behind the current in the transformers by an angle θ and produces a corresponding deflection D_θ , then $R_x/R_s = 1 + KD_i/I_s$, $\tan (\alpha_x - \alpha_s) = K/I_s [(D_\theta - D_i \cos \theta) \div \sin \theta]$.

As before, the question which secondary current is the greater and which leads the primary current by a greater angle can best be answered by changing the load on one transformer and noting the effect on the deflections.

The accuracy obtainable with this second method is limited by the resistance of the detector. This has the effect of shifting the load from one transformer to the other and may seriously affect the results if the deflection is allowed to exceed four or five divisions.

Another source of error common to both methods is the transformer action due to mutual inductance between the two coils of the wattmeter. This should always be eliminated by shifting the control springs so that the axes of the coils are at right angles.

EXPERIMENTAL RESULTS

Both of the methods described above have been tried experimentally and the results are plotted on a large scale in Fig. 3. Curves A and B give the ratio factor and phase angle respectively of a 25-amp., 40-volt-amp. portable current transformer at 60 cycles. The curve is drawn through values obtained by a precise laboratory method. The crosses are points observed by the null method, using as a standard a similar transformer

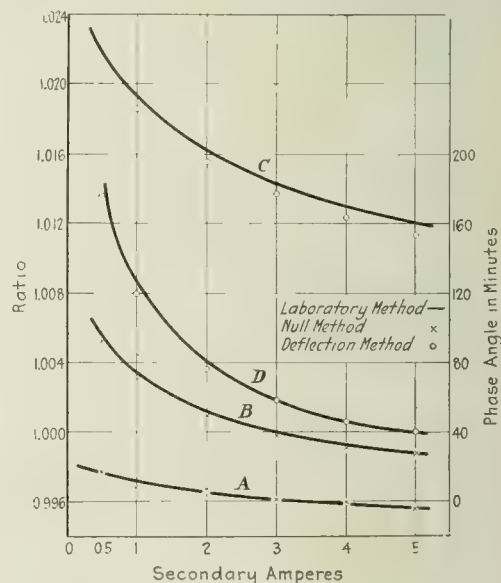


FIG. 3—COMPARISON OF NULL AND DEFLECTION METHODS WITH LABORATORY METHOD

carrying considerably less load. Curves C and D give the ratio factor and phase angle of another transformer which was tested by the deflection method. As before, the curves are drawn through the points obtained by a precise laboratory method and the circles show the values obtained by the method here proposed.*

*This paper is to be published in more extended form in the *Bulletin of the Bureau of Standards*.

Results of Midsummer Central Station Operation

Income for Light and Power for June \$37,100,000 and for July \$34,100,000,
While Outputs for the Two Months Were 2,210,000,000 Kw.-hr.
in June and 2,060,000,000 Kw.-hr. in July

CENTRAL stations continued to show during the midsummer months of June and July increases in business comparable with those of previous months. In fact, the rate of increase in earnings over the corresponding months in the previous year was slightly more in June and July than for former months in that year. It is not difficult to understand this increase in rate of growth when it is realized that a very

load, have had, as will be noted, a very salutary effect upon light and power utility earnings in the period affected.

TABLE I—CENTRAL STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percent- age of Industry Repre- sented	INCOME FROM THE SALE OF ENERGY			Kw.-Hr. OUTPUT		
		1916	1915	Per Cent In- crease	1916	1915	Per Cent In- crease
Aug.....	64	20,502,000	17,861,000	15.0	1,262,575,000	1,015,805,000	22.4
Sept.....	64	21,432,000	18,600,000	15.2	1,268,339,000	1,037,976,000	21.2
Oct.....	64	22,882,000	20,164,000	13.5	1,347,502,000	1,125,132,000	19.9
Nov.....	64	24,819,000	21,744,000	14.4	1,396,537,000	1,148,221,000	21.7
Dec.....	62	25,306,000	22,029,000	15.0	1,345,883,000	1,112,280,000	21.0
1917		1917	1916		1917	1916	
Jan.....	63	27,408,000	23,969,000	14.4	1,495,829,000	1,180,884,000	26.7
Feb.....	63	25,204,000	22,295,000	13.1	1,240,995,000	1,036,014,000	20.0
March.....	64	23,949,000	20,913,000	14.6	1,409,129,000	1,139,453,000	23.6
April.....	63	22,927,000	20,165,000	13.8	1,328,092,000	1,085,554,000	22.5
May.....	62	23,362,000	20,301,000	15.2	1,458,824,000	1,163,268,000	25.2
June.....	61	22,623,000	19,397,000	16.7	1,344,926,000	1,100,974,000	22.4
July.....	55	18,772,000	16,070,000	16.8	1,134,960,000	929,376,000	22.1

large number of companies burdened by the higher cost of operation, particularly for fuel, were forced to increase slightly the rate for power to compensate for the increased fuel charges. These increases in rates, although slight, coming as they do on the heavy power

TABLE III—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED BY SIZE

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July
INCOME:										
Group 1.....	11.6	13.0	15.0	12.0	12.5	13.0	12.0	14.0	16.3	16.2
Group 2.....	19.2	17.7	16.6	19.0	19.7	20.4	19.8	20.0	19.0	20.0
Group 3.....	18.5	18.2	15.2	15.2	12.5	15.1	15.0	16.0	14.2	13.3
Group 4.....	13.5	12.8	12.3	15.5	10.3	19.1	16.5	17.0	18.8	22.0
Group 5.....	16.0	12.8	9.5	20.2	57.5	16.1	19.8	16.3	15.5	24.0
OUTPUT:										
Group 1.....	16.6	18.2	18.7	22.5	19.0	20.0	18.7	23.3	22.2	21.1
Group 2.....	31.1	27.2	20.2	30.5	24.0	35.1	36.8	36.9	26.0	30.0
Group 3.....	24.0	32.0	28.8	34.4	14.8	25.1	24.5	23.4	17.2	18.8
Group 4.....	20.4	19.7	21.0	30.5	20.2	26.1	29.1	33.2	29.2	28.5
Group 5.....	18.3	33.0	25.4	21.3	21.7	44.0	22.4	26.3	14.4	24.0

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July
INCOME:										
Group 1.....	12.1	13.5	12.5	12.5	12.3	7.0	13.8	12.2	10.8	16.8
Group 2.....	21.3	20.0	30.2	16.1	18.4	17.2	17.2	18.2	20.7	27.0
Group 3.....	18.0	19.4	16.5	17.8	15.7	16.5	25.3	25.0	20.8	21.3
Group 4.....	15.4	16.0	16.0	22.0	12.8	25.8	23.0	30.8	20.7	30.0
Group 5.....	18.2	18.6	12.2	24.0	15.1	21.0	24.0	29.5	22.9	26.8
OUTPUT:										
Group 1.....	17.5	18.0	10.8	20.7	19.6	24.0	18.2	17.7	14.1	27.5
Group 2.....	35.0	24.7	18.2	24.8	18.5	20.0	20.4	24.8	22.8	35.0
Group 3.....	42.6	35.9	22.0	20.9	35.7	34.5	38.2	35.3	34.0	41.1
Group 4.....	48.9	40.0	55.2	73.8	38.1	32.7	49.3	61.0	47.7	51.5
Group 5.....	22.0	17.0	35.7	29.2	26.8	76.0	29.0	39.5	4.4	38.7

TABLE II—CENTRAL STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

Month	Percentage of Indus- try Represented	New England States			Percentage of Indus- try Represented	Atlantic States			Percentage of Indus- try Represented	Central States (Illinois Excluded)			Percentage of Indus- try Represented	Pacific and Mountain States			
		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase	
INCOME	August.....	65	2,203,000	1,935,000	13.7	66	8,000,000	6,875,000	16.4	56	6,195,000	5,266,000	17.7	88	3,883,000	3,582,000	8.4
	September.....	65	2,315,000	1,982,000	16.8	66	8,631,000	7,445,000	16.0	56	6,505,000	5,537,000	17.8	88	3,979,000	3,644,000	9.2
	October.....	65	2,684,000	2,331,000	15.2	65	8,887,000	7,930,000	12.1	56	6,968,000	5,895,000	18.2	87	4,213,000	3,889,000	8.3
	November.....	65	2,912,000	2,516,000	15.7	65	10,061,000	8,859,000	13.5	56	7,410,000	6,313,000	17.4	87	4,246,000	3,947,000	7.5
	December.....	65	3,203,000	2,814,000	14.0	66	11,059,000	9,348,000	19.6	56	7,898,000	6,997,000	13.0	75	2,987,000	2,735,000	9.3
	1917		1917	1916			1917	1916			1917	1916			1917	1916	
	January.....	64	3,181,000	2,762,000	15.1	66	11,409,000	9,874,000	15.6	56	8,081,000	7,013,000	15.2	86	4,602,000	4,020,000	9.5
	February.....	64	3,039,000	2,686,000	13.1	65	10,249,000	9,021,000	13.6	55	7,471,000	6,530,000	14.4	86	4,284,000	3,926,000	9.2
	March.....	64	2,861,000	2,547,000	12.3	65	10,203,000	8,902,000	14.7	56	6,692,000	5,754,000	16.5	86	4,193,000	3,780,000	11.0
	April.....	64	2,756,000	2,357,000	17.0	65	8,601,000	7,765,000	10.7	56	7,132,000	6,094,000	7.0	86	4,282,000	3,821,000	12.1
	May.....	64	2,640,000	2,253,000	17.2	65	9,488,000	8,112,000	17.0	52	6,912,000	5,914,000	16.9	86	4,173,000	3,883,000	7.5
	June.....	64	2,613,000	2,262,000	15.5	65	9,260,000	7,998,000	16.0	51	6,687,000	5,525,000	21.0	80	3,914,000	3,488,000	12.2
	July.....	50	2,178,000	1,815,000	20.0	55	7,159,000	6,161,000	16.2	47	5,978,000	5,022,000	19.0	76	3,414,000	3,037,000	12.4
KW.-HR. OUTPUT	August.....	65	97,197,000	72,900,000	33.4	66	433,129,000	344,730,000	25.7	56	374,327,000	295,866,000	26.5	88	333,468,000	279,976,000	19.1
	September.....	65	98,350,000	73,343,000	34.2	66	446,534,000	369,815,000	20.8	56	387,626,000	307,485,000	26.2	88	335,817,000	288,332,000	16.4
	October.....	65	107,756,000	83,705,000	28.8	65	426,151,000	373,705,000	14.2	56	408,364,000	324,509,000	25.9	87	355,014,000	306,828,000	15.8
	November.....	65	111,873,000	89,015,000	25.7	65	533,252,000	444,746,000	25.6	56	415,491,000	334,044,000	24.4	87	346,847,000	293,518,000	18.2
	December.....	65	117,763,000	97,387,000	21.0	66	535,410,000	424,923,000	20.4	56	425,510,000	354,258,000	20.0	75	256,006,000	206,838,000	23.8
	1917		1917	1916			1917	1916			1917	1916			1917	1916	
	January.....	64	120,211,000	91,163,000	29.1	66	564,699,000	429,432,000	31.5	56	437,923,000	351,335,000	24.5	86	363,094,000	298,990,000	21.4
	February.....	64	110,114,000	88,324,000	24.7	65	418,407,000	341,877,000	22.5	55	373,988,000	323,158,000	15.8	86	326,891,000	274,079,000	19.3
	March.....	64	121,434,000	95,515,000	27.2	65	539,028,000	425,376,000	27.0	56	383,046,000	311,841,000	23.0	86	365,541,000	301,721,000	21.3
	April.....	64	108,968,000	87,237,000	25.0	65	449,445,000	362,752,000	24.0	56	390,103,000	317,505,000	22.9	86	368,557,000	309,474,000	19.1
	May.....	64	110,991,000	86,675,000	28.3	65	526,743,000	405,504,000	29.7	52	415,795,000	325,986,000	27.7	86	394,554,000	336,541,000	17.3
	June.....	64	105,312,000	85,816,000	22.7	65	496,173,000	392,386,000	26.5	51	391,070,000	315,852,000	24.0	80	341,524,000	298,544,000	14.5
	July.....	50	92,288,000	69,194,000	33.3	55	405,695,000	323,290,000	25.5	47	337,635,000	275,581,000	22.8	76	297,946,000	260,058,000	14.5

Returns received by the ELECTRICAL WORLD from 61 per cent of the rated capacity of the industry in June and 55 per cent in July indicate earnings for those months of \$37,100,000 for the former and \$34,100,000 for the latter month. The increases over the corresponding months in the previous year were 16.7 per cent in June and 16.8 per cent in July. The output in June

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED BY SIZE

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July
INCOME:										
Group 1.....	10.7	13.7	18.8	15.0	13.0	14.3	8.9	16.8	15.8	15.7
Group 2.....	21.0	22.5	21.7	28.3	27.3	27.0	22.5	21.0	17.3	19.4
Group 3.....	14.6	13.0	13.4	12.5	10.4	15.1	13.9	16.9	16.5	16.2
Group 4.....	13.5	13.1	14.4	14.0	11.3	20.5	15.7	14.9	14.0	21.2
Group 5.....	14.3	16.0	14.3	11.1	11.8	12.5	6.3	12.5	5.2	25.0
OUTPUT:										
Group 1.....	19.2	20.8	21.5	32.5	22.0	21.3	21.6	32.0	27.0	24.2
Group 2.....	33.0	31.9	28.2	42.6	31.2	63.2	36.5	28.3	20.8	26.2
Group 3.....	4.5	19.0	15.9	27.2	21.2	21.6	25.5	24.8	28.3	31.2
Group 4.....	17.5	14.6	16.0	25.4	18.8	20.2	25.0	33.2	20.7	17.0
Group 5.....	1.5	5.8	6.9	9.4	17.0	3.2	10.0	7.2	6.1	7.0

amounted to 2,210,000,000 kw.-hr. and in July to 2,060,000,000 kw.-hr., an increase over the corresponding months of last year of 22.4 per cent in June and 22.1 per cent in July.

For many months now the light and power industry

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED BY SIZE

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July
INCOME:										
Group 1.....	18.0	16.5	13.0	15.5	14.5	16.0	16.6	16.5	22.3	19.4
Group 2.....	21.0	17.0	16.0	17.8	18.7	21.0	21.7	22.0	21.3	21.5
Group 3.....	10.9	13.0	1.8	6.0	0.5	4.4	6.5	7.6	6.8	10.0
Group 4.....	19.7	16.8	15.5	19.8	16.3	18.9	20.8	16.3	22.5	14.6
Group 5.....	18.4	14.3	†	19.3	16.7	11.0	27.0	3.3	14.6	.....
OUTPUT:										
Group 1.....	24.9	24.8	22.3	25.4	19.2	22.0	19.5	24.1	23.7	21.3
Group 2.....	31.7	29.7	24.4	29.0	23.6	32.4	44.4	47.0	29.0	33.0
Group 3.....	17.3	19.7	1.2	5.8	30.0*	4.5	4.4	5.4	6.6	6.5
Group 4.....	26.1	21.2	21.4	24.5	13.0	25.7	21.4	19.0	23.3	22.0
Group 5.....	28.2	16.8	9.9	15.5	17.1	23.5	15.5	18.5	29.0	1.5

*Decrease.

†Results omitted owing to insufficient returns.

has been growing at a very fast rate, until the earnings are at present, on an average, \$5,000,000 greater monthly in 1917 than in 1916, while the output for 1917 is running at the rate of 3,000,000 kw.-hr. to 5,000,000 kw.-hr. more each month than in the corresponding

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July
INCOME:										
Group 1.....	4.2	4.5	4.0	5.4	7.2	8.5	11.2	4.1	11.2	11.8
Group 2.....	1.3	3.0	3.6	7.5	5.5	0.6	3.4	7.8	2.9	2.3
Group 3.....	32.4	31.0	30.0	27.6	23.5	22.8	19.7	17.9	13.0	11.2
Group 4.....	7.2	0.4	0.6*	8.6	2.0	13.2	10.0	12.5	20.0	23.8
Group 5.....	13.5	17.1	11.1	20.3	14.9	15.2	14.7	14.5	15.0	20.0
OUTPUT:										
Group 1.....	5.2	8.0	8.6	11.0	22.3	15.6	15.4	13.1	15.4	16.2
Group 2.....	9.7	11.4	8.7	11.8	16.2	8.9	16.1	13.0	25.1	8.0
Group 3.....	63.7	61.3	48.0	59.5	36.8	36.3	29.7	25.7	5.2	7.5
Group 4.....	*0.5	4.2	2.6	15.2	14.0	27.9	21.0	27.0	28.0	28.5
Group 5.....	14.7	42.3	5.4	19.1	9.4	21.6	21.7	22.7	23.2	25.0

*Decrease.

month of 1916. In fact, since the war began in Europe in the summer of 1914, the monthly output of the light and power utilities has more than doubled.

When the war broke out in 1914 the industry was satisfied to show an increase over the previous year of

but a few per cent. To-day, with a load twice as great, the industry is registering a gain of over 20 per cent over the previous year. The great industrial boom of this country has necessitated a supply of power upon which the industry can depend at all times and also one which can be readily expanded as needs require. As a result power load on central stations has grown at a greater rate, and it is considerably greater in volume than ever before in the history of the industry.

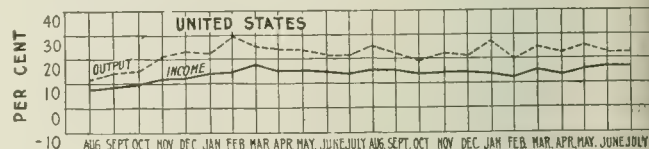
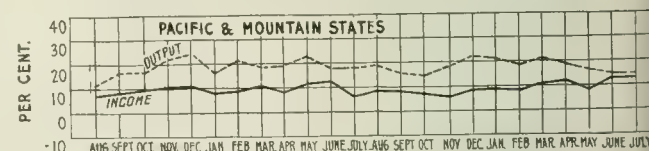
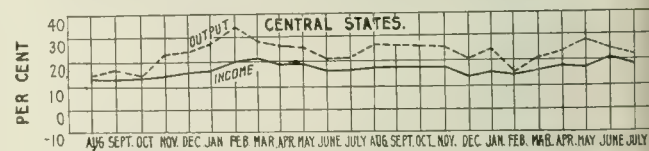
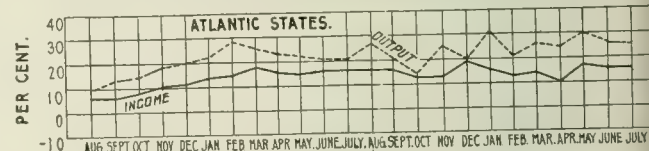
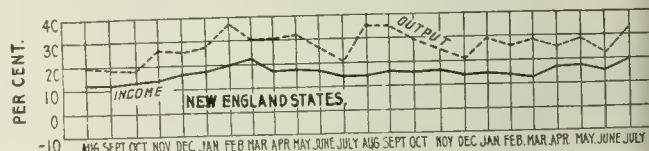


FIG. 1—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES

While the earnings have increased very considerably and are much larger than they ever have been, expenses have also rapidly mounted, so that the net earnings will show no such percentages of increase as are shown by gross earnings. In fact, in certain cases where the gross earnings show a slight increase over the previous year it will not be surprising to find that the net earnings show a considerable decrease.

THE CURVES AND TABLES

The accompanying curves show the percentages of increase, both in income and output, as contained in Tables I and II. The remaining tables show the per-



FIGS. 2 TO 5—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

centages of increase and income and output for companies grouped according to the size of communities served. These increases are taken as over the corresponding month for previous year. Group 1 contains those companies operating in cities of 100,000 inhabitants and over; group 2, those operating in cities of 50,000 to 100,000; group 3, from 25,000 to 50,000; group 4, from 10,000 to 25,000, and group 5, from 5000 to 10,000.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

A SIMPLE METHOD OF FINDING MOTOR LOAD

Watt-Hour Constant of Watt-Hour Meter Used to Determine Power Demand—Data for Various Kinds of Meters in Tabulated Form

BY WILLARD S. WILDER

Meter and Testing Department, Milwaukee Electric Railway & Light Company

Although motors in a properly equipped factory are supposed to operate at or near full rating most of the time, the assumptions on which the motor ratings were based may be in error or the load may have changed, so that it is advisable to test the power required by motors from time to time. If this is not done, the motors may operate at less than rated load unnoticed and the power factor (if they are induction motors) and efficiency will suffer thereby. While arrangements for connecting in portable ammeters are preferable, the power required can be easily checked by observing the number of disk revolutions in the watt-hour meter connected with the motor circuit. Of course, if other motors or apparatus are served from the meter, they must be disconnected while the test is being made.

For most General Electric, Duncan, Sangamo and Fort Wayne meters the watt-hour constant will be found painted on the edge of the disk. On the Columbia meters the constant is on the name plate, while on the Westinghouse meters the constant cannot be found on the outside of the meter. By the use of the accompanying table the watt-hour constant can be determined for any meter,

TESTING CONSTANTS FOR 110-VOLT STANDARD WATT-HOUR METERS*

Make of Meter	Type of Meter	CAPACITY IN AMPERES							
		3	5	10	15	20	25	40	50
General Electric..	J; J-1; JN; FN; D-1; DN....	1/5	0.5	0.5	1	..	1	..	2
General Electric..	I.....	1/5	0.3	0.6	1	..	1.5	..	3
General Electric..	C; C-5; C-6; C-9; J-2; D-2....	1/8	0.2	0.4	0.6	..	1	..	2
Westinghouse....	A; round.....	..	1/6	1/3	..	2/3	..	4/3	..
Westinghouse....	B; C; OA; D C.....	..	1/3	2/3	1	4/3	5/3	8/3	10/3
Fort Wayne.....	K.....	..	0.25	0.5	0.75	1	1.25	2	..
Sangamo.....	F.....	..	1/2	2/3	..	4/3	..	10/3	..
Sangamo.....	D.....	..	2/3	2/3	..	4/3	..	10/3	..
Duncan.....	All.....	..	0.25	0.5	1	..	1	..	2
Columbia.....	All.....	..	5/18	5/9	5/6	..	25/18	..	25/9

*For 220-volt meters double the constant.

after obtaining from the name plate on the meter the make, type and capacity in amperes of the meter. The value of the constant given in the table is for a 110-volt meter, so if the meter be a 220-volt instrument the constant must be multiplied by two, and if 440-volt by four.

Since the watt-hour constant is the number of watt-hours consumed during one revolution of the meter, all

that is necessary to do in order to compute the power (watts) demanded is to count the number of revolutions of the disk during one minute and multiply by sixty times the watt-hour constant.

As an example, take a Westinghouse type OA meter, 110 volts, 10 amp. rating. From the table the watt-hour constant is found to be 2/3. Then, operating the apparatus that it is desired to test, taking care that no other electrical device is drawing energy at the same time, the number of revolutions of the meter disk for one minute on are counted. Suppose this came out thirty revolutions. Then the power demanded would be $30 \times 60 \times 2/3 = 1200$ watts.

A table could be prepared in which sixty times the watt-hour constant would be given, but this might not be convenient to use when it was desired to count the revolutions for less or more than one minute. If the timing period is other than one minute, the multiplying factor is watt-hour constant \div period in hours.

SAVING DERIVED FROM COVERING STEAM PIPES

Industrial Plant Realizes Saving of 50.78 Tons of Coal per Year by Properly Covering Steam Pipes with Heat-Insulating Material

The Rockwell Manufacturing Company of Milwaukee, which operates a 312-kva. power plant for heating and electric service in its woodworking factory, has covered all of its power piping, carrying 150 lb. pressure (10.5-kg. per sq. cm.) and 120 deg. Fahr. (48.9 deg. C.) superheat, with two layers of asbestos millboard, $\frac{1}{8}$ in. (3.175 mm.) thick, applied in such a manner as completely to cover the pipes without breaking, each layer being bound on with copper wire. This initial covering is designed to withstand the high temperature to which it is subjected. The purpose of using two layers is to fill completely the air space which would otherwise exist under the outer molded insulation. Outside of these two thicknesses of millboard is one thickness of 85 per cent magnesia sectional pipe covering of standard thickness.

All power piping carrying 80 lb. (5.6 kg. per sq. cm.) pressure and 120 deg. Fahr. (48.9 deg. C.) of superheat is covered with one layer of 85 per cent magnesia sectional pipe covering of standard thickness. All exhaust piping is covered with one thickness of standard asbestos molded sectional covering. These joints are known as broken joints. All of the fittings are covered. Those not susceptible of being covered with the molded sections are covered with asbestos magnesia cement built up to the same thickness as the adjacent piping. Over all of these pipe coverings is a canvas jacket held in place by brass bands.

As an illustration of the savings resulting from this

practice, the Rockwell company points to the following calculation: In the 4-in. (9.16-cm.) steam line from the boilers to the superheaters there are 37 sq. ft. (3.4 sq. m.) of surface. In the 5-in. (11.7-cm.) steam line from the superheaters to the receiver there are 40.75 sq. ft. (3.8 sq. m.) of surface. On the engine side, pipes to the entrance to the receiver contain 33.50 sq. ft. (3.21 sq. m.) of surface. The total surface represented by this steam piping is 111.25 sq. ft. (10.3 sq. m.).

The temperature of saturated steam at 145 lb. pressure per square inch (10.2 kg. per sq. cm.), which is assumed to be the average of the plant, is 363.4 deg. Fahr. (184 deg. C.). It is estimated that the temperature of the external air where these pipes are installed is 100 deg. Fahr. (37.8 deg. C.). Bare pipe will radiate approximately 3 B.t.u. per hour per square foot of exposed surface for every degree Fahrenheit (60 B.t.u. per sq. m. per deg. C.) of difference in temperature between the steam contained and the external air. The difference in temperature between the steam contained in the pipes and the external exposure is 383.4 deg. Fahr. (195 deg. C.). The radiating surface multiplied by this difference in temperature and the radiation per hour per square foot ($383.4 \times 111.25 \times 3$) = the loss, or 127,960 B.t.u. per hour. Multiplying this by the number of hours per year in which steam is in the mains gives a total loss of 1,120,929,600 B.t.u. per year.

Since 1 lb. of steam contains 1192.5 B.t.u., the total steam lost per year would be 939,983 lb. (2,075,000 kg.). The company's steam costs 20.9 cents per 1000 lb. (2205 kg.). Its gross loss in money would therefore be \$196.46 if the pipes were uncovered. The latest tables give 84 per cent as the efficiency of magnesia covering. The insulation of these pipes, therefore, saves 84 per cent of \$196.46, or \$165.03 per year. Reducing to a coal basis, at \$3.25 per ton, the company's present cost of coal, it will be seen that it saves 50.78 tons (45.75 t.) of coal per year.

TAKING DOWN CONDUCTORS OVER ROUGH COUNTRY

Standard Reels Laid Flat with Sweep on Upper Side for Pulling with One Horse Prove Satisfactory and Economical

Not long ago the Puget Sound Traction, Light & Power Company of Seattle, Wash., had to devise some method of pulling out approximately 20 miles (32.2 km.) of No. 4/0 stranded copper wire without damage to the gardens, etc., over which the line ran. The wire had been strung in lengths of $\frac{1}{2}$ mile to 1 mile (0.8 km. to 1.6 km.), and to eliminate any extra splices in restringing it it was necessary to pull out the same lengths. Standard reels for No. 4/0 copper were used with a drum diameter of 3 ft. (0.9 m.) and width of approximately $2\frac{1}{2}$ ft. (0.75 m.). The reels were laid flat on a 3-in. by 12-in. (7.6-cm. by 30.5-cm.) plank on which had been bolted a $\frac{1}{2}$ -in. (1.27-cm.) plate drilled with a $2\frac{1}{4}$ -in. (5.7-cm.) hole for a shaft. The latter, which was 12 ft. (3.65 m.) long, was mounted vertically and guyed from the upper end. A sweep was bolted on the upper side of the reel so that it could be turned with one horse. A large iron ring was provided on the under side of the reel to serve as a thrust bearing.

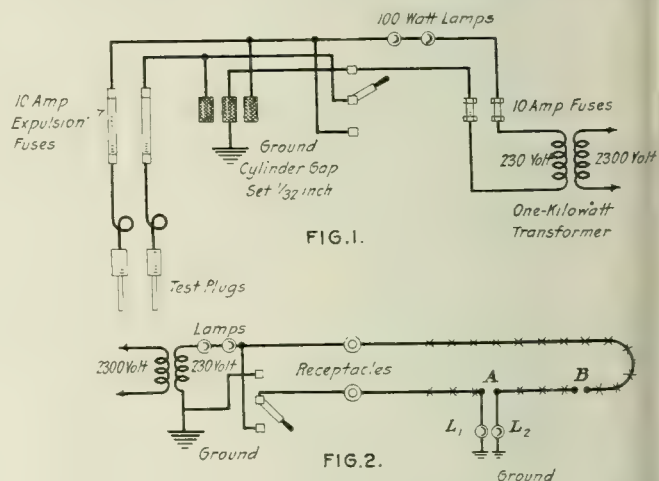
This apparatus was set up in convenient locations along the line, sometimes on a crossroad and sometimes in private lanes and uncultivated spots. The wire was untied, pulled out, reeled up and hauled 3 miles (4.8 km.) to a railroad station for approximately $\frac{1}{2}$ cent per foot. These points were brought out by A. C. Riggs, general transmission foreman of the company at the tenth annual convention of the Northwest Electric Light and Power Association.

TESTING STREET CIRCUITS FOR CONTINUITY AND GROUNDS

Substation-Testing Scheme Outlined and Method of Locating Open Circuit or Ground on Line Described

BY J. R. BALDWIN

A Southern central station company formerly used magnetos for testing arc lamp circuits for continuity and grounds and for locating trouble out on the lines. These magnetos were expensive to maintain and were not reliable, owing to the tendency to "ring through"



FIGS. 1 AND 2—TESTING SCHEME IN SUBSTATION; METHOD OF FINDING FAULT ON LINE

high-resistance grounds, thus apparently indicating trouble. Furthermore, they would get broken and out of adjustment while being carried around on the trouble automobiles.

A very simple and reliable testing scheme was arranged in each substation supplying arc lamps, and the magnetos were discarded. Instead a 1-kw. distribution transformer, connected to the 2300-volt bus, is used to supply 230 volts for testing. Two 100-watt lamps are connected in series with the lines from the transformer to the testing board and are in circuit all of the time. A single-pole, double-throw knife switch is used to test for continuity and grounds and for connecting a loop for the troubleshooters to test with out on the lines. The test leads terminate at two plugs which fit the arc-circuit receptacles. The testing circuit is protected against high-voltage crosses by a cylinder-gap arrester, set at $\frac{1}{32}$ in. (0.8 mm.), and two 2300-volt, 10-amp. expulsion fuses. There are two 10-amp. fuses in the leads from the transformer.

With the plugs in the receptacles and the switch open a ground on the circuit will be indicated by the lamps burning. When the switch is closed in the up position the arc circuit is connected in series with the 230-vol-

test circuit and the test lamps. If the lamps burn the circuit is closed. An open circuit is indicated by the lamps not burning, but before reporting the circuit open the operator should touch the plugs together to make sure that the lamps have not burned out or become loose in the socket. When the switch is thrown to the down position, the circuit is closed through a loop which is at a potential of 230 volts to the ground, and this connection is used by the troublemen out on the lines. In substations having as many as fifteen circuits three test circuits are provided, all of them being energized by one transformer.

To locate an open circuit or ground on the line the switch at the substation is thrown to the down or loop position. The troubleman opens the circuit, out on the line, at any lamp (A) and tests the circuit both ways by connecting each side through a 60-watt lamp to the ground, as shown in Fig. 2. If the fault is at B, the lamp nearest it will remain dark while the other one will light up.

EMERGENCY REPAIRS MADE UPON ELECTRIC CABLES

Method of Making Repairs to Several Cables Without
Endangering Lives of Workmen—Use of
Temporary Circuit

The effect of a manhole fire on a transmission system in which the protective means were not sufficient to withstand the heat of the electric arc is shown herewith. The damage occurred in a nine-duct conduit line which served as the main artery between a power station and several substations, five transmission feeders being installed therein. During a severe electrical storm a heavy surge caused a burn-out in one of these cables in a 6-ft. by 8-ft. (1.8-m. by 2.4-m.) manhole. The protective covering of the cable failed and the arc was communicated to the other cables, causing burn-outs in three of them. The lead sheath and the insulation were burned from the remaining cable, as shown in the accompanying illustration. This cable, however, did not short circuit but remained in operation. It was so badly damaged as to prohibit repair work on the others, owing to the dangerous conditions under

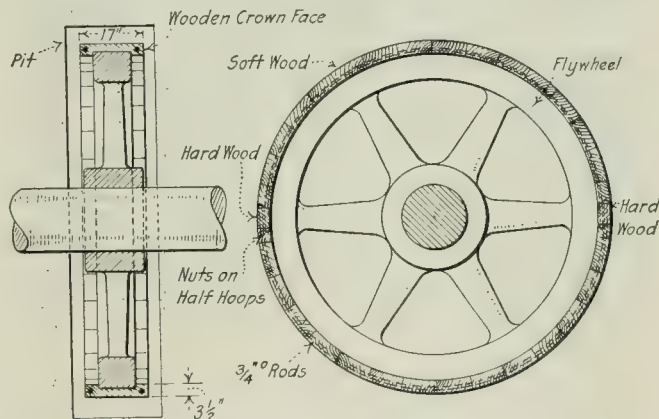
manholes on either side of the one containing the burn-outs and a section of cable was laid temporarily in the gutter and spliced in each of the manholes. When the load was transferred to this temporary cable, the work of repairing the cables in the manhole could be undertaken.

As all the cables were burned close to the duct edge, it was found cheaper to enlarge the manhole rather than pull in new sections. When the manhole was enlarged short sections of cable were inserted so as to replace the burned portions and the cables were placed again in service.

EMERGENCY SERVICE FOR AMMONIA COMPRESSOR

How Steam-Driven Compressor Was Adapted for
Temporary Belted Motor Drive by a
Wood-Stave Crown on Flywheel

At the time when the Gottfried Brewing Company of Chicago was changing its equipment from steam to electric drive it needed temporarily the services of an old ammonia compressor which it contemplated selling when the new plant was in operation. The compressor



FLYWHEEL CONVERTED INTO PULLEY BY STAVE FACE

could not be driven by steam because the old boiler plant had been shut down. It was decided, therefore, to connect the compressor to a motor. The problem was to get the compressor operating at the least possible expense.

Accordingly the crank was removed from the eccentric and arrangements were made for belting a 100-hp. motor to the large flywheel on the compressor. But before this could be done the face of the flywheel had to be broadened to permit the use of a belt wide enough to transmit 100 hp. This problem was solved by placing a wooden crown face on the outside of the flywheel.

Pieces which resembled heavy staves 17 in. long by 3.5 in. (43.2 cm. by 8.9 cm.) thick were cut as shown in the cross-sectional drawing herewith. These pieces, which were of soft wood, were fitted to the flywheel and were held in place on the 12-ft. (3.65-m.) diameter by two sets of iron half hoops 0.75 in. (1.9 cm.) in diameter. When the wooden face was attached it was turned true by driving the flywheel with a motor belted to the shaft and placing the wood-turning tool at that part of the wheel not covered by the belt.

Despite the fact that the position of the pit made it necessary to set the wooden flywheel face off center in its relation to the flywheel, the set has worked well,



TEMPORARY CABLE LAID IN STREET OVER DAMAGED CABLE SECTION AND PROTECTED AT STREET CROSSINGS BY CROSS-ARMS

which the splicers would have to work. As this was the only cable available to carry the load, it was necessary to leave it in service until emergency provision could be made to pick up the load. As a temporary measure, the cable which caused the trouble was cut in the

CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

ELECTRIC RANGE SALES MANAGEMENT IDEAS

**Merchandising Committee of Northwest Association
Reports on Sales Policies, Demonstrators and
Co-operation with Dealers**

At the recent convention of the Northwest Electric Light and Power Association the sub-committee on merchandising electric ranges presented a brief report on sales policies, demonstrators and co-operation with dealers.

The committee makes the following recommendations on these topics:

Sales Policies.—The first essential is to have a thoroughly organized and enthusiastic sales department. Its duty is to sell ranges and other appliances. It is very important to adopt some fixed policy in regard to range prices. There has been a tendency in the past to try out different methods of price fixing such as selling and installing the range at cost, installing the range at the expense of the company, making the consumer attend to the wiring, selling at cost plus the average cost of installation, etc. When the consumer is presented with more than one method he is confused, and we believe it is essential to adopt one standard method which will be universal. It is the opinion of the committee that the range should be sold at cost plus 15 per cent and a fixed added installation charge. Present statistics seem to warrant an installation charge, except in unusual cases, of \$15, but as a matter of policy a fixed charge of less than \$15 might be advisable. The wiring and installation charge should be included in the range price. The foregoing terms are based on cash sales. We advise a 10 per cent increase where payments are made by installments.

Demonstrators.—It is obvious that a complete assortment of ranges should be displayed at the office. Wiring should be so arranged that any of the ranges may be connected for demonstration. Each employee in offices where ranges are displayed should understand intimately the construction and operation of a range so that in cases of emergency he will be qualified to handle a "prospect" with grace and efficiency. Invitations should be sent to a selected list of customers to witness periodical demonstrations held at the office. Careful scrutiny should be given all announcements of public or semi-public gatherings, and arrangements made in advance to supply and demonstrate electric ranges on all such occasions. From time to time it is advisable for the company to conduct a cooking school at a location other than the office. Many of the large manufacturers of food products employ traveling demonstrators, and arrangements may be made with these demonstrators to use an electric range, thereby making the demonstrations of mutual advantage. Good prospects for home calls may be obtained from the office records of those who have manifested an interest in the ranges on display in the office. Competent women demonstrators should be detailed to visit the homes of new range customers immediately after the ranges have been installed. The customer should be impressed with the idea that future demonstrations will gladly be given upon request. Calls should be repeated until it is assured that the operation of the range is thoroughly understood and that it is working satisfactorily.

Co-operation with Dealers.—Co-operation with the electrical contractor-dealers is essential. They should be encouraged by allowing them to do the wiring when

practicable. If dealers are to do the wiring for ranges, a set of standard wiring and installation specifications should be supplied by the central station and sent to all dealers and contractors. These specifications should be strictly adhered to as the range cannot operate successfully otherwise. While it is desirable that we should co-operate with dealers as much as possible, the dealers and contractor should remember that it is the paramount duty of the central station operators to build up their business for the benefit of the stockholders. While the electric range is coming into universal recognition, it is necessary for the central station to assume a large expense for promotional work. Range prices as well as all other materials are advancing rapidly, thus greatly curtailing sales. We believe that for the present central stations must assume the undesirable burden of selling the ranges and in most instances of doing the wiring and installing. As the business develops the time will gradually come when dealers can more profitably take over the range business.

ELECTRIC HEATERS SPEED TERMINAL UNLOADING

**By Warming Oils and Other Fluids That Flow Very
Slowly Under Cold-Weather Conditions Con-
siderable Time and Expense Are Saved**

The use of electricity in conserving fuel, speeding production, reducing fire hazards and in a vast number of other ways proving a boon to mankind is well appreciated. Some of the applications are quite spectacular, some are widely heralded, and others are little heard of. Perhaps the use of an electric heater to reduce the car shortage might be considered an important and yet inconspicuous application.

A subscriber has written to tell how a 2½-kw. Simplex immersion-type heater was used last winter to heat the oil in tank cars, and how by its use the time required to empty them was reduced from three days to three hours. The shorter time required to empty saved a very considerable demurrage charge, sufficient to pay for the heater in a short time. It was equivalent to increasing trackage facilities at the industrial plant, and it likewise made it possible to obtain oil more rapidly with existing facilities.

The use of a heater in this way during cold weather is not only very convenient but is also safe and economical. It has frequently been pointed out that with the expected scarcity of coal during the coming winter the increased demand for oil for fuel and in numerous industrial undertakings may be expected to make itself felt in a way that will cause a shortage of tank cars. It is therefore not difficult to see that, with existing demurrage rates of \$1, \$2 and \$3 for the first three days and \$5 thereafter, an electric heater will prove a real economy where the winter is severe, as well as going a long way to reduce a shortage of tank cars.

A further illustration of the value of the immersion

heater in this connection is to be found in the cocoanut-oil industry. Steamship lines at New York City have been able to save many days in unloading by using the heaters in the barrels so that the oil can be quickly withdrawn.

In the winter time oils and other liquids, including molasses, become quite thick and flow very slowly. The use of heaters will be found to save considerable time in unloading.

A HALF-MILLION-DOLLAR FREIGHT PROBLEM SOLVED

Low Use of Tractors Has Assisted in Acceleration
and in Reducing Cost of Transportation Within
Plant of Meat-Packing Concern

In the meat-packing industry one of the big problems is the economical and prompt transfer of freight between various manufacturing departments and between these departments and outgoing railroad cars. This problem is particularly important with a concern handling so large a volume of delicate and perishable commodities as Armour & Company, Chicago. The magnitude of the task can be better appreciated when it is stated that the Armour company handles within its 30 acres (15.78 hectares) of plant in round numbers about 5,000,000 lb. (2,260,000 kg.) of freight a day. Of this amount 2,000,000 lb. (907,000 kg.) is attributable to interdepartmental handling and 3,000,000 lb. (1,360,000 kg.) is handled from different departments, coolers or storerooms to loading platforms and railroad cars. The cost of labor for performing this gigantic task is roughly \$500,000 annually.

It was seen as far back as 1893 that the company's freight-handling problem was a large one. At that time a step in advance of the packing industry in general was taken by erecting an elevated electric railroad structure at a cost of \$75,000. This structure, connecting all manufacturing departments with each other and with the main shipping points, comprised 7.5 miles (12.86 km.) of track. It was equipped with 2 miles (3.2 km.) of overhead trolley, seven motor cars with 5-hp. motors and 950 three-wheeled trailers of various designs weighing from 600 lb. (272 kg.) to 700 lb. (317 kg.) empty.

It was formerly the practice for freight which consists of finished products such as canned goods, soaps, fresh meats, lard, eggs, butter, etc., to be hauled on the elevated road from the departments to a central point known as the packing and shipping department. This freight, which amounted to 200,000 tons (90,718,000 kg.) a year, comes into this central department at the third-floor level. There it was unloaded from the trailers, was hauled on two-wheeled trucks to the first floor, regrouped in carload lots, and then again handled on two-wheeled trucks into outgoing railroad cars. This, it was decided, was an obviously inefficient procedure.

Tests were therefore made to determine a better method than that of the two-wheeled truck, since it was established that 300 lb. (136 kg.) was a good average load for one man to handle in this manner. Four-wheeled ball-bearing push trucks measuring 5 ft. by 5 ft. (1.64 m. by 8.20 m.) and weighing 250 lb. (113 kg.) were tried, as were also storage-battery-driven

industrial trucks. It was found that one man could handle 1000 lb. (453 kg.) on a push truck and about twice that on the storage-battery truck. But in the packing and shipping department it was decided that it was necessary to have as many square feet of truck surface as was required for storing freight on the floor if a saving was to be made between the operation of getting the freight off the elevated road and into the outgoing cars. It was figured out that this required about 1000 trucks, thereby eliminating the storage-battery truck on account of the large investment. So the four-wheeled push trucks were chosen. This change from the two-wheeled trucks reduced the trucking cost 16.5 per cent per ton.

The next logical step was to try handling these four-wheeled trucks as trailers behind storage-battery-driven tractors. This permitted placing loads greater than 1000 lb. (453 kg.) on the trailers, which was not feasible with man power. Before the motor tractors were tried the work in the packing and shipping department was carried out by from eight to ten loading



TRACTORS IN OPERATION IN MEAT-PACKING PLANT

gangs, each of which consisted of two checkers, four carmen, four truckers and one loader. The tractors made it possible to displace in each gang the four men used as truckers by rearranging the grouping of the men. It was then possible to haul as many as ten or twelve trailers behind each tractor, taking as much as 5 tons (4535 kg.) or 6 tons (5443 kg.) per tractor load. This change reduced trucking costs 25 per cent per ton. Local conditions aided in this change. The company's loading docks are wide and smooth; the assembly rooms are largely free from obstructing columns; the doorways are wide and the hauls are of fair length.

Finally storage-battery tractors were tried out in competition with the elevated railroad. A section of the road was shut down, and freight on that section was handled by two tractors and a group of four-wheeled trailers. Two railway motor cars were displaced. Making this change was easy since the tractor could operate on the board walks alongside the elevated tracks. Records of tonnage showed that during the two weeks' test period the tractors handled 27 per cent of the freight transferred over the elevated railroad at 16 per cent less cost than it could have been handled by the hand truck and elevated motor method. It is believed that a better showing could be made if the rails were covered to give a broader and unbroken dock surface. That it was possible to make such a saving is attributed to the fact that the tractors can go from the elevated structure into the departments, haul out

the trailers from trains and move these trains directly to their destination, eliminating both hand pushing and rehandling of goods. This greater flexibility of the tractor system is one of its main features in competition with the elevated railroad. In addition to effecting the direct saving on these tests the tractors gave better and quicker service and reduced the amount of overtime labor.

The Armour company at present has twenty-five tractors and 1500 trailers in service. These machines handle an average of 50 tons (45 t.) of freight each per ten-hour day. The hauls vary in length from 90 ft. (27.43 m.) to 1100 ft. (335.2 m.), the average haul being about 400 ft. (121.92 m.). In practically all instances the hauling is over smooth surfaces of wood or concrete. What few grades are encountered are from 10 ft. to 25 ft. (3.04 m. to 7.62 m.) long and of from 2 per cent to 10 per cent slope.

The twenty-five tractors have been placed in service a few at a time, care being exercised to place each unit where the volume of traffic, the condition of the docks and the length of the haul justified its adoption. In some cases the labor of three men was eliminated by one unit; in other cases one tractor displaced as many as seven men. The company figures that under these conditions the tractors will effect sufficient savings to pay for themselves in one year. Perhaps the strongest point in favor of these storage-battery units is the fact that departmental foremen are in hearty sympathy with the change, largely because it brings them relief from labor shortages and from freight congestion.

COLLECTION CONDITIONS AT A SUMMER RESORT

Many Hotels and Business Houses in Atlantic City
Put on Semi-Monthly or Weekly Basis, with
Personal Calls from Collectors

In a summer resort where the population is migratory the subject of credit extension and of collections is of more than the usual importance. The busiest time is usually from the first of July to the middle of September, this being the hottest season. Cottages are all filled as well as hotels, which means a big revenue for all in business. People go to the resort from other places just for the summer, and after Labor Day they return to their homes; and so it is with those who go there to open stores and leave in the fall. This means that the lighting company must keep a watchful eye on all consumers who desire to use electricity during this period.

At Atlantic City the subject of granting credit and making collections has received considerable attention, with the result that delinquencies have been kept very low.

Henry Cohen states in the *Bulletin* of the American Gas & Electric Company, the parent company, that consumers who have been on the local company's books from year to year and who have promptly paid are not required to make a deposit, but those who go to the city for the summer season must make a deposit sufficient so that when they leave the company will be protected. This, it is stated, has been one of the greatest drawbacks that the company has had to contend with. A great many hotels and business houses are put on a

semi-monthly and some on a weekly basis, and collectors call on them personally; otherwise, it is stated, there would be a very large delinquent list at the end of the season from which the company could not collect, since by the time the collector got there the delinquents would be gone.

OPTIONAL RATE ON AN ACTIVE-ROOM BASIS

Triplicate Charge in Force in a Wisconsin Town for
Service, Active Demand and the Total
Energy Consumption

An optional rate for electric lighting on the active-room basis is employed by the Wisconsin Public Service Company, Green Bay, in which there is a triplicate charge. First, there is a customer charge of \$1 per month; second, a demand charge of 15 cents per month for each active connected lighting unit of 50 watts capacity or equivalent, and, third, an energy charge of 4 cents per kilowatt-hour for all energy consumed.

The active load is determined as follows:

Residences lighted exclusively by electricity: Active lights, main hall, main stairway, parlors, library, dining room, living room, kitchen, den, music room, conservatory, butler's pantry, and one light on second floor. All other lights inactive. Active lights not to exceed 75 per cent of total installation.

Residences and flats occupied by more than one family, each floor used for living rooms: Classification same as residences lighted exclusively by electricity.

Residences not included in the above: All lights active.

Hotels, clubs, boarding houses: Classification same as for residences, except lights connected and used in buffets, bars, bowling alleys, billiard rooms, card rooms, lobbies, main halls, corridor on each floor, washrooms and lavatories, which shall be deemed active lights.

Auditoriums, dance halls, opera houses, lodge rooms, churches and factories closing at 6 p. m.: One-half the connected load shall be deemed active.

Retail and wholesale mercantile establishments, saloons, restaurants, factories not closing at 6 p. m., depots and other consumers not herein specifically provided for: All lights shall be deemed active.

ANOTHER OPPORTUNITY TO HELP ALONG LIBERTY LOAN

Because of Their Broad Contact with So Large a
Portion of the Public, the Aid of Public
Utilities Is of Particular Value

The second Liberty Loan campaign is now on, and according to all reports has got on its way with a flying start. This time, however, the total is greater than before, and for that reason the greater must be the efforts of those back of it to insure success.

In the previous campaign central stations proved their co-operative value in many ways, such as by window displays, free energy for Liberty Loan signs, sending out loan publicity matter with bills, and in various other ways.

In this campaign the help of the local utilities, because of their broad contact with so large a portion of the public, will undoubtedly go a long way toward producing a heavy oversubscription. The government has pointed out many times that the greater the number of small subscriptions the greater the success of the loan. It is in increasing the number of subscribers that the central stations are particularly of value.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

COMBATING SHORT CIRCUITS IN THE CENTRAL STATION

Benefits That Accrue from Sectionalizing Equipment and Conductors, from Amelioration of the Power Factor and from Reactors

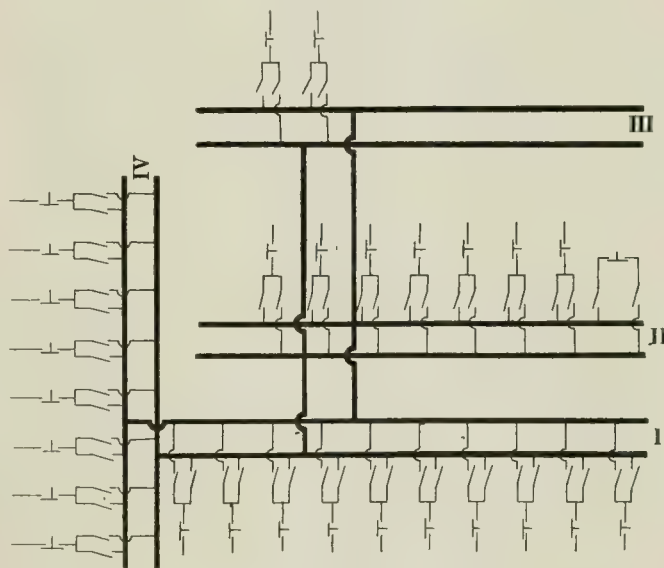
IN THE *Revue Générale de l'Electricité* for Aug. 18 there is printed the second part of an article by F. Scoumanne upon the protection of high-powered central stations against the destructive effects of short circuits. The first part of this article, which gave a description of the installation of the Société Force Electrique of Baku, Russia, relating some accidents of the kind that ordinarily occur in such power houses, inquiring into their causes and suggesting remedies, appeared in the *Revue Générale de l'Electricité* for Aug. 11 and has already been noticed in the Digest. In the second and concluding installment the author takes up seriatim the proposed remedies and recounts how they are being applied on the company's system and in its central station at Ville Blanche.

DIVISION OF THE CENTRAL STATION

The first of these remedies lies in the sectionalizing of the station equipment. This implies the impossibility of operating with an interconnected network. The author believes in the advantages of an open network, provided always that it is so constructed that every link normally open can be closed if the need should arise. The Baku company has followed this plan for networks operating at 6000 volts and 20,000 volts; while these are normally open, every substation can be energized from either of two points of supply. The principle of the division of the network in normal service is carried as far as possible, and the substations are so designed that either by the aid of a double system of busbars or by direct connections between cables there can be installed at any substation almost as many independent feeders as there are outgoing cables. When the transformation of the 6000-volt lines now under way shall have been finished it will be possible to divide the supply lines into eight distinct feeders, and all the energy transmitted from the central stations will be in eight parts entirely distinct.

It may be objected to this system that under it cables cannot be loaded in a way exactly proportional to their size and that therefore there will be either an increase of line losses or a decrease of the maximum power usable. This objection the author meets with the aid of mathematical formulas, coming to the conclusion that the line losses will be negligible and that the diminution of the maximum power transmitted over, say, twelve lines will not be a detriment, since normally two, at least, of these lines would be considered as a reserve. Furthermore, in an emergency two or three of them could be operated in parallel.

Apparatus operated by eight feeders should not be divided into more than two, three or at the most four groups, and the author discusses whether it is better to make this division at the 20,000-volt busbars of the substations or to maintain the eight distinct feeders until the 6000-volt busbars are reached. Safety and economy point to grouping the transformers in eight sections to correspond with the feeders serving them, but such a plan is hard to carry out. In the company's new substation at Ville Blanche provision has been made to connect each transformer to a system of auxiliary busbars from which one line will go out. Each of these systems of auxiliary busbars is connected in its turn to one or the other of two systems of general bus-



PROPOSED REARRANGEMENT OF BUSBARS

bars and can thus be put in parallel with any analogous system.

At the Ville Blanche central station two 6000-volt busbars are provided, permitting the operation of the machines in two groups only. Theoretically this division has been made, but practically it is never long maintained, since every day for one reason or another it is found necessary to put all the machines in parallel. It is now planned to rearrange the existing four systems of busbars, which are shown above, so as to leave I and IV connected but to separate II and III, forming a new group. Each machine will remain connected to the two sections of the first group and will be besides connected to the two sections of the second group. An oil circuit breaker will permit operating the different systems in parallel directly or indirectly, and means for connecting III and IV when this is necessary will make it possible to return to the old system.

AMELIORATION OF POWER FACTOR

A bad power factor naturally necessitates the use of electric generators whose kva. rating does not corre-

spond to that of the prime movers driving them. If, as at Ville Blanche, the power factor is 50 or 60 per cent, a 10,000-kw. turbine should be coupled to a 20,000-kva. generator. As the destructive effects of short circuits are proportional, not to the power of the motors, but to that of the generators, these effects are inversely proportional to the power factor. Consequently the destructive power created at the moment of a short-circuit will be diminished by at least as much as it has been possible to reduce the power of the alternators. In other words, the amelioration of the power factor as a means of influencing safety conditions comes into play only at the time of installing new generator groups. It does not directly affect the conductors, oil circuit breakers and auxiliary apparatus, which have supposedly been chosen of sufficient strength to withstand short circuits, nor does it influence the functioning of automatic oil switches at the critical moments of short circuits.

EMPLOYMENT OF REACTORS

When reactors are installed in the shape of special coils inserted in the circuits, there is always a loss of power due to the ohmic resistance of the coil. This loss can be reduced as much as may be desired by increasing the section of the conductors. This, of course, means an increase in the price of the coil. Economical considerations will determine the proper conductor section to use. By mathematical computation it is shown that the introduction of a reactor in a circuit produces a variation of voltage corresponding to the extent to which the current is thrown out of phase.

The circuits terminating at or starting from the Ville Blanche central station are (1) cables leading to units in service, which have little impedance; (2) cables leading to units in process of construction, which will have strong impedance; (3) cables connected with transformers, of which the impedance is strong; (4) 6000-volt lines, with a negligible impedance, and (5) lines serving the auxiliary switchboard of the power house, also presenting no appreciable impedance. If in each 6000-volt line leaving the central station there were inserted a reactor such that should a short circuit arise the current would be limited to say twenty times the normal, there would be no danger to the equipment and no sensible disturbance of the system. In case of a short circuit upon the 20,000-volt network, the current would be limited by the impedance of the transformers and would not attain more than twelve times the normal current. If the transformers were grouped in parallel on the high-tension side, each transformer would transmit this current and the effect upon the buses would be almost the same as if the short-circuit had arisen in them. On the contrary, if the transformers were operated separately, only one of the two would be affected and the momentary surge on the buses would be twelve times the normal current of one transformer only.

In the absence of reactors, falls of voltage under short-circuit may be more even than 50 per cent. This is why, in a central station like that at Ville Blanche, serving only induction motors, a division of the installation in independent sections would be desirable even if the employment of reactors eliminated all the destructive effects of short circuits. In place of creating four systems of busbars completely independent, they may

be tied together by means of four reactors so as to form a ring. The reactors connecting the different systems of busbars should be designed to allow normally from 20 to 25 per cent of the power of the strongest generator to pass through them.

Finally, the author recognizes that reactors must respond to special conditions and that it is not certain that European equipment will lend itself to their use.

Generators, Motors and Transformers

The Three-Phase Induction Motor Fed by Asymmetrical Pressures.—C. DELLA SALDA.—This article contains the application to three-phase induction motors of the general principle established by Gilman and Fortescue, namely, that "an asymmetrical polyphase system can be considered as the resultant of two symmetrical polyphase systems rotating in contrary directions." The author demonstrates this principle for the particular case of three-phase motors, using the graphic method of vectors, which furnishes the intensities and the phases of currents and voltages of the two component systems, for the case both of delta-connected and star-connected stator windings. Some practical examples illustrate the theory. The conclusion is that although the three-phase induction motor tends to equilibrate the loads of the three phases, it is very sensitive to voltage dissymmetries. The limiting case of the three-phase motor fed by a simple alternating current is considered, and it is shown that this condition is bad from the points of view of efficiency, heating, etc.—Abstracted from *Elettrotecnica*, June 5, 1917, in *Science Abstracts*, Section B, Aug. 30, 1917.

Lamps and Lighting

Life of Gas-Filled Lamps.—Gives tables showing the average efficiencies for the first 1200 hours of the life of spiral-filament gas-filled lamps of three different types and of wattages ranging from 15 to 100. The average useful life (watts per candle = 120 per cent of initial value) was found to be 100 hours for the best type of 80-watt, 120-volt lamps, while for the 75-watt and 100-watt, 220-volt lamps it was only about 100 hours. The initial watts per mean spherical Hefner candle ranged from 0.75 to 2.60 in the different types.—Abstracted from *Mitt. d. Vereinig. d. Elekt. Werken*, 15, and *Elekt. Zeits.*, May 3, 1917, in *Science Abstracts*, Section B, Aug. 30, 1917.

Generation, Transmission and Distribution

Fuel Economy.—ALEXANDER JUDE.—Comment on relative values of low-pressure high-temperature, high-pressure low-temperature, and high-pressure high-temperature plants. Some of the comparisons are:

	175 lb., 800 deg., 28½ in.	300 lb., 500 deg., 28½ in.	350 lb., 800 deg., 28½ in.
Total heat, from 32 deg.....	1,414	1,262	1,408
Total heat, from 80 deg.....	1,366	1,214	.....
Available energy, British thermal units	433	395	478
Mean temperature at half energy expansion, allowing a general nozzle efficiency of 0.88.....	390	242	277
Mean superheat	155	..	42
Mean dryness fraction.....	..	0.928	..
Final dryness fraction.....	0.925	0.812	0.882
Efficiency ratio of turbine, say....	0.74	0.69	0.7225
Useful energy	321	272	345
Power	1	0.85	..
Coal/power	1	1.047	..

From this data the author concludes that: (a) High pressure only as against high temperature will not do. (b) High pressure combined with high temperature should give a benefit up to a maximum of 7 per cent over the ordinary pressure of to-day at the same high temperature. The high-pressure proposition has also to be considered in relation to load factor, for it does not follow that an advantage in evidence at full load will continue at less than rated loads. This is indicated by the fact that the no-load consumption is greater with turbines having a large number of stages. Therefore the very high-pressure turbine, with its extra stage or diameter, or whatever it may be, will tend to have at least as high a no-load consumption as the moderate turbine. Consequently at half load the benefit from the very high pressure is not more than one-half that at full load, and so on. Ordinarily (not war time) very little of a power plant runs continuously at full load. It seems that although the working load on any one unit in a station may be high, the load factor, which is more often than not on the wrong side of 0.5, or even 0.25, is of more importance the higher the pressure and temperature, because the standing losses by leakage and radiation must in the nature of things be higher. —London *Engineering*, Aug. 17, 1917.

Installations, Systems and Appliances

The Audion.—L. W. AUSTIN.—Results of observations made on the De Forest-Hudson filament audion at the United States naval radiotelegraphic laboratory. The gas pressure used in audion detectors is generally below 0.001 mm. of mercury. By substituting nitrogen for air, to prevent the burning out of the filament, it has been found possible to construct detectors at all pressures up to that of the atmosphere. The action at 3 mm. is entirely normal. Local oscillations are easily produced, and the sensitiveness is fully as great, both for continuous and damped signals, as at the usual pressure. At 10 mm. the sensitiveness is about normal, but local oscillations are more difficult to produce. In the neighborhood of atmospheric pressure no local oscillations have been observed and the sensitiveness to spark signals is much less than at the low pressures. The conditions in this case would undoubtedly be much improved by bringing the electrodes closer together. Even with the ordinary arrangement of electrodes, the changes in the grid and plate currents due to the incoming waves are similar to those observed in the usual vacuum. With 200 volts, the plate current amounts to 20 or 30 micro-amperes. Data are also given on the effect of the direct-current voltage between the grid and filament on grid and plate signals.—*Journal of the Washington Academy of Sciences*, Sept. 19, 1917.

Electrophysics and Magnetism

Ionization Potential of Electrodes in Various Gases.—F. M. BISHOP.—A comparison has been made of the two methods previously used for determining the ionization potentials of gases by electrons, and the method where the electrons are liberated by ultra-violet light is shown to give misleading results because the number of electrons set free is too small. This explains the discrepancy between the results hitherto obtained by this method and those obtained with apparatus where the source of electrons was a hot metal surface. The ionizing potential of several gases has been determined under conditions which tend to minimize the photo-electric

effect on the receiving electrode due to radiations in the tube. Results were obtained in good agreement with the accepted values for the following gases: Oxygen, 9; nitrogen, 7.5; hydrogen, 11. In hydrogen, in addition to this ionization, which begins at 11 volts, a second and more intense type was found, which begins at about 15.7 volts. For mercury vapor no ionization could be detected below 10.27 volts, which is in agreement with the recent work of Goucher and Davis. The ionizing potential of nitrous oxide has been measured and found to be identical with that of nitrogen. It thus appears that in this case at least the ionization potential of nitrogen is not affected by its chemical combination in a compound.—*Phys. Review*, September, 1917.

Telegraphy, Telephony and Signals

Phototelegraphy Between Berlin and Constantinople.—According to the *Annales des Postes, Télégraphes et Téléphones*, Dr. Korn proposes to introduce his system for the telegraphic transmission of pictures on the Berlin-Vienna-Sophia-Constantinople-Bagdad route. For this purpose either telegraphic or telephonic connections could be utilized.—*London Electrician*, Sept. 7, 1917.

Miscellaneous

Open and Inclosed Fuses.—A. B. EASON.—This article deals with the fusing currents of open and inclosed fuses rated at 3 amp. to 100 amp. for 250 volts and 500 volts. Advantages and disadvantages of both types

PARTICULARS OF QUALITIES PERTAINING TO FUSE WIRES OF VARIOUS METALS

	Iron	Copper	Silver	Lead	Tin
Specific heat, calories.....	0.200	0.100	0.075	0.035	0.055
Density, gm./cm. ³	7.8	8.9	10.0	11.0	7.0
Factors <i>re</i> heat generated in electrical resistance, for <i>Q</i> :					
Resistance, microhms/cm. cube, <i>s</i>	9.70	1.60	1.60	19.00	10.00
Temp. coef. per 1 deg. C., <i>a</i>	0.0062	0.0040	0.0038	0.0039	0.0036
<i>T</i> ₄ - <i>T</i> ₁ = <i>θ</i> = temperature rise to melting point.....	1300	1100	930	320	213
<i>s</i> (1 + <i>aθ</i>).....	87.8	8.62	7.23	42.90	17.70
0.239 <i>s</i> (1 + <i>aθ</i>), for calories... ..	21.0	2.06	1.73	10.20	4.20
Conduction, for <i>q</i> ₁ , <i>f</i> ₁ :					
Conductivity, <i>k</i> , cal./cm. ²	0.165	0.720	1.10	0.080	0.150
2 <i>π</i> ² (<i>T</i> ₄ - <i>T</i> ₁).....	25,700	21,800	18,400	6,340	4,230
2 <i>π</i> ² (<i>T</i> ₄ - <i>T</i> ₁) <i>k</i> = <i>f</i> ₁ / <i>e</i>	4,260	15,700	20,240	507	633
Convection, for <i>q</i> ₂ , <i>f</i> ₂ :					
<i>πB</i> (<i>T</i> ₄ - <i>T</i> ₁), with <i>B</i> = .00063.....	2.58	2.18	1.84	0.634	0.423
Radiation, for <i>q</i> ₃ , <i>f</i> ₃ :					
(<i>T</i> ₄ ⁴ - <i>T</i> ₁ ⁴)/(1000) ⁴ = <i>Qr</i>	6.15	3.57	1.90	0.119	0.051
2 (0.239) <i>π</i> ² (4.30) <i>Qr</i>	125	72.2	38.5	2.42	1.03

are summarized and reference is made to several other papers on the subject. Empirical formulas are developed for determining the fusing currents. For open-type fuses the instantaneous current in amperes required to rupture a fuse is

$$\sqrt{\frac{f_1 R^3 + f_2 R^{2.5} + f_3 R^2}{0.239 S (1 + a\theta)}}$$

and for inclosed fuses is

$$\sqrt{(\frac{f_1}{e}) R^3 + 2\pi 2 (K'/l) (T_4 - T_1) R^2}$$

The values of *f*₁, *f*₂, *f*₃ and 0.239 *S* (1 + *aθ*) are given in the accompanying table. *R* is the radius of the wire in centimeters. The values of *l*' and *K*', the mean length from the fuse wire to the filling and the conductivity of the filling respectively, are so various that it is difficult to apply the second equation.—*Post Office Elect. Eng. Journal*, July, 1917.

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

KENTUCKY COAL STRIKE CAUSES SHORTAGE OF FUEL

F. W. Bacon Says that Central Factor Is the Adjustment of Government Coal Price for the Territory

Coal conditions in Kentucky involve serious shortage of supply for utilities. Replying to a request from the *ELECTRICAL WORLD* for a statement of the facts, F. W. Bacon, vice-president of the Lexington Utilities Company and the Kentucky Traction & Terminal Company, which furnish energy for other communities in addition to their own properties, writes:

Owing to the general strike prevailing in the coal fields of the eastern Kentucky district, from which this company procures its coal under a long-term contract running until 1920, the coal contractors in this territory have been unable to furnish us our regular coal requirements, as a result of which the company has been forced to go into the market under these conditions and to buy such coal as could be acquired.

In discussing this matter with Dr. Garfield, he promised to do everything in his power to protect this property and to guarantee the coal supply. Whether he will be able to accomplish this or not remains to be seen. Up to this writing only a limited amount of coal has been commandeered and consigned to Lexington through G. W. Elliott, who is looking after the fuel distribution for public utility properties for Dr. Garfield.

Naturally the real result desired in this territory is that the strike conditions in eastern Kentucky should be settled and mine operations resumed. The central factor to bring this about is the adjustment of the price which the government has fixed on coal for the territory, which from the statement of the operators is not sufficient to justify a large percentage of the mines resuming operations. I believe, therefore, that the greatest service Dr. Garfield can render in this acute condition is to adjust on an equitable basis the price which these operators are going to be allowed to charge, which in my judgment, in equity to all miners, even in the same fields, could not be done by a flat amount, as the production costs vary widely, but should be based on cost plus a percentage of return on the investment. Such a plan would permit the immediate resumption of all operations, irrespective of what their cost may be, at the same time allowing these operators a fair margin of profit.

Writing on the same situation, the Louisville correspondent of the *ELECTRICAL WORLD* says:

Action by the government authorities to bring about a resumption of coal production in the southeastern Kentucky-Tennessee field, which has been tied up by a strike since early in August, is essential to the supply of utilities and other consumers in central and eastern Kentucky outside of the actual neighborhood of the mines. The power plant of the Kentucky Traction & Terminal Company, which supplies a considerable part of the territory around Lexington, is operating on almost a day-to-day basis because of the failure of the supplies abundantly contracted for.

Special arrangements with the Chesapeake & Ohio Railroad provided for a limited number of cars of coal from the West Virginia and eastern Kentucky fields until means can be provided for resumption of the supply from the strike-closed field, usually the source of central Kentucky. Western Kentucky operators are being begged for coal by rep-

resentatives of consumers from Kentucky, Indiana and southern Illinois points, as well as from points south of Kentucky. These emissaries are unable to offer any pecuniary inducements since the operators may not accept more than the scale which the government has promulgated, and the result is that the envoys to the "coal barons" are not getting much satisfaction.

ONE-DAY MEETING OF THE INDIANA ASSOCIATION

Coal and Labor War-Time Conditions Discussed and Officers and Committees for the Ensuing Year Elected

At a meeting of the Indiana Electric Light Association at the Claypool Hotel, Indianapolis, on Sept. 26 delegates from less than one-half the member companies met to discuss various problems affecting the industry and to elect officers.

Discussions of labor and coal conditions occupied most of the day. It seemed to be the consensus of opinion that up to the present time the drafting of men into the National Army had not interfered seriously with operations of the companies. None of the organizations represented in the association had asked for exemption of men on industrial grounds.

Discussion of the coal situation centered mainly on two phases, one the decision as to which classes of load could best be dropped in time of emergency, the other relating to means for insuring shipment of coal to Indiana electric companies during the coming winter months.

It was thought that in an emergency electric signs and display lighting would probably be the first to go by the board, and these, if it became necessary, would be followed by such power loads as could be interrupted without interfering with operations of factories engaged in government work. To assist in insuring adequate coal supply for the winter the executive committee was instructed to go into the coal situation further, and it was recommended that the committee employ a coal agent to assist association members in securing fuel and in handling shipments from mines to electric companies. It is understood that if the executive committee acts favorably upon this recommendation a man will be selected who is well acquainted with the coal business.

The following officers were elected for the ensuing year: President, J. P. Ohmer, Elkhart; vice-president, T. A. Wynne, Indianapolis; secretary-treasurer, Thomas Donohue, Lafayette. Executive committee: S. W. Greenland, Fort Wayne; E. J. Condon, Angola; F. J. Hass, Evansville; P. H. Palmer, Kokomo; C. C. Perry, Indianapolis. Advisory committee: J. W. Robb, Clinton; H. H. Harrison, Indianapolis, and Thomas English, Muncie. S. W. Greenland, Fort Wayne, is the retiring president.

**PRIORITY IN MONEY
AS A WAR MEASURE**

In Possible Apportionment of Available Capital to Corporations, Says Frank L. Dame, Electric Companies Should Ask Prior Consideration

Under war conditions the apportionment of any much needed commodity is likely to be in the hands of a priority board. In an interview with a representative of the ELECTRICAL WORLD Frank L. Dame, New York, discussed the possibility that the supply of capital available for corporation financing may be regulated by a board of this character. Mr. Dame is a director of the Republic Railway & Light Company and has been identified with public utilities practically throughout his business career. As electric light and power companies represent an acknowledged economic use of capital, Mr. Dame is of the opinion that these interests should prepare to present their claims for recognition. Capital investment in these properties is of twofold advantage at this juncture: It means low initial expenditure per unit of power and low consumption of fuel.

"In England," said Mr. Dame, "new capital issues can only be made after approval by the British treasury. In this country, which is now the banker for the Allies, we are rapidly approaching a similar restriction, either officially or by the co-operative action of banking interests, and Mr. Sabin of the Guaranty Trust Company has already suggested a priority board on money."

In view of this situation, and without further regard to whether this is the time to inaugurate a campaign of education, it seems necessary to have concerted action on the part of public utility companies in formulating their claims for a priority basis in financing.

THE STANDPOINT OF ELECTRIC UTILITIES

From the standpoint of electric light and power companies, if it can be shown that in the grand total of financing, absolutely necessary in war times, the capital requirements can be substantially lessened by meeting the demand of the light and power company rather than the manufacturer or isolated power plant for the power plant involved in any enterprise under consideration, the preference of the light and power company, Mr. Dame said, should be favored as a war measure.

If, in addition, Mr. Dame added, it can be shown that from 1½ tons to 3 tons of coal can be saved per year per kilowatt of new central station investment, resulting in the release of 1500 tons to 3000 tons of coal for domestic consumption, together with the cars for carrying it, for every 1000 kw. of new central station capacity installed, and that there will be a further release of labor, the claim for priority will assume greater importance.

Instead of leaving this situation to be dealt with in individual cases as conditions may arise in future, it seems advisable to have due consideration in advance by the state and national organizations representing these utilities in preparation for the contingencies which will undoubtedly arise and possibly for an educational campaign that will be of permanent benefit to the industry.

"Take first for illustration the case of a manufacturer requiring, say, 3000 kw. to 5000 kw.," Mr. Dame

continued. "He would undoubtedly install a power plant to generate electricity for distribution through his factory if at all modern in his methods. While the cost to the central station using much larger units to serve him would probably be \$150 per kilowatt at present prices, the cost to the manufacturer would be, say, \$200 per kilowatt without adequate reserve. This would mean a saving in capital of \$50 per kilowatt, or \$50,000 for 1000 kw.—33 1/3 per cent of the capital required by the central station. As we come to smaller units the disparity will increase.

"Similarly, in the matter of operation, it is probably safe to say that there will be at least ½ lb. of coal per kilowatt-hour after allowing for transmission losses in favor of the central station over the manufacturer referred to above. At 60 per cent load factor this amounts to more than 1½ tons of coal per kilowatt per year, or to 1000 kw. or 1500 tons per year."

As units become smaller or are operated non-condensing, efficiency falls off rapidly, and in small units there is usually a lower load factor, which again gives the central station more advantage in both investment and efficiency through diversity in use. There are, of course, certain situations, such as in large steel mills having waste gases, where the advantage may not obtain. This would prove the exception to the rule.

The above figures were offered by way of illustration by Mr. Dame, and not as figures which have been substantiated by investigation. The associations have data upon which satisfactory figures can be based, but this calls attention to a subject which seems worthy of serious attention.

**REPRODUCTION COST OF
MILWAUKEE PROPERTIES**

Report of Engineering Staff of Wisconsin Railroad Commission on Physical Properties as Compared with Outstanding Securities

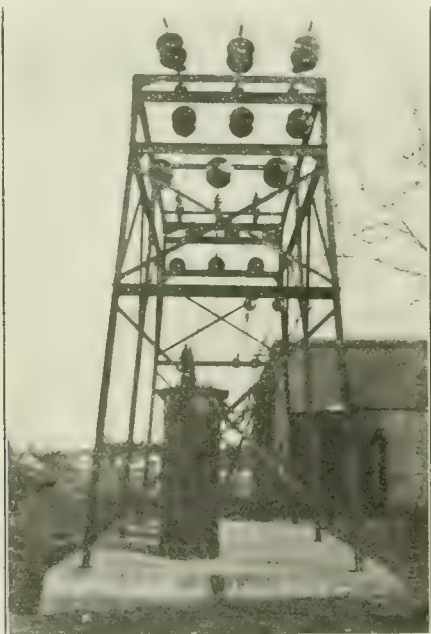
After more than three years of work the engineering staff of the Wisconsin Railroad Commission has submitted to the commission its report on the reproduction cost of the physical properties of the Milwaukee Electric Railway & Light Company and the Milwaukee Light, Heat & Traction Company. This valuation was made as of Jan. 1, 1914, and showed a reproduction cost on that date of \$37,319,297 for the property of the two companies. The capital expenditures of the two companies during the intervening years up to Jan. 1, 1917, were \$3,206,700. The reproduction cost on Jan. 1, 1917, would accordingly be \$40,525,997. This does not include any allowance for working capital or going value. The companies had cash and accounts receivable of \$1,174,000, which when added to the reproduction cost gives a total valuation of \$41,699,997.

Against this valuation of \$41,699,997 the company had outstanding in the hands of the public and owned by the Wisconsin Edison Company \$41,006,000 par value of securities, or about \$694,000 less than the reproduction cost of the properties. In order to determine the present value of debt represented by bonds sold at a discount, the unamortized discount may be deducted therefrom. If this be done, the present value of bonded debt and outstanding capital stock and notes is \$39,500,856, as of Jan. 1, 1917, or \$2,199,141 less than the reproduction cost of the properties.

FURNISHING SERVICE TO THE CHILLICOTHE CAMP

Completion of Transmission Line to Ohio Cantonment Will Provide Abundant Energy for All Purposes

As reported in last week's issue of the ELECTRICAL WORLD, construction of the transmission line to meet the requirements of the city of Chillicothe, Ohio, and of Camp Sherman, the army cantonment at that point, is progressing rapidly. The transmission line is being built by the Ohio Utilities Company. After its completion the generating plant of the Chillicothe Electric Railroad, Light & Power Company will be held as a reserve station. Both of these companies are controlled by the National Utilities Company, New York. A. F. Beringer of that company has given the ELECTRICAL WORLD the following account of the situation,



TYPE OF SUBSTATION USED AT TYPICAL CANTONMENT

showing the large increase in business at Chillicothe during recent months:

The Ohio Utilities Company, which is building the transmission line from a point south of Columbus through Circleville to Camp Sherman at Chillicothe, states that current will be turned into this line on the night of Oct. 4, barring unexpected delays, and that this program has the approval of cantonment officials and civic authorities at Chillicothe.

At present, in order to meet the rapidly increasing needs of the camp for power, it is necessary for the Chillicothe Electric Railroad, Light & Power Company to limit the street lighting within the city for a short time each evening. This condition, of course, will cease to exist after Oct. 4, when the transmission line is in operation, as ample energy will then be available not only for the entire needs of the city of Chillicothe but for the total requirements of the cantonment, as well as to serve a considerable number of manufacturing concerns, which have made application for power, but which it has not been possible to supply owing to the necessity for diverting all spare energy to the camp. Approximately 750 hp. in such industries is available and will be connected shortly.

As a consequence of the exceptional activity in and about

Chillicothe, due to the establishment of the National Army camp, the earnings of the Chillicothe Electric Railroad, Light & Power Company have increased greatly as will be noted from the following statement:

	Gross	Operating	Net
July, 1917.....	\$10,342.61	\$5,419.71	\$4,922.90
July, 1916.....	7,383.03	5,127.91	2,255.12
Increase	\$2,959.58	\$291.80	\$2,667.78
August, 1917.....	\$13,902.56	\$6,606.50	\$7,296.06
August, 1916.....	7,905.62	5,497.58	2,408.04
Increase	\$5,996.94	\$1,108.92	\$4,888.02

The earnings are still increasing daily, and it is estimated that when motors have been installed for the industries above referred to and additional electrical installations at the camp now under way are completed, the gross earnings of the company will approximate \$20,000 and the net \$10,000 per month, or at the rate of \$120,000 net per year.

In order to take proper care of the camp requirements, which, when all installations are completed, will probably average a connected load of 3000 kw. and a maximum demand of 2000 kw., expenditures for transmission line and other equipment approximating \$250,000 were made.

When it is remembered that the government order to supply energy to the cantonment was not received until about the middle of July one can appreciate readily the tremendous task confronting the Ohio Utilities and the Chillicothe Electric companies (which are co-operating in furnishing this energy) in providing equipment to supply approximately 2500 kw. By enlisting the co-operation of the government officials in charge of the construction of the cantonment, the railroads and firms supplying poles, conductors, generators and other equipment, about 45 miles (72.4 kw.) of transmission line have been built in slightly over sixty days, although the actual working time, after sufficient materials had arrived on the ground, was about forty days, and in addition the generating capacity at the Chillicothe station has been increased considerably.

The cantonment officials have expressed themselves repeatedly as more than pleased with the results obtained by these companies in their efforts to serve the government on time.

ELECTRIC VEHICLES IN NEW YORK EXPOSITION

Growth of the Business Here and Abroad Due to Fuel Situation Gives Special Interest to These Exhibits

The electric vehicle industry is getting ready for its participation in the annual Electrical Exposition, which opens in Grand Central Palace, New York, on Oct. 10 and will last ten days. Electric cars and trucks, batteries and other accessories have always been a prominent feature of these expositions in which the year's progress is shown.

The electrical vehicle industry has benefited greatly from conditions resulting from the war, especially the gasoline situation. This benefit is world-wide, and electric vehicle manufacturers in this country have been shipping products to every part of the globe. Scores of electric vehicles have been placed in South Africa.

Jobbers' Meeting at Cincinnati

The semi-annual meeting of the Electrical Supply Jobbers' Association will be held at the Hotel Sinton, Cincinnati, Ohio, on Nov. 13, 14 and 15.

Buy a Liberty Bond and Help to Win the War

APPOINTMENTS IN THE NAVY RESERVE FORCE

Secretary Daniels Authorizes Commissioning of One Hundred Graduate Electrical Engineers as Lieutenants, Junior Grade

The Secretary of the Navy has authorized the commissioning of 100 graduate electrical engineers as lieutenants, junior grade, in the reserve force of the navy.

Eighty-five nominations of candidates will be made by each of the following agencies: (a) Naval Consulting Board, (b) National Research Council, (c) American Institute of Electrical Engineers.

The qualifications for such officers will be in general as follows:

- (a) College graduates in electric engineering.
- (b) Not less than three years' employment in electrical work since graduation.
- (c) Between twenty-five and thirty-five years of age.
- (d) Of character and physique required for officers of the regular service.

Note.—Pay and allowances of lieutenants, junior grade, are approximately as follows, and they are the same as for the regular navy, except a uniform gratuity in time of war of \$150 in addition: Shore, \$2,480; sea, \$2,200.

Upon receipt of nominations thus made about Oct. 20, 1917, a board of naval officers will make selections for appointment.

A training period of six months at sea will be required of those appointed, and reports received upon the completion of this period will determine retention in the service as reserve officers for the period of the war. Applications for nomination must be made to one of the three agencies outlined above.

CARBON AND CARBIDE COMPANIES ARE MERGED

Myron T. Herrick, Chairman of Board; George O. Knapp, President—Capital 3,000,000 Shares
Without Par Value

Organized in New York with 3,000,000 shares of no nominal par value, the Union Carbide & Carbon Corporation will acquire the following companies: Union Carbide Company, National Carbon Company, Inc., Prest-o-lite Company, Inc., and Linde Air Products Company.

Myron T. Herrick will be chairman of the board of directors and George O. Knapp president. In addition to these two, the board of directors will consist of C. K. G. Billings, Charles A. Coffin, Jesse J. Ricks, Andrew Squire, Nicholas F. Brady, G. W. Davison, Conrad Hubert, James Parmelee, Roger C. Sullivan, F. C. Walcott and James N. Wallace. Other officers will be Edgar F. Price, Giles W. Mead, M. J. Carney and J. S. Crider, vice-presidents; H. E. Hackenbery, secretary, and Giles W. Mead, treasurer.

In the exchange of securities Union Carbide Company stockholders will receive two and one-half new shares for each present share. Prest-o-lite Company stockholders will be given two shares of new stock for each old share. Linde Air Products Company holders will have three and one-quarter new shares for each exist-

ing share. Stockholders are asked to send stock for exchange to the Central Trust Company, New York, up to Oct. 31.

The Air Reduction Company, which it had been reported would be part of the combination, was not mentioned in the announcements issued this week.

LIBERTY LOAN ADVERTISED BY MEANS OF ELECTRIC SIGN

Largest Sign in the World Tells New York People
to Subscribe for the National Govern-
ment New Issue

In Times Square, New York City, an electric sign which is seen by 1,000,000 people every twenty-four hours has been given to the government to advertise the second Liberty Loan. The sign was donated by William Wrigley, Jr., the chewing-gum manufacturer, for the use of the Liberty Loan committee during October. The name of the manufacturer has been taken down and the moving figures on the sign now point to an advertisement of the national bond issue.

The sign is the largest electric sign in the world and the most elaborate large sign. It is 50 ft. high and



LARGEST ELECTRIC SIGN AIDS LIBERTY LOAN

200 ft. long (15.2 m. by 60.9 m.), containing over 15,000 lamps. In the design of the sign three new patents were developed. One covers the iridescent peacock's tail, another the electric fountain effect, and one the intricate figures of the "little" men, who are 18 ft. (5.4 m.) high. About thirty different motions are made by the little men. The sign costs \$5,000 a month. It was built by the O. J. Gude Company.

THE WAR REVENUE BILL FINALLY BECOMES A LAW

Tax Measure of Nearly \$3,000,000,000 Passed by
Agreement to Overlook Differences of Opinion
Between House and Senate

President Wilson signed the war revenue tax bill on Wednesday evening. This record-breaking tax measure, designed to produce very nearly \$3,000,000,000, the largest revenue tax bill ever passed by any legislative body in the history of the world, was agreed upon without a roll call in either the House or the Senate, although it had been thought that the whole bill might fail as the result of certain differences of opinion in regard to the bill by a number of members.

The deadlock which had existed between the House and the Senate conferees was overcome.

Buy a Liberty Bond to Make the World Safe

RATE CASES BEFORE INDIANA COMMISSION

Public Service Regulating Body Disposed to Grant
Some Relief and Keep Companies from
Serious Harm

The Indiana Public Service Commission has closed its fiscal year after having accomplished three separate lines of work, according to an announcement from E. I. Lewis, chairman. The first was the payment of all outstanding bills against the commission and the return to the State treasury of \$50,000, which has been saved from the total appropriation of \$115,000 for the year ended Sept. 30.

The next situation entirely cleared from the docket was the final disposal of the last of the electric rate surcharge cases, which have been holding attention since the Indiana Electric Light Association filed a blanket petition. The original blanket petition covered twenty-eight companies, operating in sixty towns and cities. Shortly after the petition was filed, it was decided that the association had no power to act under the law but that the individual companies must petition. Eventually a number of companies filed individual petitions. Commission records show that it was decided that only six companies—after an investigation of the financial situation of all companies which petitioned individually—should be granted relief. These companies, supplying nine towns and cities, including Indianapolis, were given authority to add surcharges in rate schedules. In granting relief the commission did not take dividends on common stock—at least not to the 6 or 7 per cent return mark—into consideration. It made sure that a proper depreciation allowance and bond interest were taken care of during the war emergency.

ATTITUDE OF THE COMMISSION

Chairman Lewis said that the idea of the commission has been to keep the utility companies "skin-whole" during the crisis, wherever possible, but not to relieve them entirely from all burdens of war conditions.

The final electric surcharge petition dismissed was that from the Indiana Utilities Company, which operates in northern Indiana. Chairman Lewis announced, after dismissing this case, following a survey of its financial condition by commission auditors and engineers, that the commission intends the public generally to know that the regulating body will "see the utilities through" the present emergency, granting all reasonable relief to the point that will keep the utilities unharmed in operation by the war period troubles. The utilities generally, Mr. Lewis said, had evidenced a most reasonable attitude toward the present conditions and in many cases in which surcharges were urged had not asked for the guarantee of common stock dividends during the crisis. "They merely want to get through as nearly unharmed as possible," he said.

The third conclusive action taken by the commission with the end of the fiscal year was final action on the last one of the petitions under which steam and hot-water heating companies asked for wartime relief. Twelve applications for relief of that nature have been filed with the commission during the last few months. These twelve utilities operated in fifteen towns and cities. The commission granted wartime relief to each of the companies.

In an order affecting the Citizens' Mutual Heating Company, Terre Haute, the commission allows a surcharge on steam-heating rates. The commission takes up the coal situation in detail in its opinion in this case, saying in part concerning higher costs and an existing contract:

THE COAL PROBLEM ALL-IMPORTANT

Testimony and exhibits offered by the company show that under the contract existing last year the petitioner obtained coal for \$1.25 per ton f.o.b. its plant until increases were made in the mining wage in April this year; that in April the cost of coal used was \$1.3793 per ton, and in June \$1.50; that this contract expired and that on July 14, 1917, petitioner made a new contract at a price of \$2.50 per ton for either screenings or mine run f.o.b. mine, which, with an existing 35-cent freight rate, would make the cost \$2.85 per ton delivered. Testimony is that under the then existing contract petitioner's coal bill last year was \$12,902; that provided the consumption of coal is the same as last year, under the contract made July 14, 1917, and now in force, petitioner's coal bill will be \$29,154, an increase of \$16,252. Testimony reveals that the operating costs of petitioner for the heating season 1916-17 were \$13,017. Petitioner estimates a 20 per cent, or \$2,603, increase in these costs for the heating season 1917-18, raising the total increase of operation and fuel to \$18,855.

Testimony places the cost of fuel at 41.44 per cent of total cost of rendering service for the year ended June 30, 1917, which percentage will be increased to over 60 per cent during the heating season of 1917-18.

The whole question of emergency and relief is tied up in the advance in fuel costs to petitioner, whose fuel bill last year was \$12,902 and whose fuel bill on same tonnage and kinds of coal petitioner has, on the basis of a 35-cent freight rate, estimated at \$29,154 for this heating season. The chief accountant of the Public Service Commission, after making an investigation of the books and records of petitioner, estimates—on a 40-cent freight rate—that this year's fuel bill will be \$29,458, provided the consumption is the same as for the heating season 1916-17, namely, 10,158 tons. The reason for using the 40-cent freight rate rests on the authorization, in conformity with the Interstate Commerce Commission's July order increasing interstate coal rates 15 cents a ton, granted Indiana railroads to increase short-haul intrastate rates 10 cents a ton.

The terms of the hereinafter analyzed coal contract are such that the Public Service Commission is warranted in making its deductions on the basis of the contracting coal company supplying screenings, rather than mine run, said screenings coming from the old 30-cent freight-rate territory. Petitioner may, however, receive some coal from the old 35-cent field, but the former field instead of the latter will be taken as the basis for this consideration.

The real matter for consideration here is the coal contract, which, if it stands, means an increase in operating costs, on the basis of radiation served last year, amounting to 8.2 cents per square foot of radiation. On July 14, 1917, the board of directors of petitioner company made a contract with the Jackson Hill Coal & Coke Company for its coal supply for the ensuing year at a price of \$2.50 f.o.b. mines, for either screenings or run-of-mine coal—the terms of the contract being that screenings were to be furnished except when such supply could not be given and the run-of-mine would be furnished.

Since this contract was made the Congress has enacted federal legislation under which the President has caused to be set a price of \$1.70 per ton for such Indiana screenings and \$1.90 for mine-run coal—a price considerably lower than petitioner's \$2.50 contract. Specific provision, however, incorporated in the federal act, states that existing contracts are not annulled. Testimony indicates that officers of petitioner entered into said contract after mature deliberation and believing they were serving the best interests of petitioner and its patrons. Testimony of the secretary and general manager and of the directors of petitioner is that in July they were face to face with what was announced in dispatches from Washington to be "a government price" of \$2.75 for Indiana coal—the price set by

the operators in an agreement with a Cabinet officer—and that they were advised by local coal men that the coal situation during the coming winter would be critical, and, under those circumstances, they entered into said contract as a wise measure of foresight.

Said officers of petitioner company testify specifically that they and other directors of said company are not stockholders or in any wise interested in the Jackson Hill Coal & Coke Company or in any other coal interests. They further testify that, in light of the Public Service Commission's reluctance to authorize the surcharge prayed for, they have gone within the last ten days to said Jackson Hill Coal & Coke Company and tried to get lower prices, and that said company gave them opportunity to cancel the contract, but that they have been unable to get coal contracts with any other companies to which they have applied, and that as the directors of said public service company, and after deliberation, they have decided that it would not be to the interests of this company or its patrons to surrender what is accepted as a guarantee of supply of fuel necessary to afford heating service in the coming winter.

The startling fact that stands out is that in this city, the metropolis of the Indiana coal fields and itself practically situated over coal mines, coal has been advanced to such a price that in this case the cost of coal for the ensuing year is estimated at \$16,252 to \$16,760 more than last year, an increase from \$12,902 to \$29,154 or to \$29,663 for the same grades and quantity of coal. The total cost of fuel during the coming year will be in excess by at least \$3,000 of the entire cost of operation for the fiscal year ended June 30, 1917. Such an increase in coal cost was characterized by witnesses at the Terre Haute hearing as "outrageous."

Petitioner has been granted a 3-cent increase in its rates, and a 7-cent surcharge hereinafter granted will raise the total to an even 10-cent increase over the rates which were charged on what may now be considered low costs of coal, labor and supplies and which did not permit the company to declare dividends. The reasonableness of such an increase is emphasized by the voluntary agreement which has just been entered into between the Terre Haute, Indianapolis & Eastern Traction Company and the patrons of its limited steam-heating service in the downtown section of Terre Haute. By that mutual agreement, which the Public Service Commission is called upon to ratify, said patrons voluntarily agree to a rate 50 per cent in excess of the rates last season, and further provide that if there are costs beyond this 50 per cent, they will meet those costs up to and including 100 per cent increase over the rates that have formerly been charged.

ACTION IN OTHER CASES

Because after rearrangement of depreciation charges the Owensville Light Company showed earnings of at least 6 per cent on the investment, even at wartime prices, the commission denied the petition to add a temporary surcharge of 30 per cent to bills for electrical energy.

For similar reasons the petition of the Oakland City Electric Light & Power Company for authority to add a surcharge of 25 per cent to its existing rates was denied.

The commission found that some of the electric company petitioners showed earnings even under war-time conditions high enough to insure sufficient return on the investment. In these cases no surcharges have been allowed.

With the consent of petitioners, for instance, the 30 per cent increase petitions instituted by the Madison Light & Railway Company and the Wabash Valley Electric Company were dismissed. Increases have been allowed in the cases of various companies, including the Interstate Public Service Company, which petitioned for hot-water-heat increases at Fowler, Bedford,

Lebanon, Kokomo and Newcastle. The commission uniformly denied all petitions that asked for permanent readjustments in rates and all the increases are in the nature of temporary surcharges, most of them being for one year only.

ALLOWANCE FOR SMALL COMPANY

One of the surcharges allowed in part was to the Batesville Electric Light & Power Company. The commission said in its decision:

The evidence in this case shows that the operating expenses of this company were considerably higher for the year ended June 30, 1917, than for the year ended June 30, 1916. The secretary and general manager of the company testified that the plant of this company was worth about \$80,000. The annual report for the year ended June 30, 1917, gives the cost of this plant at approximately \$83,000. The same report shows the accumulation of a depreciation reserve fund of approximately \$13,000. If the depreciation which has accrued as shown by said report be deducted from the cost of this plant, the present value would not be over \$70,000. While there was no evidence on this question, the present or depreciated value is probably lower than \$70,000.

This commission has usually allowed for depreciation of electric companies 3 per cent of the present value. This would be 3 per cent of \$70,000, or \$2,100. Deducting this sum from total net earnings of \$5,678 leaves for return on the property of petitioner the sum of \$3,578. This is equivalent to more than 5 per cent on the value as taken. However, under ordinary circumstances an electric light company should be permitted to earn a greater return than 5 per cent. This company has a bonded indebtedness of \$35,000 which draws 6 per cent interest. There is also outstanding \$26,000 of preferred stock which provides for dividends of 6 per cent. It will thus be seen that the net earnings will not be sufficient to pay the interest charges and dividends on preferred stock, thus leaving nothing for dividends on the common stock.

This company bought its coal in 1916 for \$1.65 per ton at the mines. Since Jan. 1, 1917, it has been paying \$3 per ton and a contract for this price runs until January, 1918. The fuel cost of this company will therefore probably be slightly greater for the year ending June 30, 1918, than for the year ended June 30, 1917.

Under all the circumstances in this case the commission is of the opinion that petitioner should be permitted to add a 10 per cent surcharge on all its bills, including bills for heat, for the period of one year.

ANNUAL MEETING OF THE ILLUMINATING ENGINEERS

Joint Session to Be Held with New York Section—
Symposium on Color Comprising Six Papers
to Be Presented

The Illuminating Engineering Society will hold its annual business meeting at the Engineering Societies Building, New York, Oct. 11, at 8 p. m. This meeting will be held jointly with the New York Section of the society, the feature of the meeting being a symposium upon the subject of color. This symposium will consist of six papers.

The papers and authors are as follows: "Potentialities of Color in Lighting," M. Luckiesh; "Colors from the Physical Point of View," H. C. Richards; "Psychology of Color in Relation to Illumination," L. T. Tholand; "Establishment of Color Standards and Methods of Color Specifications," I. G. Priest; "Color in Illumination," Beatrice Irwin, and "Some Experiments on the Eye with Different Illuminants," Prof. C. E. Ferree and Miss G. Rand.

SOUTHEASTERN COMPANIES ADD MANY CUSTOMERS TO LINES

Isolated Plants Being Shut Down Because of the
Cheaper Energy and Better Service of
Central Station Companies

Electric companies in the southeastern part of the country have had unprecedented success in converting owners of isolated plants to the introduction of central station service. A large number of the plants shut down are in cotton mills. The change from steam to electric drive in many of these mills will involve the expenditure of several million dollars in the purchase of electrical equipment, mostly for motors. Most of the mills will install individual motors on the spinning frames in the spinning department, the latest refinement in cotton mill drive. Other important plants that have contracted for central station service are in the steel, mining, fertilizer and cotton-oil industries. A large number of municipal plants have also been shut down in the last few months.

The Georgia Railway & Power Company during April, May, June and July added approximately 52,000,000 annual kilowatt-hours to its load as against a 23,000,000 kw.-hr. load added in 1916, a record year.

Warden F. G. Zerst and Chief Engineer S. E. Bixby of the United States Penitentiary at Atlanta, which has contracted for 250 hp., made a thorough investigation before they recommended that the penitentiary plant be discontinued. Their action displaces an efficient existing steam plant which was reaching the point of inadequacy and for which coal fuel was growing alarmingly scarce. An appropriation of \$250,000 by the government for a new plant will be unspent under the new arrangement.

In the case of several mills, electric power displaces cross-compound Cooper-Corliss condensing engines, with rope drive, the steam being used twice in each engine. The mills will discard engines, shafting, belting and nearly all boilers, retaining only enough of the latter for heating buildings, for fire pumps and for the slashing of yarn.

The contract with the city of Cartersville removes from the territory served by the Georgia Railway & Power Company the last municipal electric plant.

This company has announced that it will add immediately a 12,000-kw. generator to its Tallulah Falls plant. Of the several alternative methods considered for increasing the capacity to serve hydroelectric power customers, whose demand recently has been growing as cited here, the construction of the sixth unit at Tallulah offered the most direct and practicable plan. The Tallulah plant was designed and constructed for six units, the sixth being left for installation when it became necessary. The projected addition, therefore, will complete the station.

In line with this company's policy to give its power customers the best service possible, it has begun improving its Tallulah Falls-Atlanta 110,000-volt transmission line. Fifty thousand insulators are to be changed on 753 towers, and when the work is done the number of strain towers in the whole distance will have been cut down from about 179 to 15, suspension towers being substituted. The failure of insulators on the strain towers is believed to have been the cause of recent shutdowns on the Tallulah line. The work will require a year or more. All the strain towers are to be elim-

inated first with the line dead, one line being killed at a time while work is in progress on it. Later, when the strain towers are all out, the changing of insulators along the entire remainder of the line will be done with the conductors alive, with the use of Johnson live line apparatus, described in the June 10, 1916, issue of the ELECTRICAL WORLD.

In order to render more effective service to the Carrollton end of the Newman-Carrollton line insulation is being changed to operate on 38,000 volts instead of 11,000 volts as at present, and upon completion of this work and other necessary changes in stations, etc., the whole line from Atlanta to Carrollton will be operated at 38,000 volts. The Atlanta-Newman section now is being operated at 110,000 volts. A transformer bank will be moved from the Boulevard substation to the Newman substation in order to effect a tie at the latter point with the Columbus Power Company, which delivers energy at 11,000 volts. The new Norcross substation of 6000 kva. capacity is ready for service.

This company is also changing the insulators on its Stone Mountain-Monroe line prior to raising the voltage from 22,000 to 38,000. About 10 miles (16 km.) of the line are finished between Stone Mountain and Lithonia. The total length of the line is 25 miles (40.2 km.). All branch lines have been changed. Twelve stations along the line are being rebuilt. All the work on this section is being handled while the line is in service.

The Alabama Power Company is also taxed to the limit of its capacity, but expected to have its Warrior River steam plant in operation during the fall to take care of the many new customers obtained recently. Originally this station was planned for use as a reserve steam plant to take the peak loads at high water and the heavy load at low water. Owing to the heavy demand this plant will probably be taxed to its full capacity. It has one 25,000-kva. Westinghouse turbo-generator. Provision is made for two more units of the same size, which will probably be built in the near future, provided that equipment can be obtained. The present installation will cost about \$1,750,000 and the final plant more than \$5,000,000. The station, which is 54 miles northwest of Birmingham, is situated at a coal mine, insuring low fuel cost. The company is now installing at its hydroelectric plant on the Coosa River a new fifth unit which will make the total generating capacity 92,000 hp.

The Southern Power Company, with headquarters at Charlotte, N. C., is building a new hydroelectric plant on the Wateree River that will have a total capacity of 108,000 hp. Contracts for nearly this amount have already been signed, so that on completion this plant will be running with a heavy load. To conserve water power this company has been inducing owners of small hydroelectric plants to tie in with its system and to combine the small plants as a part of the system, using them only in times of heavy demand. Heretofore the small plant was in operation even when it had little demand. It is hoped that eventually every small plant in the Southern Power Company's district will be connected to the main system in this manner.

Other companies in this section are being called upon for more energy than ever before and all are meeting the demand because of the interconnection of the various systems throughout Alabama, Tennessee, Georgia and North and South Carolina. This system was described in the May 30, 1914, issue of the ELECTRICAL WORLD.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Agreement Not to Infringe on Territory Not Found.—The Pennsylvania Public Service Commission has dismissed the complaint of the Pine Grove Electric Light, Heat & Power Company against the Eastern Pennsylvania Light, Heat & Power Company, Pottsville. The Pine Grove company held that the Eastern Pennsylvania company had, in defiance of an agreement, infringed upon its territory. The commission held that no evidence of an agreement could be found.

Discount on Securities in Indiana.—The Indiana Public Service Commission, in a decision involving only a small issue of bonds, has reiterated its position concerning discounted securities, and says it intends to continue decisions in such cases in the same line. In this case, wherein the Indiana Utilities Company asked authority to issue \$26,000 bonds at 80, the commission gave the company the choice of issuing the bonds at 80, provided it would provide for amortization of the discount, or of issuing them at 85 without the amortization plan. The company accepted the 85 per cent plan.

Schedules Should Not Be Complicated or Obscure.—An order of the New York Public Service Commission, First District, written by Commissioner Whitney, revises the orders relating to schedules of electrical corporations. The opinion says in part: "A rate schedule defeats its own purpose if it is so complicated or obscure that consumers are unable intelligently to select that rate which is applicable or most advantageous to them. Instead of being aided in their selection, the consumers are likely to be misled by such a schedule. A schedule should be so formulated that an applicant for service of average intelligence can understand and correctly apply the rates to his particular case. Moreover, rate schedules should serve for comparison of rates and contracts of different companies, enabling the detection of unjustifiable divergencies."

Hydroelectric Plant Sale Approved in California.—The California Railroad Commission has authorized the Merced Stone Company to sell to the San Joaquin Light & Power Company for \$35,000 a hydroelectric plant of 375 kva. installed rating and the distribution system at Kittridge, Mariposa County, and a transmission line from Kittridge by way of Jasper Point to Merced Falls, together with water rights on the Merced River, covering 15,000 miner's inches of flow, with way for a diversion dam and flume, real estate and buildings. The Stone com-

pany was incorporated in 1907 and built the hydroelectric plant and distribution system, and it has been serving power for quarrying and mining purposes to two mines near Jasper Point and Kittridge. The company now wants to go out of business as a public utility, and the power corporation wants to increase its business in Mariposa County by operating this plant in conjunction with the San Joaquin system and by extension into territory beyond Kittridge. It was estimated that the property if it were reproduced new would cost \$76,267.

Unremunerative Plant Need Not Be Rebuilt.—A decision has been rendered by the New York Public Service Commission, Second District, in the matter of the complaint of the board of trustees against the Waterville Gas & Electric Company, protesting against discontinuance of gas service by that company. The Waterville company was formed by consolidation of a gas company and an electric company. The consolidated company established a steam-heating plant apparently under still another franchise. The electric and the steam-heating business has been remunerative, but the gas business for many years has been conducted at a loss. The gas works were destroyed by fire, and the company undertook to surrender its gas franchise. The village and a number of its inhabitants asked substantially that the company be required to reconstruct its plant and continue the gas business. It was held that under such circumstances the commission should not grant the relief sought, as to do so would either be confiscatory so far as the gas plant is concerned or else would burden the consumers of electricity and steam with the losses due to the gas operation.

Merger of Corporations in New York.—The New York Public Service Commission, Second District, in a decision on a petition of the Lockport Gas & Electric Light Company for authority to merge with the Lockport Light, Heat & Power Company, holds: "There is no inhibition in the statutes of this State against the merger of one domestic gas and electric corporation with another merely because such merger would result in a foreign holding corporation becoming the owner of the stock of the corporation formed by the merger by virtue of its ownership of all of the stock of the merging corporation, which has continued for many years prior to the merger and before the creation of the commission. Where the conduct of the affairs of corporations can be simplified by the elimination of intermediate holding companies without detriment to the interests of the public or the corporations, the commission should encourage such procedure and aid in all reasonable ways. There is no reason why a corporation should be forbidden to carry on its books as an intangible item a sum representing money actually paid for stock of another company when the transaction was originally approved by this commission."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Duty or Obligation to Furnish Service.—Rights and duties are correlative, and unless there was a duty or obligation upon the water board of a city to install water in a residence the property owners were not entitled to a writ of mandamus against the board, the Maryland Court of Appeals held (101 A. 716).

Liability for Trespasser's Injuries in Power Plant.—In an action for injuries received by a trespasser in the defendant's electric power station it was held by the Georgia Court of Appeals in *Central Power Company versus Walker* (93 S. E. 306) that there could be no recovery, since the defendant did not know of the trespasser's danger at time of injury.

Admissibility of Commission Findings in Taxation Assessment Case.—On appeal to the State Tax Commission from an assessment made by the Appeal Tax Court of Baltimore of the physical structures of a telephone company in the city, evidence for the telephone company of the findings of the Public Service Commission in the matter of the telephone company's rate case was admissible as part of the record of proceedings of the Appeal Tax Court, under laws providing for appeals to the State Tax Commission, it was held on an appeal (101 A. 677). The first prayer for ruling of the Mayor and City Council of Baltimore was that, if the court found that the State Tax Commission, in reducing the assessment of the property of the telephone company from one amount to another, acted on the assumption that the value fixed by the Public Service Commission for rate-making purposes was the value which should be fixed by the Tax Commission for purposes of taxation, etc., the Tax Commission committed an error, and that the value fixed by the Public Service Commission had no pertinency or application, and certainly no binding force, in the assessment placed upon the company's property by the Tax Commission. In the decision handed down by the court upon this point it was held that the prayer was erroneous as requiring the court to find a question of fact, when it was sitting to review questions of law only, involved in the assessment of the telephone company's property. The final determination of assessments of all property in the counties, cities and towns of Maryland is specially conferred by statute on the State Tax Commission, and the valuation is to be made according to its best judgment from the evidence before it, and the courts are without jurisdiction to review its findings on questions of fact.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Increase in Rates in Kentucky.—An increase in lighting rates of 25 per cent has been announced by the Kentucky Light & Power Company, Hartford, Ky., due to the increased cost of coal and all supplies and materials entering into the business.

Rational Public Ownership.—William H. Hodge, manager publicity department for H. M. Byllesby & Company, Chicago, has published in pamphlet form a lecture on "The Customer as a Financial Partner in a Public Utility" which he delivered before the graduate school of business administration, Harvard University, on April 2, 1917. It dealt with the Byllesby plan of selling stock in the territory of the operating company.

Economy Through Lamp Renewal Discontinuance.—The Rochester (N. Y.) Railway & Light Company in announcing discontinuance of the policy of free renewal of carbon and gem lamps said: "It costs twice as much to operate a carbon lamp as it does to operate a Mazda lamp of like candlepower. Because of this fact we have been discouraging the use of the wasteful carbon and gem lamp. As the result of the terrific increase in the cost of all things that enter into the production, sale and distribution of electricity we are confronted with the necessity for effecting every economy we can in order to ward off as long as possible a general increase in the rates for electricity. As there exists no valid reason for continuance of the demand for carbon and gem lamps and as the economy to be effected by the withdrawal of our free renewal policy is both necessary and mutual, the free renewal of carbon and gem lamps will be discontinued."

Hydroelectric Industries in Bergen, Norway.—United States Consul Charles Forman, writing from Bergen, Norway, says: "Much of the recent influx of wealth into Bergen has been invested in hydroelectric development in the Hardanger, Sogn, Søndhordland and Nordfjord districts. Among the new concerns and those which have lately enlarged the scope of their activities are the following: At Indre Aalvik, on the Hardanger Fiord, the Bjølvfossen company, which will manufacture carbide, and at Bremanger, a coast island about 100 miles north of Bergen, the Bremanger Kraftselskab company, which hopes to increase its output of carbide and cyanamide to 20,000 tons and 10,000 tons respectively, and also to make improvements in its plant by which other smelting and electrochemical products can be manufactured in

the future should conditions prove favorable. At Knarrevik, on a coast island just outside of Bergen, a superphosphate factory recently started with a capital of more than \$800,000, as well as several other manufacturing plants. The total investment in hydroelectric development in the districts mentioned is about 50,000,000 crowns (\$13,400,000)."

Tasmania Hydroelectric Development.—The Lake Margaret hydroelectric power scheme in Tasmania is to be developed by the Mount Lyell Company so as to make available 8000 hp. in addition to the present installation, involving a cost of about \$344,200, the aggregate expenditure in this connection being approximately \$1,117,800. At the request of the Tasmanian government the Mount Lyell Company has investigated a scheme for generating electrical energy on the King River. The results indicate that it "appears economically feasible" to install a 30,000-hp. plant. Additional power from the Lake Margaret installation will in the first instance be used for the electrolytic production of spelter. Robert C. Sticht, general manager Mount Lyell Mining & Railway Company, is in the United States investigating the Anaconda Copper Mining Company electrolytic process. His present address is care Canadian Bank of Commerce, San Francisco.

Street-Lighting Investigation in Toledo.—A report of an investigation of street lighting at Toledo, Ohio, was made to the committee on light of the City Council on Sept. 27 by professors of Toledo University, working under the direction of Dr. Milo R. Maltbie, employed by the city as an expert. This report states that the city's contract stipulates that the Toledo Railways & Light Company should furnish magnitite-arc lamps of 2000 cp., whereas the investigation discloses that the average candlepower of the lamps in use is 448. It is further stated that the energy actually furnished is 4 amp., whereas the contract requires that it shall not be less than 5½ amp. Lamps should be not less than 450 watts, according to the contract, it was stated, but investigation showed that the lamps are about 300 watts. Energy should register 70 volts and this voltage seems to have been maintained. The investigation covered a period of about one year, and it was declared that every precaution had been taken to have the tests accurate. Company officials, the report stated, admitted the accuracy of the findings and made some tests to substantiate them for their own satisfaction. The report says: "It seems to us that the issues are very clear at present. Either the company must agree to a reduction in price or no contract should be made until the war is over. As soon as normal prices prevail our figures will show beyond reason of doubt that rates for both street and domestic lighting should be reduced. If we wait until the war is over, too, it might be advisable to require more up-to-date lights than the company is now furnishing."

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 701 of this number.

The Electrical League of Cleveland.—Commander H. C. Martindale of Memorial Post No. 141 of the G. A. R. addressed the Electrical League of Cleveland on the subject of "The World War" recently.

The Institute of Radio Engineers.—A paper on "Radio Telegraphy in Competition with Wire Telegraphy in Overland Work" was read by Robert Boyd Black, U. S. N. R. F., at a meeting of the Institute of Radio Engineers in New York City on Oct. 3.

The Wyoming Electric Utilities Association.—The Wyoming Electric Utilities Association closed its third annual convention with a banquet given to the delegates by Judson Bibb, manager of the Sheridan County Electric Company. Cheyenne was chosen for the 1918 convention.

Electrical Contractors' Association of Massachusetts.—The following officers of the Electrical Contractors' Association of Massachusetts were elected for the year 1917-1918 at the recent annual meeting held at Worcester: President, Alfred J. Hixon, Boston; first vice-president, Arnold J. Stone, Brockton; second vice-president, W. H. Doughty, Fall River; secretary, J. W. Wilson, Boston; treasurer, Frank L. Barnes, Boston.

Washington Association of Electrical Contractors and Dealers.—V. S. McKenny of Seattle, Wash., was elected president of the Washington Association of Electrical Contractors and Dealers at the annual convention, and Seattle was chosen the next meeting place. Vice-presidents for the different divisions were elected as follows: Seattle J. J. Agutter, W. M. Meacham and S. Hepler; Spokane, Charles A. Duncan and M. McCain; Tacoma, H. C. Rohrbach; Bellingham, J. R. Martin; Yakima, Ralph Wiseman.

Meetings of Ohio Commercial Men.—Dates and places for meetings of the new-business co-operations committee of the Ohio Electric Light Association have been fixed as follows: Lighting and merchandising section, Cincinnati, Oct. 10; lighting and merchandising section, Toledo, Oct. 21; power and heating section, Dayton, Jan. 6; lighting and merchandising section, Columbus, March 6; power and heating section, Cleveland, May 8. The committee this year has adopted a plan of having meetings devoted exclusively to the problem of lighting and appliance sales and other meetings dealing only with power and industrial questions. It is believed that this specialization will make the gatherings of greater value. C. E. Yacoll, Youngstown, Ohio, is chairman of the committee.

L. M. Alexander has been appointed instructor in electrical engineering at the University of Cincinnati.

C. W. E. Clarke of the Stone & Webster organization has gone to France on some government work in connection with the war.

F. L. Reardon, auditor of the East St. Louis (Ill.) & Suburban Railway Company, has been appointed a major in the Third Illinois Artillery.

De Lancy Rankine of Niagara Falls, N. Y., was elected president of the Tonawanda Power Company, North Tonawanda, on the reorganization of the company.

Charles R. Berry, connected with the Scranton Electric Company, Scranton, Pa., as manager of the Carbondale district, has been transferred to the Pittsburgh district.

C. L. Jacklett has been appointed district manager of the Pacific Power & Light Company at Prosser, Wash., succeeding **D. L. Lewis**, who was transferred to Dayton.

D. L. Lewis, district manager of the Pacific Power & Light Company at Prosser, Wash., has been appointed district manager at Dayton, Wash., succeeding **H. A. Mott**, resigned.

Paul Rambo, acting district manager for the Pacific Power & Light Company at Pomeroy, Wash., has been appointed district manager, succeeding **R. L. Dean**, who joined the colors.

Harlow Moore, chief clerk for the Pacific Power & Light Company at Seaside, Ore., has been appointed local manager to take the place of **M. McClellan**, who resigned.

I. Clyde Pattee of Hood River has been appointed local manager for the Pacific Power & Light Company at Waitsburg, Wash., to succeed **John Longstaff**, deceased.

Alfred J. Hixon of the Hixon Electric Company, Boston, Mass., was elected president of the Electrical Contractors' Association of Massachusetts at the recent convention held at Worcester.

W. D. Myers of the Portland Gas & Coke Company has been appointed district manager at Hood River for the Pacific Power & Light Company, succeeding **John V. Strange**, who has been transferred to Pasco.

S. A. King, line foreman for the Pacific Power & Light Company at Toppenish, Wash., has been appointed district manager at Goldendale, Wash., in place of **J. C. Naylor**, who joined the colors.

A. Von Hacht of the Hood River (Ore.) Pacific Power & Light Company organization has been appointed local manager at White Salmon, Wash., vice **H. G. Humphreys**, who has been transferred to the construction department.

W. M. Wood, district manager of the Pacific Power & Light Company at Lewiston, Idaho, has been appointed assistant to the general manager, with headquarters at Portland. Prior to going to Lewiston **Mr. Wood** was in charge of the company's Sunnyside office.

Men of the Industry

Changes in Personnel
and Position —
Biographical Notes

C. R. Wylie has resigned as assistant professor in the department of electrical engineering of the University of Cincinnati to go into an entirely different line of work.

E. T. Wagenhals, superintendent of the Ohio Light & Power Company, has been promoted to be manager of the southern division of the company at Newark, succeeding **Frank Espy** in that post.

Howard F. Hemenway has resigned from his position as superintendent of the Westboro (Mass.) Gas & Electric Company to take a position in the electrical department of the government arsenal at Springfield, Mass.

John V. Strange, district manager of the Pacific Power & Light Company at Hood River, Ore., has been appointed district manager at Pasco, Wash., succeeding **A. S. Hall**, who has joined the colors.

L. R. Madison has been appointed superintendent in district B of the power generating department of the West Penn System, Pittsburgh, Pa., succeeding **H. F. Ferguson**, who resigned.

J. P. Ohmer, superintendent for the Indiana & Michigan Electric Company at Elkhart, Ind., was elected president of the Indiana Electric Light Association for the ensuing association year at the one-day meeting held at Indianapolis on Sept. 26.

Herbert B. Reynolds, formerly with the Interborough Rapid Transit Company, New York City, as assistant engineer in the motive power department, has been appointed mechanical assistant to the superintendent of motive power of the United Railways & Electric Company, Baltimore, Md.

Frank Espy, general manager of the Ohio Light & Power Company, has been transferred to the home office of the parent company, the American Gas & Electric Company, New York City, as assistant to the general manager. **Mr. Espy** was appointed general manager of the Ohio property of the company in the spring of 1916, having formerly been manager of the northern division of the company.

L. H. Palmer, general manager of the Eastern Pennsylvania Railways Company and the Eastern Pennsylvania Light, Heat & Power Company, Pottsville, Pa., has resigned to accept the position of assistant to the president of the United Railways & Electric Company at Baltimore, Md. No successor has been announced, but for the present **Mr. Palmer** will continue to act as general manager, spending part of each week in Pottsville.

V. T. Mavity, who has spent three years in electrical engineering in Central America, has been appointed instructor of electrical engineering at the University of Cincinnati. **Mr. Mavity** was graduated from Purdue in 1913.

Thomas F. Kelly, commercial manager of the Dayton (Ohio) Power & Light Company, has been elected a director of the Greater Dayton Association. The association is made up of three divisions, industrial, commercial and civic. **Mr. Kelly** is one of the three representatives of the commercial division.

Van Dusen Rickert, assistant general manager of the Eastern Pennsylvania Railways Company and the Eastern Pennsylvania Light, Heat & Power Company, Pottsville, Pa., has resigned. **Mr. Rickert** had been with the Pottsville company for a number of years. He is widely known in the utility field in the State, having been secretary-treasurer of the Pennsylvania Electric Association in 1910-1911 and president of the association three years later.

Obituary

J. K. Robinson, the Chilean representative of the Westinghouse Electric Export Company, died at his summer home, Naples, Me., on Sept. 7. **Mr.**



J. K. ROBINSON

Robinson was born in Chicago in 1866 and secured his technical education at the Massachusetts Institute of Technology. He then entered the employ of the Thomson-Houston Electric Company, which sent him to Chile on construction work. Soon afterward he decided to go into business for himself, and was appointed representative of the Westinghouse Electric & Manufacturing Company at an exposition in Chile. This was the beginning of a lifetime connection, during which **Mr. Robinson** became an engineer of wide repute and one of the best-known Americans on the west coast. **Mr. Robinson** was a fellow of the American Institute of Electrical Engineers and a member of numerous other professional and social organizations in this country and abroad.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

MANUFACTURERS WORK UNDER SHEET-STEEL CURTAILMENT

Rolling Mills Are Requisitioned by the Government to Roll Tin Plate to Make Food Containers for Military Forces

During the spring—or in April, to be exact—the federal government, under a statute enacted by the existing Congress, requisitioned all the sheet-steel rolling plants of the country for various purposes, but particularly to roll tin plate to meet the demand for food containers required in enormous quantities by the military service. Manufacturers of all kinds who employ sheet, especially in a large way, were thereupon notified that the supply in the future would be curtailed at least 20 per cent for an indefinite period, and that they should govern their operations accordingly. Considering the stocks in hand, the shortage was not immediately felt, but now the curtailment is very much in evidence.

The leading manufacturers were not long in taking action, and buyers of machinery and all equipment of which sheet steel was an important constituent were notified that their requirements would be proportionately reduced. The output of sheet steel has since been distributed from the mills under governmental regulations and supervision. What remains after official needs are satisfied is distributed on an allotment basis. The mills accepted all orders as usual, but deliveries cannot and will not be guaranteed; hence manufacturers of finished products are in turn obliged to adopt the same tactics toward their respective customers.

In some instances the curtailment of the sheet-steel supply exceeds 20 per cent, ranging from 25 to even 50 per cent in some descriptions of apparatus, as the government decides. This is especially true of transformers. There is neither appeal nor recourse, and no attempt is made to mitigate the rigor of the federal order. Public service customers as well as private ones have accepted the restriction in like spirit. The apportionment has not proved vexatious or embarrassing as yet, but the buying trade is not infrequently "up in the air" when making estimates for large units. The manufacturers are equally perplexed when the question of deliveries is reached. The shipments of sheet steel from the mills vary so greatly or are strung along in such a manner that by the time notification is given that the last lot is ready or on the cars an indifference as to its receipt in connection with some particular order is plainly apparent. In deference to this state of mind, as expressed by one of the leading apparatus makers, the order may as well be canceled.

LABOR UNRESTFUL AND SUPPLY IS UNCERTAIN

Wages Everywhere Show a Continuing Tendency to Increase—The Draft Makes Many Vacancies in Sales Forces

With scarcely an exception, every branch of manufacturing in the electrical industry reports a state of unrest and uncertainty in respect to labor. The selective service law has also taken away for military service a large number of house and traveling salesmen, whose absence is appreciably felt in many instances. In fact, there is a greater demand for and dearth of salesmen in all departments of the trade than ever before. The vacancies are not being filled so rapidly as would be desired, and the applications

to take the place of the drafted men are not meeting the insistent demand.

Factory operatives are continually presenting new scales of wages arranged on a higher basis and in not a few instances a curtailment of working hours is also embodied in the ultimatum. Both of these factors are disturbing in so large a measure that not only the cost of products is unavoidably increased but deliveries are affected. The steel mills have recently granted a wage increase to their workers, a concession that has been followed by other lines in the past. Manufacturers freely admit that the question of an increase in wages and in some instances also a shortage of labor is an element in current business, causing anxiety of no slight moment.

According to the review of the labor market for August by the Bureau of Statistics and Information of New York State, the number of employees in the manufacturing activities has lessened with each month since March, while the total aggregate of wages has been decreasing each month since May. As compared with August a year ago, 1 per cent more employees are figured and 16 per cent more wages was paid. Corresponding increases over August two years ago were 21 and 53 per cent, and over August three years ago 26 and 67 per cent respectively.

During September, however, in harmony with reports obtained from original sources and at first hand, the number of employees has increased, proportionately to their availability, in the various lines of the electrical industry and wages have been on the up-grade continually, with the prospect of a future persistent progression. Just how long this unsettled process will continue no one in a position to predict is inclined to state with any degree of positiveness or accuracy.

DEMAND FOR SECOND-HAND GOODS GREATER THAN EVER

Large-Sized Motors, Transformers and Generators Are Difficult to Obtain, and They Easily Command Top-Notch Prices

Second-hand apparatus of all kinds is becoming so scarce that it is almost impossible to obtain. Particularly is this true of motors running from 300 hp. up. A large number of inquiries are constantly being received from all parts of the country, which has practically been scoured for machines, and the demand is increasing rather than diminishing. In fact, this condition has prevailed for months, but now it is becoming more acute. As for price, it is a secondary consideration and the figure arranged in the ultimate selling stage is about "all the traffic will bear." In other words, if a motor of this type and power can be secured and is in prime order, the buyer is willing to pay almost any price, no matter how comparatively high, in order to obtain the machine.

Within the scope of 50 hp. to 200 hp. the supply of motors is more liberal, but at the same time the stock on hand is by no means plentiful. Prices are, however, exceedingly firm and dealers are not parting with apparatus of this capacity at anything but a satisfactory price, which they have no difficulty in getting before shipment.

An active demand is in strong evidence for motors of from 50 hp. to 100 hp. The time when machines of this class were in easy supply has gone by. The Eastern market is about exhausted, and the Northwest and Far West are being gone over with a fine-tooth comb for such motors to meet the call of the immediate market. In truth, they are

seldom offered for sale. During the last three weeks the demand for 50-hp., 75-hp. and 100-hp. motors has been far beyond the visible supply. What the second-hand people have regarded in the past as "mines" for motors are now non-productive. No contracts for future delivery are being accepted for less than four months. This, of course, is due to the general unrest in the market, in which labor, the price of material and the difficulty of assured deliveries all figure—not to mention the disinclination of possessors of second-hand machines to part with their property unless an alluring buying figure is named.

Inquiries for transformers of all sizes are many, but the difficulty of filling orders is of almost the same proportions as in the case of motors. Sales are made on a rising market and no time is lost in price discussion. The first offer is usually final, at least on the part of the seller.

A hectic market is noticeable for generators, with the highest obtainable prices being quoted. This condition, which has caused the practical disappearance of generators in the hands of second-hand houses, is stimulated and maintained by the corresponding scarcity in new goods, deliveries just now being made for orders placed at the first of the year.

Supply parts are also far behind in delivery arrangements, and the immediate future is disclosing no daylight in this respect. The government or official buying price on copper is not affecting the sale of finished goods. A recent purchase of ribbon wire—bare copper—was made at 50 cents a pound, and the buyer was quite pleased to have it placed at his disposal at this quotation. The second-hand trade is not figuring on any cut in price for specialties or supplies in which copper is a component part.

An Eastern house which recently purchased a 25,000-kw. mine plant has already disposed of a couple of large loads of machinery, now en route for the Pacific Northwest. The apparatus is of English manufacture and after installation was superseded by a more economically operated and producing plant, which was originally valued at \$1,000,000. Half of this amount closed the deal. The machinery is described as in prime condition, each piece being accompanied by a duplicate, and throughout is built in the most thorough manner. The final distribution of this rather uncommon sale and resale will eventually lead to a portion of the equipment going to Japan.

METAL MARKET CONDITIONS

No Market for Copper—Government Orders Deliveries Suspended—Tin and Aluminum Weaken

There is still no market for copper. Dealers and second-hand men have some small amounts, but not enough to make any market. The government, it is reported on authority, has notified producers to suspend deliveries until government needs are determined, which it is expected will be soon.

Both tin and aluminum show a decided weakness over last week. Spelter also declined a bit.

NEW YORK METAL MARKET PRICES

	Sept. 24			Oct. 1		
	£	s	d	£	s	d
Copper:						
London, standard spot.....	110	0	0	110	0	0
Prime Lake	Govt. price	23.50		Govt. price	23.50	
Electrolytic	Govt. price	23.50		Govt. price	23.50	
Casting	Govt. price	23.50		Govt. price	23.50	
Wire base	32.00	to	33.00*	30.00	to	32.00*
Lead, trust price.....	8.00			8.00		
Nickel, ingot	50	00		50	00	
Sheet zinc, f.o.b. smelter.....	19.00			19.00		
Spelter, spot	8.42½			8.37½		
Tin, Straits	62.25			61.00		
Aluminum, 98 to 99 per cent..	39.00	to	40.00*	37.00	to	39.00

OLD METALS

Heavy copper and wire.....	23.00	to	23.50	23.00	to	23.50
Brass, heavy	14.00	to	15.00	14.00	to	15.00
Brass, light	11.00	to	11.50	11.00	to	11.50
Lead, heavy	6.50	to	7.00	6.50	to	7.00
Zinc, old scrap	6.00	to	6.25	6.00	to	6.25

*Nominal.

THE WEEK IN TRADE

EVERYWHERE the volume of business seems to keep up, although there is some indication from New York that buyers are not so precipitant as they have been in placing orders. Prices are quite firm, except perhaps for copper wire, on which the higher-priced producers have lowered their prices somewhat. Labor conditions are causing more and more worry in both sales and manufacturing organizations.

There is a growing feeling in many parts of the country that present prices are at the peak. Government prices for raw materials are generally responsible for this point of view. However, members of the trade are not expecting any sudden drop, but rather a continuance of present prices at least until the supply of raw materials on hand, which were purchased at higher prices, is depleted. Even then, if prices become lower, the drop will in all probability be gradual.

NEW YORK

In general the underlying tone of the market is quiet. There apparently has been no appreciable let-up in buying, but buyers are not so eager to place orders as they have been. The building trades show no change, but a co-operative movement is under way whereby it is hoped capital will be attracted. The government steel prices, it is thought, may have a stimulating effect. Minimum wire prices show no change, but higher quotations, it has been noticed, are somewhat nearer the minimum. Utility purchases are being deferred wherever possible. Central stations are buying almost entirely for maintenance. Orders from central stations for the regular fall construction work bring forth nothing very large and indicate no new construction of any importance. The fall business from this direction is coming in fairly well for materials to strengthen existing lines against the winter.

PORCELAIN.—Deliveries are beginning to show some betterment.

CONDUIT.—There is considerable difficulty in obtaining deliveries. One large order, for instance, has been on the way for two months.

POLE-LINE HARDWARE.—Most of the manufacturers, foreseeing the higher prices to come, made contracts for their supply of raw materials at prices somewhat under the prices recently established by the government, and as a result were well protected. Prices consequently did not advance so much as if the manufacturers had been forced into the open market for raw materials, and therefore the government price, it developed under inquiry, will probably have little effect on the price of the finished product.

WIRE.—While in the past there has been some difference in quoted price of wire, the effect of the government price of 23.5 cents noticed this week has been to level the higher prices to a point much nearer the minimum quotations. Weatherproof wire is lower, but rubber-covered has not changed.

SERVICE METERS.—Within the last ten days an advance of 10 to 18 per cent, averaging about 15 per cent, has been announced on house-service meters. No further increases are looked for in the near future unless conditions become still more abnormal than at present. It is figured that if a further mark-up is contemplated it will have a deterrent effect on the placing of orders. In other words, prices are about near the top.

PORTABLE LAMPS.—Business is very good. Prices are relatively higher than last year, on account of the increased cost of brass and other metals, but no further advance is looked for, provided that the metal market does not become more acute. Manufacturers, as in other lines, are in an unsettled frame of mind, caused by uncertain labor conditions and similar disturbing elements.

LAMP POSTS, STANDARDS.—The situation in the lamp-post field is not so active as it might be. While a number of large contracts for public lighting service and private

use are pending and have been in this unsatisfactory stage for some time, the war situation is chargeable as the sole obstacle. It is one which seems to be difficult to overcome by any argument or special pleading on the part of the sellers. No inducements to "close" are being offered, as the raw-material market is not such as will permit any such indulgence, even if the manufacturer were inclined otherwise. These lamp installations, it is stated, must therefore await more favorable natural conditions. Prices are unchanged, with a tendency to further stiffening—subject to amendment without notice. Some speculation is heard about the effect of the government price on iron and steel affecting finished goods. Trade in standards is excellent, especially in export shipments to the West Indies and South American countries. It appears that Mexico is again in the market, and a number of appreciable installations are under negotiation. Wall brackets are also selling in a satisfactory way at steady prices. One of the large Eastern corporations is trying to economize by substituting for underground wiring and metal posts for lighting service wooden poles and overhead distribution.

CHICAGO

Electrical business in general is showing some improvement over a week or so ago. There is a better movement of goods and a more optimistic tone in the market. There is no one who sees anything but the most rosy future for business in the Chicago territory. One reason for the optimism is that big buyers who have been waiting for the government to fix the prices of copper and steel are now free to act. The uncertainty has been largely removed. The reason action has not already taken place is that definite information concerning prices to consumers has not yet reached the buyer. Government requirements have not yet been decided upon, and there is some question as to whether the domestic consumer will have to pay a premium or whether he will get his copper at 23.5 cents. There is some opinion that public utilities are trying to keep down their purchases to a minimum but are being forced to do some buying by the general industrial expansion. This statement of the case is not generally true, however, as some of the larger utilities in this territory are going ahead with expansion at the regular rate.

TRANSFORMERS.—An Eastern company is asking central Western manufacturers for a quotation on \$165,000 worth of transformers.

MOTORS.—In the motor market there is a general tone of optimism. Deliveries are still poor.

GENERAL LIGHTING EQUIPMENT.—The fall buying season is not yet in full swing, but the peak is expected withing two or three weeks.

LIGHTING SPECIALTIES.—Analysis of the market for special electric lighting fixtures indicates that while the building of residences and apartment buildings is not progressing so rapidly as it has heretofore, schools, university buildings, public institutions and factory buildings are more than making up for the deficiency in the construction of homes. This has had the effect of making business in special lighting fixtures very good, in spite of the fact that there is some talk about inactivity in the building trade.

AUTOMOBILE HEATERS.—The Hughes Electric Heating Company will increase the price of automobile engine and carburetor heaters to the trade from \$4 to \$5 on Oct. 15.

GOVERNMENT BUSINESS.—In industrial circles observers of market conditions are marveling at the quietness with which United States government orders have been and are being placed. It is easy to recall how French and English buyers within the last few years plunged into the market in a manner that brought rather undue publicity to the orders being placed, resulting in the market reacting unfavorably to the buyers. There has been none of this in the present purchasing campaign of our own government. It is thought by some, therefore, that not all manufacturers are aware of the breadth of the movement, and that some are mistaking what is in reality quiet and smooth government action for lack of action.

BOSTON

Business conditions have not changed to any great extent during the week. Small jobbers are reported to be doing a relatively large business, contracting interests stating that among these firms co-operation at present is vigorous. Collections are improving. Manufacturers are feeling the effects of the draft and are finding it difficult to obtain dependable labor. Present high wages are accompanied, in some plants at least, by the desire to take an undue amount of time off. The time is ripe for an appeal to the patriotism of all workers, urging them to stick faithfully to their tasks and thus help do their bit in the war for democracy and liberty. Irregular labor rather than high wages is said on good authority to be a primary cause of the shortage of many necessities. Prominent electrical contracting interests report that industrial business continues unflagging in activity. Central station appliance departments are doing well as the fall advances, and holiday stocks are gradually being prepared. Electric radiators are in great demand, and it is doubtful if the market will not be oversold before Christmas. Deliveries show little sign of improvement, and these govern the ability of manufacturers to supply present demands rather than prices fixed by or outside the government. The opinion is widespread in New England manufacturing and trade circles that the maximum price level has now been reached on electrical apparatus and machinery, although some manufacturers are still unwilling to predict that no further advances will occur. It was announced a few days ago that the government will spend \$100,000,000 in the creation and service of a very large plant at Fore River, Mass., for the building of destroyers. Considerable electrical equipment will be required, including wiring for a large number of new residences which will be necessary for the use of the factory employees. From now on the holiday trade should increase among the jobbers, and there is every prospect of an intensely active winter in New England factories.

FIRE-ALARM SUPPLIES.—A steady business has been enjoyed in this equipment, notwithstanding a noticeable scarcity of labor and material. Prices were increased about 10 per cent recently, but the present volume of business appears about normal for the season, which is ordinarily dull at this time of year.

MAGNETIC CHUCKS.—Heavy demand characterizes the present market, notably for the munitions industry. Manufacture of machine guns is being expedited by this labor-saving equipment. Manufacturers have no chance to stock up at present.

FANS.—Trade has fallen to insignificant dimensions pending the revival to be anticipated in connection with frosty windows. There is some prospect that fans will be used more this winter than before in connection with domestic heating service, the high price of coal tending toward the use of more efficient methods of heat distribution.

ELECTRIC RADIATORS.—The demand is so heavy that stock accumulation is very difficult. The availability of low-priced equipment means much to the fall trade. Prices are holding firm. The use of these equipments by officers at the military cantonment in Ayer is forecast by a representative central station appliance man, who reports that he cannot maintain a stock of electric radiators at his offices.

PORTABLE LAMPS.—A considerable sale for military wedding presents is reported, and an improved trade in connection with the holiday season is anticipated. On the whole, the present domestic demand seems to be below normal.

ELECTRIC HEATING PADS.—Demand is steady, prevailing prices apparently proving no bar to steady purchase.

ELECTRIC PASSENGER CARS.—A very satisfactory fall business appears in sight, based in part upon the withdrawal of gasoline-car chauffeurs from private to government service. Cars are in stock at Boston for immediate delivery, and these will be replaced as soon as sold.

WIRE AND CABLE.—The opinion is current that no immediate price reductions are likely to take place, although it appears that further increases are not to be expected at present. Labor is reported as fairly plentiful in New England wire-manufacturing circles. Government orders are taking about 50 per cent of output.

MOTORS.—Large motors are most difficult to obtain, but in the smaller sizes up to 25 hp. many stock machines can be found for prompt delivery.

TRANSITE AND EBONY BOARD.—The demand for insulating material is enormous. On plain asbestos board deliveries of about one month can be made, but on ebony board two or three months is required. No recent price changes are noted.

ATLANTA

Replies to inquiries made to the trade indicate that business on the whole is in excellent shape and that underlying conditions are favorable for the immediate future at least. The price-fixing program and the publicity given to it are beginning, however, to show some effect in certain quarters in that there is a slight tendency to hold off on the purchase of materials in which steel forms a part. The remarks and consensus of opinion of a few large jobbers would indicate that they anticipate a drop in price shortly on conduit products, if not on other material. This feeling on the part of the jobbers has probably been accentuated by the fact that some large orders for flexible and rigid conduit have been placed recently at a price shading the market about 5 per cent. There is no doubt that conduit has shown a weakness lately, due probably to a few factories having mastered the raw-material situation more successfully than others; but stocks in this section are in bad shape generally and a buying movement for this class of goods cannot be held off very long.

Contractors' and jobbers' collections are keeping up nicely. The manufacturers report a considerable improvement in collections for September as over August. They further report a leaning toward retrenchment by the large central stations, as reflected by inquiries and future purchases for heavy equipment. Then, too, this condition may be the result of tight money prior to the second Liberty Loan issue.

MOTOR-DRIVEN AIR COMPRESSORS.—One manufacturer of direct-connected units reports a very active business, especially in those rated 150 cu. ft. to 225 cu. ft. per minute and designed to be used in connection with sulphuric acid plants and fertilizer works and also for isolated hoist work. The shipment on these equipments depends a great deal on motor deliveries.

ELECTRICAL AUTOMOBILE ACCESSORIES.—A large volume of sales is reported covering all the articles in this line, and considerable difficulty is being experienced in securing shipments, with no apparent prospect for any betterment soon. A jobber reports his sales up to date as being 20 per cent ahead of last year, and present indications point to a greater increase for the year. Miniature lamps, ignition systems and their supply parts and spot lights have enjoyed a very active market.

ARMORED-STEEL CONDUCTOR.—Speculative building in the Southeast has fallen off lately, which has affected the market for this class of goods. A price reduction of 8 per cent was noted on a substantial order placed this week.

THEATRICAL DEVICES.—This year has proved a good one for these appliances, and a nice business is being done in footlights, switchboards and dimmers. Shipments are good on all but the latter; these are promised for ten weeks.

LAMPS.—While a big business is expected at this season of the year, the demand is above normal, possibly because of cantonment requirements. These camps have almost exhausted local stocks, and although the factories are in better shape to make deliveries now than they were last year, it is going to be hard to keep the demand supplied. Miniature lamps for headlights and similar uses show a gain in sales over last year of approximately 300 per cent.

WIRE AND CABLE.—The pressure on weatherproof and rubber covering is easing up, the demand for the past week being light. Large and special heavy cables are still in demand and the deliveries are very poor.

TRANSFORMERS.—The volume of business in these is still heavy, especially for the 2300-volt distribution type up to 50-kva. rating. The demand continues for the larger-power type, but is curbed somewhat by the discouraging promises of delivery.

SEATTLE

Following the example set by employees in wooden ship-building plants in Seattle who struck recently, as previously noted, 10,000 metal trades workers, employed in three steel shipyards and a number of contract shops, including foundries and machine shops, were called out on Sept. 29 for a new wage scale, entailing a 35 per cent increase along all lines. The work on thirty uncompleted steel and wooden ships, valued at \$32,000,000, was halted. The United States Shipping Board has already arranged for conferences with the strikers and employers in Seattle for next week.

Local electrical jobbers and dealers state as a whole that electrical business will not be materially affected by the strike unless it is of long duration. Naturally, buying will be lighter and may in some cases be discontinued altogether, but when the plants resume increased buying will make up for the temporary decrease. Up to date no evidence of the strike has been felt by electrical dealers, as shipyards are replenishing depleted stocks and making ready for the resumption of activity. Dealers are not perturbed, saying that if employers cannot effect amicable and agreeable settlement with their employees, the government will take a hand, not allowing anything to stand in the way of the ambitious shipbuilding program.

During the last two months a marvelous increase in the number of shipyards, machine shops, tool-making plants and allied industries has been recorded. The striking carpenters have returned to work temporarily under truce, but the settlement affected is not satisfactory or permanent. This strike has had but little if any effect on the electrical industry, as building is at a very low ebb. The Pacific Telegraph & Telephone Company and the Home Telephone Company are facing a strike of linemen, who are asking a 25 per cent increase. The strike is set for Oct. 21. The mill men and logging operators in the Pacific Northwest insist the strike of employees for an eight-hour day is all but over, saying production for the last week was 28 per cent of normal. The strikers claim renewed strength, stating that they will win.

The outstanding feature in the week's business along electrical lines was the increased sales of domestic appliances, particularly washing machines, toasters, socket devices, heaters and the like, the effect of the "lighten the home" campaign being felt locally. Dealers and central stations are putting forth masterful efforts. The effect of the campaign will be more pronounced within a month. With the exception of domestic appliances, no particular increase or decrease in sales is noticeable.

Dealers report a good volume of business, with no appreciable increase or decrease in prices noted during the week. Stocks are low, freight conditions satisfactory and buying for the future light. Credits and collections are satisfactory.

LAMPS.—Lamps are moving rapidly; the demand exceeds the supply by far and is increasing rapidly. Stocks are hard to obtain and prices remain firm.

CONDUIT.—The conduit demand is strong, prices steady. Shipments are coming through slowly.

MOTORS.—A decrease in the demand for both large and small motors is noticeable. It is expected to increase with the resumption of industrial activity.

LINE MATERIAL.—A perceptible increase in sales was noted last week. This was a temporary movement. The demand has been extremely light for months.

SAN FRANCISCO

There is very little change in business conditions. Industrial lines have been affected somewhat by the metal workers' strike, but this has been settled, the men having returned to work Sept. 29. Stocks in the more staple lines are in good condition, and demand is steady. The demand for household appliances is showing much activity, and it is expected that this business will continue until after the holidays. Excellent business is being done in washing machines and vacuum cleaners. Stocks are in good condition. Demand is heavy for incandescent lamps and stocks are fair. Some activity was shown in fan business during a few warm days through the week. Collections this week are not quite up to normal.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor		List, per 1000 Ft.
B. & S. Size		
No. 14 solid		\$61.00
No. 12 solid		71.00
No. 10 solid		90.00
No. 8 solid		106.00
No. 6 solid		145.00
No. 10 stranded		95.00
No. 8 stranded		115.00
No. 6 stranded		160.00
No. 4 stranded		205.00
No. 2 stranded		266.00
No. 1 stranded		315.00

Twin-Conductor		
No. 14 solid		104.00
No. 12 solid		135.00
No. 10 solid		185.00
No. 8 stranded		235.00
No. 6 stranded		370.00
No. 4 stranded		575.00

NET PRICE PER 1000 FT.—NEW YORK

Single-Conductor		
No. 14 solid:		
Less than coil		\$61.00
Coil to 1000 ft.		59.17
No. 12 solid:		
Less than coil		71.00
Coil to 1000 ft.		68.87

Twin-Conductor		
No. 14 solid:		
Less than coil		\$104.00
Coil to 1000 ft.		80.00
No. 12 solid:		
Less than coil		135.00
Coil to 1000 ft.		130.95

DISCOUNT—CHICAGO

Single-Conductor		
Less than coil		+10%
Coil to 1000 ft.		-10%

Twin-Conductor		
Less than coil		+10%
Coil to 1000 ft.		-10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10% to +10%
1/5 to std. pkg.	10% to 20%
Std. pkg.	34% to 44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	12% to 20%
1/5 to std. pkg.	20% to list
Std. pkg.	30% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31 to .3175	.32 to .3275
Barrel lots.....	.28 to .2875	.29 to .2975

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 30.....	.35	.35
50 to barrel.....	.31 to .3175	.32 to .3275
Barrel lots.....	.28 to .2875	.29 to .2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. Per Coil	List, Per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip.....	\$75.00 \$69.75
3/8-in. double strip.....	75.00 72.00
1/2-in. single strip.....	100.00 93.00
1/2-in. double strip.....	100.00 96.00

NET PER 1000 FT.—CHICAGO

Less Than Coil	Coil to 100 Ft.
3/8-in. single strip.....	\$75.00 \$63.75
3/8-in. double strip.....	78.75 71.25
1/2-in. single strip.....	100.00 85.00
1/2-in. double strip.....	105.00 85.00-95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
5/8.....	.15	2.....	.55
3/4.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$55.00	\$24.50
1/4-in.—	60.00	27.00
		23.50

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$36.67-\$55.00	\$27.50
1/4-in.—	\$40.00-\$60.00	\$23.10-\$24.75
		\$25.20-\$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List Elbows, List

1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.60
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

Less than 2500 lb.	1/4 in. to 1/2 in.	3/4 in. to 3 in.
6%	8%	8%
2500 to 5000 lb.	9%	11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

Less than 2500 lb.	1/4 in. to 1/2 in.	3/4 in. to 3 in.
3.8%	5.8%	5.8%
2500-5000 lb.	6.8%	8.8%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price.....	\$5.00
Discount.....	30%

CHICAGO

List.....	\$5.00 to \$6.00
Discount.....	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	\$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	23%
1/5 to std. pkg.	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

Per 100 Net

Less than 1/5 std. pkg.	\$5.75
1/5 to std. pkg.	4.50
Standard package, 500.	List, each, \$0.07.

CHICAGO

Per 100 Net

Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500.	List, each, \$0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	\$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulbs, 3 1/8 in., frosted:		
15-watt—G 25	50	.50
25-watt—G 25	50	.50
40-watt—G 25	50	.50
Round bulbs, 3 1/8 in., frosted:		
60-watt—G 30	24	.72
Round bulbs, 4 1/8 in., frosted:		
100-watt—G 35	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

Per 1000 Ft. Net

Less than coil (250 ft.)	\$34.88
Coil to 1000 ft.	26.52

CHICAGO

Per 1000 Ft. Net

Less than coil (250 ft.)	\$36.88 to \$37.20
Coil to 1000 ft.	27.66 to 27.90

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	\$20.00 to \$29.00
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CHICAGO

Net per 100	\$14.58 to \$38.35
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OUTLET BOXES

Nos.	List, per 100.
101—A, A1 1/2, 4 S.C., 6200, 320	\$30.00
102—B.A., 6200 S.E., 300, A.X., 1 1/2, 4 S	30.00
103—C.A., 9, 4R, B 1 1/2	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list..	List	List
\$10.00 to \$50.00 list..	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list	40%	35%
\$10.00 to \$50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

Per 1000 Net

Less than 1/5 std. pkg.	\$20.00
1/5 to std. pkg.	15.00
Standard package, 2200.	List per 1000, \$20.

CHICAGO

Per 1000 Net

Less than 1/5 std. pkg.	\$15.80 to \$20.54
1/5 to std. pkg.	13.00 to 19.24
Standard package, 2200.	List per 1000, \$20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
	5 1/2 N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg.	\$24.30	
1/5 to std. pkg.	12.15	

CHICAGO

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
	5 1/2 N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg.	\$11.85 to \$18.00	\$20.75 to \$30.75
1/5 to std. pkg.	9.00 to 11.10	16.30 to 24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/8-in. cap key and push sockets	500	\$0.33
1/8-in. cap keyless socket	500	.30
1/8-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No. Fuse

High Grade:	List
30-amp. S. P. S. T.	\$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

Low Grade:

30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

Less than \$10 list	Plus 5% to 5%
\$10 to \$25 list	11% to 16%
\$25 to \$50 list	14% to 24%

DISCOUNT—CHICAGO

Less than \$10 list	5% to +5%
\$10 to \$25 list	11% to 16%
\$25 to \$50 list	14% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp., three-point	100	.54
10-amp., three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List to +20%
1/5 to std. pkg.	15% to list
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar	List, Each
No. 155	\$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list	List	..
\$2.00 to \$10.00 list	20%	..
\$10.00 to \$50.00 list	30%	..

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list	25% to 50%	15% to 40%
\$2.00 to \$10.00 list	25% to 50%	20% to 40%
\$10.00 to \$50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	\$6.00
Discount	30%

CHICAGO

List price	\$4.50 to \$5.00
Discount	20% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

No. 18, less than full spools	\$0.52
No. 18, full spools	0.48

CHICAGO

	Per Lb. Net
No. 18, less than full spools	\$0.64 to \$0.6885
No. 18, full spools	0.5285 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No.	18.00	\$14.00	\$11.25
14.....	27.93	23.94	19.85
10.....	39.20	33.60	28.00
8.....	55.44	47.52	39.60
6.....	87.78	75.24	62.70

CHICAGO

	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No.	18.00	\$16.00	\$14.00
14.....	23.24-28.63	21.30-24.54	19.52-22.50
10.....	34.44-40.28	29.82-34.44	27.34-31.57
8.....	48.84-49.91	42.18-44.77	38.67-47.77
6.....	70.24-78.95	63.85-66.72	57.47-61.16

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$40.25
25 to 50 lb.	39.25
50 to 100 lb.	38.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	\$41.85 to \$42.50
25 to 50 lb.	40.85 to 41.50
50 to 100 lb.	39.85 to 40.50

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Lighting Unit for Industrial Plants

The Luminous Unit Company of St. Louis, Mo., is placing on the market an industrial lighting unit, to be known by the trade-marked name of "Industrolite." The unit is composed of two essential elements, an upper reflector



GLARE WITHIN NORMAL RANGE OF VISION IS ELIMINATED

of white porcelain-enameled steel and a porcelain-enameled reflecting band which is suspended from the upper reflector in such position that it will intercept all light within the angles of 45 deg. and 85 deg. and direct it to the upper reflector for redirection to useful angles. In this manner glare within the normal range of vision is entirely eliminated, and this elimination is accomplished with very little loss in efficiency of the unit, it is claimed.

The arrangement of parts is such that all light is emitted below 90 deg., the distribution of light from the unit being more or less intensive, and the utilization efficiency therefore quite high.

Pilot-Lamp Receptacle and Plates

There is always need for pilot lamps to indicate whether or not heating devices or remote lamps are consuming energy. For this purpose the General Electric Company of Schenectady, N. Y., has a new line of pilot-lamp receptacles and flush plates.

The device consists of a standard-size flush plate in which is set a small



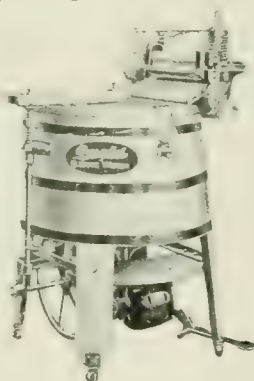
RECEPTACLE SHOWING PILOT LAMP

bull's-eye of ruby glass. Behind the bull's-eye is a receptacle equipped with a 2-cp., 125-volt candelabra-base lamp. When energy is being consumed on the circuit this lamp lights beneath the bull's-eye and shines through as a warning signal until the light is turned off. Combination plates can be fur-

nished so that this device can be used in connection with a push-button switch or with a push-button switch and "Standard" separable flush receptacle. These combinations are particularly desirable as the signal light is located at the point of current control.

Washing Machine with Corrugated Sides

The Arnold Electric Company of Racine, Wis., has developed an electric washer equipped with an Arnold 1/4-hp. motor. The inside of the tub of this washer is corrugated like a washboard. Wooden fingers gently take hold of the clothes and force them through soapy water and at the same time rub them on the washboard sides and bottom of the tub. The machine is equipped with a safety foot pedal which, it is pointed



MACHINE HAS SAFETY FOOT PEDAL

out, gives instant control of starting and stopping the wringer. This wringer can be used in three different positions. The tub is constructed of specially treated cypress wood that is not affected by water. This machine occupies a floor space of 24 sq. in. (154.8 sq. cm.).

Electric Ventilating Set

A small "conoidal" ventilating set for general air changing, blowing and exhausting purposes has been added to the products of the Buffalo Forge Company, Buffalo, N. Y. A multi-blade fan directly connected to an electric motor is used to furnish a large volume of air at a relatively low pressure. The manufacturer calls attention to the fact that because of its low speed the fan does not make an objectionable hum. The fan case may be swung around to discharge air in any desired direction. The outfit is equipped with a cord and attachment plug, ready for connection. Motors are furnished for 110 volts or 220 volts.

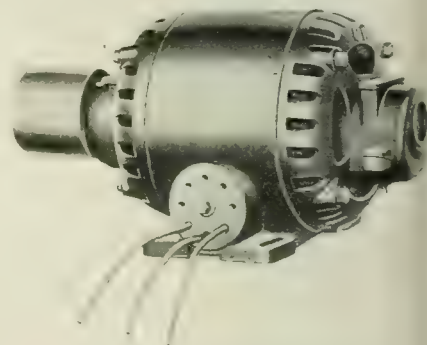
Electric Vacuum Cleaner

The Pnevuc Company of Worcester, Mass., announces an electric suction cleaner which embodies a belt-driven brush. A balanced motor is used, the eight-bladed suction fan being mounted at one end of the armature shaft and the worm-gear drive for the brush pulley at the other. For use with attachments the brush, which is mounted on impregnated wood bearings, can be thrown out of operation by a conveniently located lever. Comfortable control is provided in a thumb-switch on the handle. The motor is made by the Braun Electric Manufacturing Company. The machine weighs 11 lb. (4.1 kg.) and, the manufacturer points out, it is very easy to operate.

Small Squirrel-Cage Induction Motor

A line of induction motors has been recently placed on the market by the Crocker-Wheeler Company, Ampere, N. J. These motors, known as the C-W form P motors, are of the squirrel-cage type, ranging in size from 0.5 hp. to 3 hp., and are designed for constant-speed operation on 60-cycle polyphase circuits.

Good starting torque and high power factor are among the electrical features of these motors. Another feature is their efficient ventilation. A number of the rotor bars project for a short distance at each end of the rotor core. These projecting ends of the rotor bars serve as efficient fans. Attached to the inside of each of the bearing shields is a pressed-steel guide that separates the incoming from the outgoing air. Air is thus drawn into the motor at each end through open-



MOTOR HAS HIGH POWER FACTOR

ings near the shaft and then forced by the fans against the stator winding, around the ends, and finally out through the holes at the outer periphery of the shields. This construction

prevents the outgoing warm air from mixing with the air being drawn into the motor. A maximum cooling effect with a minimum of windage loss is thus obtained.

Strong insulation of the stator windings is obtained by placing the coils in well-insulated slots and impregnating the complete core and winding with a special varnish which renders them moisture-proof and enables them to withstand acid fumes. After the core and coils are removed from the impregnating tanks they are baked, once more dipped in varnish and again baked.

The bearings are large with oil grooves so placed that no matter in what direction the belt pull may be there will be a film of oil between the shaft and the bearing, thus reducing friction to a minimum. Dust and dirt are kept out of the bearings by sheet-metal caps at the ends and by self-closing oil-well covers.

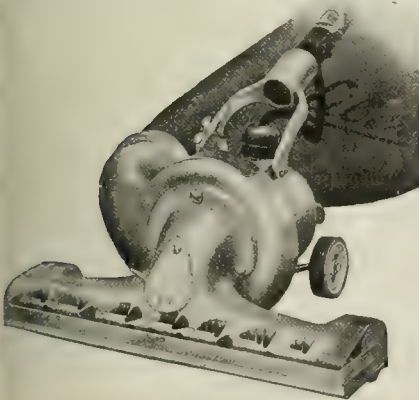
Slotted feet cast integral with the stator frame facilitate accurate belt-tension adjustment.

Motor-Driven Creamery for Home Use

The Minnetonka Company, Owatonna, Minn., has developed a butter-making and butter-working machine. It is equipped with a removable roll and basket which causes a thorough agitation of the cream, facilitating the work and permitting the finished butter to be lifted out in a solid mass. An adjusting feature of the basket permits working either a small or large quantity of butter by changing the distance between the rolls. These machines are made in various capacities and are equipped with motors supplied by the Emerson Manufacturing Company of St. Louis, Mo.

Electric Vacuum Cleaner

An electric vacuum cleaner to be known as No. 18 is announced by the Federal Sign System (Electric) of



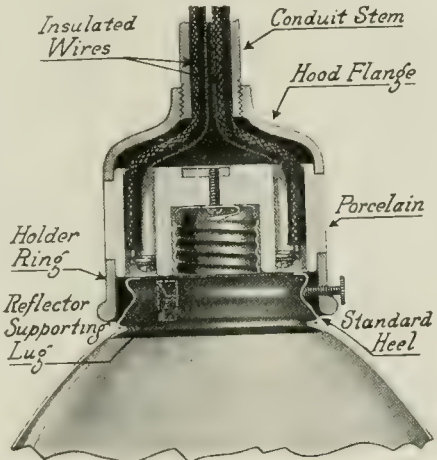
CLEANER HAS SIX-BLADE FAN

Chicago, Ill. A six-blade, one-piece aluminum fan is used which is mounted in the center of the armature shaft. The fan is machined so that it fits the fan housing with a clearance of

1/32 in. (0.8 mm.), and prevents dirt, string, hair, etc., from passing the baffleplate and injuring the motor. A straight floor brush is fastened to the outside front of the nozzle when it is desired to clean rugs or carpets which have a large amount of threads and lint to be removed. The universal type of motor which drives this machine is rated at 1/8 hp. at 10,000 r.p.m.

Holder Sockets for Standard Heel Reflectors

A device which combines a holder for standard-heel reflectors and a socket for tungsten lamps has recently been designed and placed on the market by the George Cutter Company of South Bend, Ind. The holder socket, as the device is called, is made in three different styles—with hood flange for attachment to 1/2-in. (1.27-cm.) conduit, with 4-in. (10-cm.) cover for attachment to outlet boxes, and with porcelain bushing for drop-cord suspension. It is also made in two sizes—for 2 1/4-in. (5.7-cm.) and 3 1/4-in. (8.4-cm.) standard-heel reflectors.



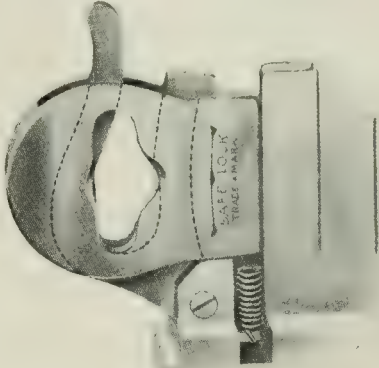
HOLDER SOCKET MADE IN THREE STYLES

The holder socket consists of a cast-iron ring which has two lugs and a thumb-screw for engaging the groove in the heel of the reflector. This ring is attached, by means of two screws, to a porcelain body which includes the socket shell and wiring terminals. The porcelain body is attached to a hood flange tapped for 1/2-in. (1.27-cm.) conduit or to a 4-in. (10-cm.) outlet-box cover by means of two screws which are independent of the screws which support the holder ring.

Lock-Type Disconnecting Switches

Disconnecting switches with locks that consist of a rugged latch member pivoted on the jaw clip end of the disconnecting switch, a spring, and attachment or extension to the blade, are being made by the Electrical Development & Machine Company of Philadelphia. The blade end is slotted to receive the pivoted latch member and

has an aperture for the switch hook. The nose of the hook readily passes through the larger part of the aperture, but only the shank of the hook can pass into the smaller part of the aperture. The latch hooks over the upper surface of the blade and locks the blade closed. In opening the switch the operator inserts the hook in the aperture and pulls upward just as if



SWITCH CANNOT BE CLOSED UNLESS HOOK IS IN APERTURE

there were no locks. This causes the shank of the hook to enter the upper small parts of the hole. In so doing the shank strikes the surface and rotates the pivoted latch member toward the left against the action of the spring. This causes the latch to swing beyond the edge of the upper surface and unlocks the switch. Continued pull on the hook removes the blade and opens the switch in an ordinary way. The pivoted latch member returns to its original position, but is prevented from moving further to the right by the stop on the pedestal. If, however, the operator attempts to remove the switch the latch bears on the driving surface, he will be unable to do so as long as the large part of the aperture is partly blanketed by the surface on the pivoted latch member. It is claimed that the switch hook cannot be removed during a considerable range of movement near the closed position until the blade is opened or entirely closed and locked. The operator cannot close the switch unless the switch hook is in the aperture.

Electric Range

The Standard Electric Stove Company of Toledo, Ohio, is now offering the trade an electric range that has an elevated oven and three hot plates. The oven is lined with aluminum and is equipped with a side-opening door with three glass panels. The two-oven elements are of the open type. The three hot plates measure 8.5 in. (21.59 cm.) each in diameter and are of the inclosed-element type. The control of the entire range is centered in a master switch. In addition to this each oven unit and each hot-plate unit is equipped with a multiple-temperature switch.

The size of the cooking surface is 20 in. by 29 in. (50.8 cm. by 73.6 cm.). The range complete occupies a 30-in. by 30-in. (76.2-cm. by 76.2-cm.) space.

Trade Notes

ROYAL CANFIELD PEABODY, president of the Combustion Engineering Corporation, New York, died Sept. 15.

D. R. SHEARER, formerly engineer of the Boone Fork (Tenn.) Lumber Company, will engage in the practice of engineering—hydroelectric, steam and automatic power plants—at Johnson City, Tenn.

M. W. HERRON, in addition to his own territory in the metropolitan district, has taken out the selling assignment of L. B. Valentine at the New York office of the National Metal Molding Company. Mr. Valentine is an officer at the cantonment near Anniston, Ala.

THE WESTINGHOUSE LAMP COMPANY, New York, put in operation on Sept. 1 a new factory at Trenton, N. J. It is equipped to produce 50,000 lamps, with an ultimate capacity of 75,000 daily. The new four-story building is 500 ft. by 80 ft., with an adjacent power house. This is the company's fourth plant.

THE POOLE ENGINEERING & MACHINE COMPANY, Baltimore, Md., has recently opened branch offices in Minneapolis, Minn., and Pittsburgh, Pa. The Minneapolis office is at 716 McKnight Building, in charge of R. L. Lunt, and the Pittsburgh office at 433 Union Arcade, in charge of J. P. Flippen.

THE MULTI-REFILLABLE FUSE COMPANY, Chicago, has opened a branch office at 120 Liberty Street, New York City, with James W. Morey in charge as Eastern sales manager. A liberal stock of both refillable and non-refillable fuses will be carried at this branch. Mr. Morey has been actively engaged in the electrical supply business for the last ten or twelve years and is widely acquainted in the Eastern territory.

THE NATIONAL LAMP WORKS have announced that their Northwestern branch plant, between St. Paul and Minneapolis, Minn., will be in full operation shortly after Jan. 1, 1918. Under normal conditions this factory will have a monthly output of a million to a million and a half lamps. Shipments are expected to begin about Dec. 1. Lamps of standard voltage range will be made by the Northwestern factory.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY has made a number of changes in its organization. F. H. Poss, formerly sales and advertising manager in the central district, has resigned to return to San Francisco, his former home, where he will take up the distribution of the Avery tractors in the West. G. B. Weber, who has been associated with the sales force of the Chicago office of the company for the last seven years, has been made sales manager, while P. A. Powers, who has been connected with the publicity department for the last three years, has been made advertising manager.

THE SANFORD RILEY STOKER COMPANY, LTD., of Worcester, Mass., has arranged for additional manufacturing facilities in Detroit, Mich., at the plant of the Murphy Iron Works. There will be no change in the management or policy of the latter. They will continue the manufacture of the Murphy automatic furnace, increasing their facilities as required for the production of Riley stokers. R. Sanford Riley, Worcester, has been elected president of the Murphy company. The B. F. Sturtevant Company, Hyde Park, Mass., will continue to manufacture and act as selling agent for the Sanford Riley Stoker Company.

THE WORTHINGTON PUMP & MACHINERY CORPORATION announces the opening of a new branch sales office in the American Trust and Savings Bank Building, Birmingham, Ala., to take care of a portion of the very large territory hitherto controlled by the Atlanta office. Edward Staufferman, formerly with the Atlanta office, will be in charge of the Birmingham office as manager. The territory controlled by the Birmingham office will be most of Alabama and Florida and part of Georgia, North and South Carolina and that portion of Georgia north of the Seaboard Air Line will continue to be served by the Atlanta office under the management of A. W. Jones.

THE A/S NORSKE ELEKBROVERKA, Frederikstad, Norway, is erecting a new plant for the manufacture of electrodes, with a yearly capacity of 1000 tons of graphite electrodes and 4000 tons of carbon electrodes. About Dec. 1 the factory is expected to be in operation. American engineers and machinery experts will conduct the work of the factory, in which American machinery is to be used almost exclusively. It is understood that the same general

standards and sizes of electrodes are to be manufactured as those used in the United States, while the carbons will run in very large sizes, most of them being in the shape of squares, after a European method and style, the most common size being 15% in. by 7 1/2 in. Carbon will be the first product turned out. It is stated that the plant will be operated in co-operation with the Norwegian government, which will have the first call on its finished goods when required for governmental uses.

Trade Publications

FUSE AND SWITCH BOX.—W. N. Matthews & Brother, Inc., St. Louis, Mo., is distributing a mailer descriptive of its "Fuse-switch."

WASHING MACHINES.—The Crystal Washing Machine Company, Detroit, Mich., has prepared a bulletin descriptive of its new washing machine.

FLUID GAGE.—The Coats Machine Tool Company, Inc., 30 Church Street, New York City, has prepared a bulletin descriptive of its Prestwich fluid gage.

FIRE EXTINGUISHER.—The fire gun is illustrated and described in the leaflet now being distributed by the Fire Gun Manufacturing Company, 17 Battery Place, New York City.

ELECTRICAL SUPPLIES.—Julius Andrae & Sons Company, Milwaukee, Wis., has prepared its fall bulletin and supplement to catalog No. 112, descriptive of automobile, bicycle and gas-engine supplies.

INDUCTION MOTORS.—Bulletin No. 182, descriptive of form P induction motors for two-phase and three-phase squirrel-cage type, 60-cycle, made in sizes of 1/2 hp. to 3 hp., is being issued by the Crocker-Wheeler Company of Ampere, N. J.

PUMPS.—The Worthington Pump & Machinery Corporation, sales agent for Henry R. Worthington, 115 Broadway, New York City, is distributing bulletin W-400, descriptive of the Worthington outside-packed plunger pattern pump designed for general service.

SPRINKLER SYSTEM.—"The Pursuit of Safety" is the title of a new bulletin now being distributed by the Automatic Sprinkler Company of America, 123 William Street, New York City. This bulletin gives photographs of fires where the sprinkler system was installed, besides illustrations showing modern structures and rebuilt structures equipped with fire extinguishers.

REFLECTORS.—The National X-Ray Receptor Company of Chicago and New York is distributing its September issue of *Eye Comfort*, published to aid advocates of good lighting. This number includes pages on available X-ray literature, helping the merchant, service in store lighting, photographs of recent industrial installations of X-ray lighting, correct lighting for bank cases, etc.

DISCONNECTING SWITCHES.—The Lewis & Roth Company, Philadelphia, has prepared bulletin No. 21, descriptive of its electric switches. This bulletin is said to be the most complete ever issued for this line of apparatus, 1013 combinations of disconnecting switches being listed. The book shows care in preparation and contains sixty pages of useful information. The arrangement is orderly, eliminating need for hunting for wanted items. This company has also prepared bulletin No. 20, descriptive of its switchboard and structural devices and fittings. This list contains a complete outline of drawings, weights, catalog numbers etc., which are necessary in the proper selection of materials.

BUREAU OF MINES.—The following bulletins and technical papers have been issued by the Bureau of Mines: Bulletin 120, on extraction of gasoline from natural gas by absorption on methods, by G. A. Burrell, P. M. Biddison and G. G. Oberfell; bulletin 138, on coking of Illinois coals, by F. K. Ovtz; technical paper 147, on absorption of methane and other gases by coal, by S. H. Katz; technical paper 149, containing answers to questions on the flotation of ores, by O. W. Ralston; technical paper 150, on the limits of complete inflammability of mixtures of mine gases and of industrial gases with air, by G. A. Burrell and A. W. Gauger; technical paper 156, on carbon monoxide poisoning in the steel industry, by J. A. Watkins; technical paper 169, on permissible explosives tested prior to March 1, 1917, by S. P. Howell. Applications should be addressed to the director of the Bureau of Mines, Washington, D. C.

New Incorporations

THE POWER TRANSMITTING COMPANY of Peoria, Ill., has been incorporated with a capital stock of \$200,000 by H. H. White, Emil Kramer and R. V. Ralph.

THE MISSOURI WATER POWER & ELECTRIC COMPANY of Lebanon, Mo., has been incorporated with a capital stock of \$300,000 by J. C. Settle, S. R. Price, Guy R. Stanton and J. B. Quigley.

THE CAPITAL ELECTRIC LIGHT COMPANY, New York, has been incorporated by S. and M. Siegel and S. Eisenberg, 356 Miller Avenue, Brooklyn, to manufacture electric lamps.

THE C. & C. ELECTRIC CONSTRUCTION & SALES COMPANY of Cleveland, Ohio, has been incorporated with a capital stock of \$10,000. The incorporators are: F. L. Stevens and F. M. Cerny.

THE VICO SUPPLY COMPANY of New York, N. Y., has been incorporated with a capital stock of \$10,000 by William H. Vidor, George A. Paine and Henry Brill. The company proposes to deal in electrical supplies.

THE UNIVERSAL ELECTRIC CONECTOR COMPANY of Los Angeles, Cal., has been incorporated with a capital stock of \$20,000 by R. H. Holabird, L. O. Lieber, E. W. Maxson, R. C. Hamlin and H. G. Holabird.

THE ROEDDING SIGNAL TAIL LIGHT COMPANY of Detroit, Mich., has filed articles of incorporation with a capital stock of \$10,000. The incorporators are: Gordon E. Roedding, Edward B. Roedding and Clarence E. Lehr.

THE RELIABLE STORAGE BATTERY MANUFACTURING COMPANY of Los Angeles, Cal., has been organized to operate a plant at 743 North Main Street, Los Angeles. C. V. Graham, 1200 East Main Street, Alhambra, is the promoter of the concern.

THE LUND & WEISS COMPANY of East Orange, N. J., has been incorporated by Edward P. Lund, Arthur J. Weiss and Frank Tunstead of East Orange, N. J. The company is capitalized at \$10,000 and it is its intention to engage in the manufacture of motors.

THE RYDER (N. D.) ELECTRIC LIGHT COMPANY has been organized with a capital stock of \$10,000 to furnish electricity in Ryder. The officers are: B. A. Dickinson, president; C. A. Aafedt, vice-president; S. A. Olsen, secretary, and Aleck Haraldson, treasurer.

THE STANDARD IGNITION COMPANY of Elkhart, Ind., has been chartered with a capital stock of \$200,000 by Andrew H. Beardsley, Martin E. Crow, William H. Foster, John F. O. Stratton and Edward B. Zigler. The company proposes to manufacture magnetos, parts and electrical devices.

THE CANADIAN COIL COMPANY of Walkerville, Ont., has been incorporated with a capital stock of \$40,000 to manufacture spark and ignition coils, electrical goods, etc. The incorporators are: Carlos C. Cleverdon, Frank Nauta, Harry E. Westerdale and others, all of Detroit, Mich.

THE IMPROVED SIGN COMPANY of New York, N. Y., has been chartered by F. M. Whittemore, H. S. Williams and B. Riesner, 550 West 144th Street, New York, N. Y. The company is capitalized at \$100,000 and proposes to manufacture electric signs and to do general electrical business.

THE HERBERTS ENGINEERING COMPANY, 10 East Forty-third Street, New York City, has been incorporated with a capital stock of \$100,000. H. J. Herberts is president and general manager. The company proposes to make the "Selfast," a device to display goods, to develop sales ideas, exhibitions, etc.

THE BARDSELY-RILEY ELECTRIC COMPANY of Newport, R. I., has been organized by Charles E. Bardsley and Henry G. Riley. The company will take over the machine shop of the late George S. Slocum on Prospect Hill Street and will do a general electrical construction business and deal in electrical supplies, etc.

THE UNION POWER & LIGHT COMPANY of Omaha, Neb., has been incorporated with a capital stock of \$2,000,000. The company owns and runs twelve electric-light and power plants in Nebraska, Iowa and South Dakota. The officers are: W. B. Roberts, president; Willis Todd, vice-president, and Charles T. Kountze, treasurer.

New England States

BOSTON, MASS.—Contract has been awarded by C. E. Cotting, Barristers' Hall, to the Walter H. Preble Company, 11 Pemberton Square, Boston, for the construction of a one-story transformer station, 20 ft. by 55 ft.

BOSTON, MASS.—The Crosby Steam Gauge & Valve Company has awarded a contract for the construction of an addition, 25 ft. by 40 ft., to the boiler house at its plant at 38 Central Street, to the North East Concrete Construction Company, 201 Devonshire Street, Boston.

BOSTON, MASS.—The Bay State Street Railway Company is installing a new turbo-generating set in the new addition to its Quincy power house. It expected to have the unit in operation about Nov. 1, at which time the company expects to furnish about 3000 hp. to the Fore River Shipbuilding Corporation, to be used in building government war vessels. The Legislature has given the Bay State Street Railway Company a special permit to furnish this power during the construction of these ships.

SPRINGFIELD, MASS.—Contract has been awarded by the Gilbert & Barker Manufacturing Company for construction of a power house, 57 ft. by 93 ft.

BRIDGEPORT, CONN.—Contract has been awarded by A. & E. Henkels, Connecticut Avenue, for the construction of a new power house, 47 ft. by 82 ft., at their lace manufacturing plant.

NEW BRITAIN, CONN.—The Corbin Cabinet Lock Company has applied for permission to erect feed w.res from the north-west part of the company's plant to the P. & F. Corbin power house.

Middle Atlantic States

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company has been awarded a contract for furnishing electricity to the proposed new plant of the Hires Condensing Company of Philadelphia, Pa. The plant, which will be erected north of the city, will require energy to the amount of 250 hp.

BROOKLYN, N. Y.—Plans are being prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a new power plant at the local naval hospital.

BUFFALO, N. Y.—Plans have been filed by the International Railway Company for the erection of a new substation at 285 Military Road, to cost about \$7,000.

BUFFALO, N. Y.—The board of managers has awarded the contract for the installation of lighting fixtures, equipment, etc., in the new city hospital to the Robertson-Catacart Electric Company, 151 Mohawk Street, at \$20,968.

FULTON, N. Y.—Plans have been prepared by Sackett & Park, 34 Syracuse Savings Bank Building, Syracuse, for the construction of a new engine house, 35 ft. by 40 ft., for the Volney Paper Company in Fulton.

ITHACA, N. Y.—The Cayuga Power Corporation is considering the construction of an addition to the power plant at its Portland Point works, to cost about \$15,000.

LOCKPORT, N. Y.—The United Paper Board Company, 171 Madison Avenue, New York, N. Y., has awarded a contract to Curran & Swartout, Granite Building, Rochester, for the construction of a new power house, 35 ft. by 100 ft., at its local plant.

NEW YORK, N. Y.—The construction of a substation at 351 East 139th Street to serve the Bronx division of the Lexington Avenue subway, which will run east through 138th Street to the Southern Boulevard, is under consideration by the Interborough Rapid Transit Company.

ROCHESTER, N. Y.—Plans are being prepared by the Rochester Railway & Light Company for the erection of a substation, 51 ft. by 30 ft., for the Anderson-Symington plant in University Avenue. The plant is being erected under the direction of the government for the manufacture of field pieces and will require a large amount of electrical energy. Electricity will be supplied at 11,000 volts.

UTICA, N. Y.—The Mutual Box Board Company is planning to build an addition to its power house, 25 ft. by 25 ft., one story, at 1532 Erie Street. Contract has been awarded to the John F. Hughes Construction Company, 200 Post Street, Utica, N. Y.

BORDENTOWN, N. J.—Plans are being considered by the City Commission for the

Construction

News of Projects, Plans, B'ds and Contracts. Notes on Work Under Way

construction of a municipal electric-lighting plant near Mile Hollow.

NEWARK, N. J.—New stoker equipment will be installed at once at the Point-nopoint power plant of the Public Service Electric Company. The cost is estimated at about \$50,000.

NEWARK, N. J.—The Public Utility Commission has approved the application of the Public Service Electric Company for permission to issue \$5,000,000 in capital stock, the proceeds to be used for general improvements.

PERTH AMBOY, N. J.—Plans have been filed by the Lehigh Valley Railroad Company, 143 Liberty Street, New York, N. Y., for the construction of an addition, 50 ft. by 120 ft., to the power house at its local plant. Contract has been awarded to George W. Rogers & Company, 29 Broadway, New York, N. Y.

PERTH AMBOY, N. J.—Arrangements are being made by the Board of Aldermen for the installation of a new transformer and generating equipment at the local plant. Contract has been awarded to the Watson Flagg Engineering Company, 120 Liberty Street, New York, N. Y., for the installation of a new underground commercial lighting system, at a cost of \$32,545.

PLAINFIELD, N. J.—Contract has been awarded by the Niles-Bement-Pond Tool Company of New York, N. Y., to H. E. Baton of Philadelphia, Pa., for the construction of a power house, 90 ft. by 110 ft., on South Second Street, to cost about \$15,000. When completed the plant will furnish power to operate the entire plant.

SALEM, N. J.—Bids will be received by W. A. W. Grier, Mayor, Salem, until Oct. 22 for furnishing and installing one 150,000-gal. electric motor-driven centrifugal pumping unit on concrete foundations. Specifications and further information may be obtained at the office of William H. Boardman, engineer, 426 Walnut Street, Philadelphia, Pa., or at the office of the water superintendent, Salem.

TRENTON, N. J.—Plans have been prepared by J. O. Hunt, 114 North Montgomery Street, Trenton, for the construction of a two-story addition, 30 ft. by 45 ft., to the power house of the Delion Tire & Rubber Company.

GROVE CITY, PA.—Plans have been prepared by the Grove City Creamery Company for an addition to its power plant. K. E. Parks, Thirteenth and B Streets, S. W., Washington, D. C., is engineer.

HARRISBURG, PA.—Contract has been awarded by the Harrisburg Railway Company for the construction of a new substation, 32 ft. by 43 ft., at Marion and Reilly Streets, to the Central Construction Company.

PHILADELPHIA, PA.—The Quaker City Rubber Company has awarded Barclay, White & Company a contract for the construction of a power plant to be erected at the corner of Comly and Milnor Streets, to cost about \$5,000.

PHILADELPHIA, PA.—Plans have been prepared by Charles Casper, 925 Chestnut Street, Philadelphia, for the construction of a new boiler house, 44 ft. by 50 ft., for F. A. Poth & Sons, Inc., at Thirty-first and Jefferson Streets, to cost about \$75,000.

PHILADELPHIA, PA.—The Department of Health and Charities has awarded the Standard Construction Company, Drexel Building, the contract for the construction of a power house at Thirty-fourth and Pine Streets for the Philadelphia General Hospital, at \$238,600. Philip H. Johnson is architect.

SCRANTON, PA.—Plans are being prepared by Duckworth Brothers, Coal Exchange Building, Scranton, for a new brick, steel and reinforced concrete power house, about 32 ft. by 42 ft., for the Mac-car Truck Company.

DANVILLE, VA.—The installation of electric lamps in many of the residences of the mill village is under consideration by the Dan River & Riverside Cotton Mills.

RICHMOND, VA.—Plans are being considered by the Virginia Railway & Power Company for the construction of a substation, to cost about \$2,500.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington,

D. C., for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 1502—one directly connected, centrifugal salt water circulating pump; Schedule 1505—4000 ft. armored interior communication cable, 9000 ft. covered, single bell cord, 20,000 ft. copper conducting cord, 75,000 ft. silicon bronze aerial wire; Schedule 1504—150,000 ft. rubber insulated, lead-covered wire, 77,000 ft. rubber-covered, stranded, single-conductor wire, 125,000 ft. twisted telephone wire. Puget Sound, Wash., Schedule 1503—13,500 ft. leaded and armored interior communication cable, 200,000 ft. plain bell wire, 36,000 ft. single-conductor lighting and power wire. F. o. b., Schedule 1506—150,000 ignition caliber major fuses. Boston, Mass., Schedule 1497—one motor-driven 5-ft. plain radial drill, one 16-in. by 8-ft. quick change, motor-driven engine lathe, two motor-driven, 4-ft., radial-drilling semi-universal machines, one 24-in. by 24-in. by 6-ft. planer, with reversing motor drive, one 30-in. by 30-in. by 10-ft. planer with reversing motor drive, one 42-in. by 42-in. by 12-ft. planer with reversing motor drive, one 96-in. by 96-in. by 24 ft. planer with reversing motor drive. Application for proposal blanks should designate the schedule desired by number.

North Central States

DETROIT, MICH.—Contracts have been awarded for the construction of a two-story power house at Third and York Avenues for the Burroughs Adding Machine Company.

HANCOCK, MICH.—The Council is considering the removal of poles from Railroad Avenue and the substitution of iron standards on this thoroughfare.

TRAVERSE CITY, MICH.—The spillway at the lower dam of the Boardman River Light & Power Company was dynamited on Sept. 27, causing a loss of about \$50,000.

AKRON, OHIO.—The County Commissioners have awarded the contract for construction of a power plant at the County Infirmary to the H. P. Moran Company, general contractors on the county infirmary buildings, at \$6,800.

BUCYRUS, OHIO.—The City Council has approved the report of the lighting committee authorizing the installation of 13 additional arc lamps to be placed at various points in the city.

CALEDONIA, OHIO.—At an election to be held Oct. 9 the proposal to issue \$10,000 in bonds for the purpose of erecting an electric transmission line to Marion will be submitted to the voters.

CANTON, OHIO.—The board of education will award contract for wiring the new high school building as soon as arrangements have been made for securing funds for the work. The cost is estimated at \$32,000. Conduits for wiring have already been installed at a cost of \$8,000.

CINCINNATI, OHIO.—The National Lead Company has been granted a permit for the construction of a concrete and brick power plant at its local plant, to cost about \$45,000.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until Oct. 11 for one turbine reduction-gear-driven centrifugal pumping unit for the Fairmount pumping station. Copies of specifications may be obtained at the office of the commissioner of water.

COVINGTON, KY.—Bids will be received at the office of the city recorder, Covington, until Nov. 30 for a franchise to construct and operate an electric-light and power plant for a period of 20 years in Covington.

LOUISVILLE, KY.—Bids will be received at the United States Engineer office, Louisville, Ky., until Oct. 31 for construction of power house at Lock No. 41, Ohio River. Further information may be obtained upon application.

MOUNT VERNON, IND.—The capital stock of the Mount Vernon Electric Light & Power Company has been increased from \$50,000 to \$100,000.

CHICAGO, ILL.—The Apex Electric Manufacturing Company 1410 West Fifty-ninth Street, Chicago, is asking for bids for the construction of a factory, 115 ft. by 123 ft., one story, at West Fifty-ninth and Bishop Streets, to cost about \$25,000.

CHICAGO, ILL.—The Chicago, Milwaukee & St. Paul Railway Company is planning to erect a substation at Tacoma Junction, to cost about \$160,000, in connection with equipping its railroad between Othello, Seattle and Tacoma for electrical operation.

EAST MOLINE, ILL.—Extensive improvements will be made to the system of

the Central Union Telephone Company in East Moline.

BELOIT, WIS.—The City Council has engaged Arthur J. Sweet, consulting engineer, Palace Theater Building, Milwaukee, Wis., to prepare plans for an ornamental street-lighting system, consisting of 105 standards mounted with single lamps of 250 cp.

LADYSMITH, WIS.—The proposal to purchase the electric plant of the Ladysmith Lighting Company, to be owned and operated by the municipality, will soon be submitted to the voters.

STEVENS POINT, WIS.—Frank A. Vaughn, consulting engineer, Milwaukee, has been engaged to prepare plans and take bids for the construction of an ornamental street-lighting system. The plans provide for 120 lamps of 100 cp., 80 of 250 cp., 10 of 400 cp. and one of 600 cp.

ANOKA, MINN.—The Boettger Electric Company of St. Paul has been awarded the contract for electrical work on the new chapel and gymnasium at the Anoka State Hospital, at \$5,040.

WILLMAR, MINN.—The contract for power plant improvements at the Willmar State Hospital has been awarded to J. G. Robertson of St. Paul, at \$15,403.

BONESTEEL, S. D.—Arrangements are being made by the city of Bonesteel for the installation of a municipal electric-lighting system, to cost about \$15,000, and extensions to water-works system, to cost about \$14,000, for which bids have already been received. The Electrical Development Company, 803 Frances Building, Sioux City, Iowa, has charge of the engineering work.

GROTON, S. D.—The plant of the Groton Power & Light Company is reported to have been destroyed by fire on Sept. 15, causing a loss of about \$15,000.

ORD, NEB.—Bids will be received by the city of Ord until Oct. 11 for station equipment and distribution system, in connection with the proposed municipal electric-light plant, to cost about \$30,000. The Electrical Development Company, 803 Frances Building, Sioux City, Iowa, has charge of the engineering work.

ABILENE, KAN.—Bids will be received by the Board of Education of Abilene until Oct. 24, for the construction of a high school building, including general contract, plumbing, heating and electric wiring. The cost of the building is estimated at about \$90,000. Copies of plans and specifications may be obtained at the office of William H. Saylor, Gumbel Building, Kansas City, Mo., upon deposit of \$25.

GRENOLA, KAN.—Contracts have been awarded for improvements to the municipal electric-light plant as follows: For construction work to the Connor Construction Company; engine generator, switchboard and storage battery to the Challenge Company, and for poles to the Naugle Pole & Timber Company, all of Kansas City, Mo.

KANSAS CITY, KAN.—All bids submitted on Sept. 25 on three 100-kva, 13,200/6600-volt, outdoor type, single-phase, 60-cycle, oil-cooled transformers have been rejected by the city. New bids, it is understood, will soon be asked for.

Southern States

LAKE VIEW, N. C.—The capital stock of the Electric Light & Power Company has been increased from \$25,000 to \$75,000.

AUGUSTA, GA.—Arrangements have been made by the Augusta-Aiken Railway & Electric Corporation for the erection of a new electric transmission line through Druid Park Avenue to connect its lines at Summerville and Monte Sano.

MURRAY, GA.—Bonds to the amount of \$20,000 have been issued for the installation of a municipal electric-light and power plant and water-works system.

SAVANNAH, GA.—The Savannah Electric Company is contemplating the construction of a street car line to Port Wentworth.

JACKSONVILLE, FLA.—The Jacksonville Traction Company is considering the question of extending its street railway system to the quartermaster's camp at Black Point.

JACKSONVILLE, FLA.—The City Commissioners are contemplating extending the electric-light and power transmission lines from Jacksonville to the State Camp. The cost is estimated at \$19,000.

NASHVILLE, TENN.—The City Commissioners are considering plans for the installation of a new police-alarm system and other improvements. Arrangements are being made for an issue of \$25,000 in bonds.

LUMBERTON, MISS.—The city of Lumberton has engaged X. A. Kramer of Magnolia, consulting engineer, to prepare plans for improvements to the municipal power plant, for which \$12,000 in bonds have been authorized.

MONROE, LA.—The Vicksburg, Shreveport & Pacific Railroad Company is planning to erect a number of buildings at its local plant, to include blacksmith shop, 60 ft. by 120 ft.; seven-stall addition to round-house; machine shop, 97 ft. by 120 ft. Electrically-driven machinery will be installed, including overhead crane, locomotive hoist, etc. The cost of the entire work is estimated at \$100,000. The Arnold Engineering Company of Chicago, Ill., will have charge of the work.

OKLAHOMA CITY, OKLA.—The contract for electric wiring, etc., in the new Young Men's Christian Association building has been awarded to Arnold & Wetherbee, 116 North Broadway, Oklahoma City, at \$5,199. D. J. Johnson is secretary of building commission.

WAPANUCKA, OKLA.—Improvements are contemplated to the municipal electric-light plant, to cost about \$6,000.

ABILENE, TEX.—Plans are being prepared by the Fulwiler Electric Company for building a Ford agency on North Second Street, 90 ft. by 90 ft. A repair shop will be installed in connection with the proposed building.

CARLSBAD, TEX.—The contract for mechanical equipment, including plumbing, heating and electric wiring, for the State Tuberculosis Sanatorium at Carlsbad, has been awarded to the Bollinger-Petty Company of San Angelo, at \$47,295.

SAN ANTONIO, TEX.—Contract has been awarded by the Southern Ice & Cold Storage Company of San Antonio to the York Manufacturing Company of York, Pa., for the construction of an ice manufacturing factory with a daily capacity of 165 tons.

Pacific and Mountain States

BREMERTON, WASH.—At an election held recently the proposal to purchase the local electric-light plant, to be owned and operated by the municipality, was defeated.

EDMONDS, WASH.—The Washington Coast Utilities Company of Arlington, recently granted a franchise in Edmonds, will begin at once the installation of the local system. The distribution system now in use will practically be rebuilt and arrangements will be made to provide for considerable new business, which will include several small industrial plants.

SEATTLE, WASH.—The American Nitrogen Products Company of Seattle has begun work on the development of its power project in Snohomish County. The company proposes to build a large power plant for the nitrogen products plant along lines established by the company at La Grande. Surveys have been completed by the company for a railroad from the Whitechuck to Red Mountain, a distance of 18 miles; also from Barlow Pass, on the Monte Cristo line, reaching power sites on the north and south sides of the Sauk River.

TACOMA, WASH.—The City Council has passed a resolution providing for the installation of ornamental street lamps in South Tacoma along Union Avenue. It is proposed to do this work this fall.

BAKER, ORE.—A 66,000-volt transmission line is to be erected from Robinette to Halfway, a distance of 12 miles, for the purpose of supplying a minimum of 200 hp. to the Cornucopia (Ore.) Mines Company. A substation will be erected in Halfway and also a distribution system to furnish electricity for lamps and motors in that community. The cost of the work is estimated at about \$30,000.

BURNS, ORE.—E. T. Brusselle has applied to the City Council for a franchise to install and operate an electric-light and power system in Burns. Arrangements, it is understood, are under way for construction of the proposed plant.

THE DALLES, ORE.—Plans have been prepared by Malcom Moody of The Dalles for the construction of a large hydroelectric power project, including dam and power house, on the Deschutes River, near here.

EUREKA, CAL.—Arrangements have been completed by the Western States Gas & Electric Company whereby the Eureka division will secure 1000 kw. of electrical energy from the Northern California Power Company. This will enable the Western States Gas & Electric Company to close down its local steam generating plant.

FRESNO, CAL.—The San Joaquin Light & Power Company has filed a petition with the State Railroad Commission for permis-

sion to operate an electric system in Mariposa County, under a franchise granted by the county. The San Joaquin company has purchased the generating plant and distribution system of the Mercer Stone Company in Mariposa County, and proposes to extend its service to the mines and farms in that vicinity.

LOS ANGELES, CAL.—The City Council has adopted the ordinance providing for a new lighting system on Broadway, from the Tunnel to Tenth Street, for which plans have been prepared by William D'Arcy Ryan, of New York, N. Y., chief illuminating engineer of the General Electric Company. The lamps will be similar to those installed in the "path of gold" along Market Street, San Francisco.

RIVERSIDE, CAL.—Ordinances have been passed by the Board of Public Utilities approving the lighting system proposed for Jurupa Avenue, Eleventh and Mulberry Streets.

SANTA ANA, CAL.—An election will be held Oct. 11 to vote on the proposed Tustin lighting district in Orange County.

SAN FRANCISCO, CAL.—The cost of completing the lighting system for the San Francisco Civic Center is estimated by the Bureau of Architecture at about \$30,000.

SAN FRANCISCO, CAL.—Bids have been asked by the Board of Public Works for the installation of electrical yard work in connection with the northeastern wing of the San Francisco Hospital.

SAN FRANCISCO, CAL.—The Great Western Power Company of San Francisco is contemplating the erection of an electric-transmission line from Vermont station, near Talymerville, to the Walker mine, via Genesee mine in Genesee Valley, a distance of 16 miles.

HAILEY, IDAHO.—The City Council will soon call an election to submit the proposal to construct an electric-light plant to the voters. A preliminary survey for a proposed site and the pipe line has been made by Joseph Vernon, civil engineer, who has prepared estimates of cost and filed the necessary papers with the State Engineer to hold the proposed site. The cost of building the proposed power plant and waterworks system complete is estimated at \$90,000. The plans provide a development of 450 hp.

SALT LAKE CITY, UTAH.—The Salt Lake & Utah Railroad Company, it is reported, contemplates the construction of an extension from Salt Lake City to Eureka.

OATMAN, ARIZ.—An electric transmission line will be erected to the gold ore mine in Oatman and complete electrical equipment will be installed.

TROY, MONT.—The Kootenai Light & Power Company, it is reported, has entered into a contract with the Snowstorm Mining Company by which the latter will furnish electricity for lamps and motors in Troy under a franchise granted by the Council last June. Work will begin on the installation at once.

Canada

TORONTO, ONT.—Work has begun on the construction of a new substation at Ninth Street and Birmingham Avenue, New Toronto for the distribution of energy from the system of the Hydro-Electric Power Commission. The cost of the building with equipment is estimated at about \$80,000.

TORONTO, ONT.—Surveys are being made by the Toronto & York Radial Railway Company along the lake shore of Toronto with a view of making extensive improvements. Plans are being considered for either moving the present power plant at the Humber River to New Toronto or the establishment of a new plant at Port Credit. Charles Johnston, engineer, and J. F. Deadey, superintendent of the company, have charge of the survey.

YAMASKA, QUE.—The Miner Rubber Company of Yamaska River is contemplating the construction of a power house to cost about \$5,000.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Oct. 18 for furnishing steel, nickel, chrome steel castings, copper tubing, lead pipe, storage batteries, hand pumps, etc. Blanks and further information relating to this circular (No. 1172) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co. Annual meeting, Birmingham, Ala., Oct. 23, 1917.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, A. H. Krom, 29 South La Salle St., Chicago, Ill.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York. Annual meeting, Oct. 9, 1917.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City. Annual meeting, Jan. 14, 1918.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio. Annual meeting, Pittsburgh, Dec. 27-29, 1917.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary-treasurer, Roy B. Fowles, Pine Bluff, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, George C. Holberton, San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, McKeesport, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreuetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, W. L. Connelly, Gibson, Ind.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, R. B. W. Pirie, 406 Yorkshire Building Vancouver, B. C.

CALIFORNIA ASSOCIATION OF CONTRACTORS AND DEALERS. Secretary, James W. Redpath, 505 Rialto Bldg., San Francisco, Cal.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, Alan Sullivan, Excelsior Life Building, Toronto, Can.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, F. D. Beardslee, Union Electric Light & Power Company, St. Louis, Mo.

EASTERN NEW YORK SECTION, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Company, Schenectady, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF CONNECTICUT. Secretary, George M. Chapman, Waterbury, Conn. Annual meeting, New Haven, Conn., May, 1918.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, J. E. Wilson, 263 Summer Street, Boston, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo. Annual meeting, Jan. 19, 1918.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF PENNSYLVANIA. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, J. C. Staff, 578 Jackson St., Milwaukee, Wis.

ELECTRICAL DEALERS AND CONTRACTORS' ASSOCIATION OF ONTARIO. Secretary, E. E. Drury, 45 Murray St., Toronto, Can.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, H. B. Crouse, Crouse-Hinds Co., Syracuse, N. Y.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavelay, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert E. Elliott, 34 Ellis St., San Francisco, Cal.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Affiliated with the N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

EMPIRE STATE GAS AND ELECTRIC ASSO-

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CIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, L. W. W. Morrow, Norman, Okla. Annual meeting May, 1918, Oklahoma City.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, Dan Carey, Atlanta Builders' Exchange, Atlanta, Ga.

ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, L. B. Van Nuys, Central Electric Co., Peoria, Ill. Annual meeting Chicago, January, 1918.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, R. H. Abbott, Petersburg, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skillman, Indianapolis, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 111 Broadway, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre 28 Victoria St., Westminster, London, S. W., England.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

IOWA SECTION, N. E. L. A. Secretary-treasurer, L. E. Caldwell, Iowa City, Iowa.

JOVIAN ORDER. Jupiter (president), Henry L. Doherty, New York City; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo. Annual convention, Oct. 22-23, New York.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, R. M. Sutton, Wichita.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan. Annual meeting, Salina, Kan., Oct. 19 and 20, 1917.

KENTUCKY ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, F. F. Valinoti, Louisville, Ky. Annual meeting May, 1918, Louisville, Ky.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 323 Chartres St., New Orleans, La.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Augusta, Me.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Monroe, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, H. E. Young, Minneapolis General Electric Company, Minneapolis, Minn.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, G. M. Jones, 112 South Seventh St., Minneapolis, Minn. Annual convention, Jan. 20, 1918, Minneapolis, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary-treasurer, W. F. Wheeler, Hattiesburg, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass. Annual convention, New York, March, 1918.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, H. C. Brown, 41 Martin Building,

Utica, N. Y. Next meeting, New Orleans, Oct. 10-13, 1917, New Orleans, La.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343-1349 Marquette Build'g, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass. Biennial meeting, Oct. 23 and 24, New York.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. P. Egan, Room 201, Union Pacific Building, Omaha, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York. Annual meeting June, 1918.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NORTHWEST SECTION, N. E. L. A. Secretary, J. F. Farquhar, Washington Water Power Company, Spokane, Wash.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, R. N. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus. Annual meeting, Columbus, Ohio, Nov. 15, 1917.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary-treasurer, J. W. Oberender, 301 Dekum Building, Portland, Ore.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, Crossley Building, San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davison, West Virginia Water & Electric Co., Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 152 Beech St., Yonkers, N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa. Annual meeting, Evanston, Ill., June, 1918.

SOUTH DAKOTA ELECTRICAL POWER ASSOCIATION. Secretary-treasurer, Frederick D. Brown, Huron, S. D.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, Thomas W. Peters, Columbus, Ga. Annual convention, Birmingham, Ala., Oct. 23-26.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, H. C. Bower, 602 Metropolitan Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, Forrest E. Baker, 721 First National Bank Building, El Paso, Tex.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, H. S. Ashley, Fort Worth, Tex. Annual meeting, Galveston, Tex., June 15, 1918.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C. Annual meeting, Charlotte, N. C., April, 1918.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt. Annual meeting February, 1918.

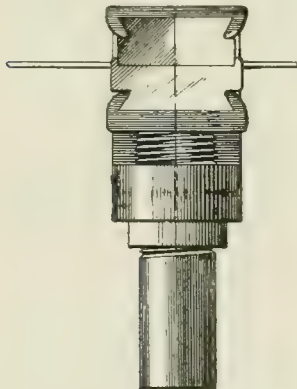
VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 W. Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis.

- 14,367. INDICATING SIGNAL FOR VEHICLES; William F. Hammond, Passaic, N. J. App. filed July 7, 1917. To indicate direction.
- 1,240,806. METHOD OF BUILDING COMMUTATORS FOR ARMATURES; Vincent G. Apple, Dayton, Oh. App. filed Jan. 22, 1917. Improvements.
- 1,240,844. INSULATOR; Franck S. Gregur, West Brownsville, Pa. App. filed Feb. 7, 1917. Quickly and easily operated to re-



1,240,844—Insulator

lease the wire when it is desired to take the latter down for repairs or other purposes.

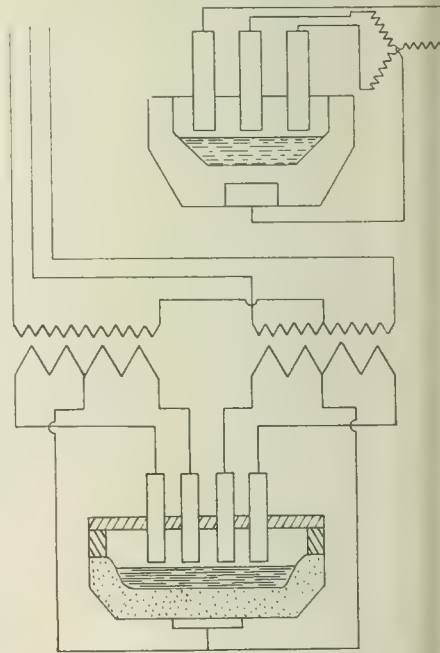
- 1,240,856. GALVANIC BATTERY; Heinrich H. M. Kammerhoff, Orange, N. J. App. filed Feb. 9, 1914. Particularly for portable batteries.
- 1,240,871. HEATER FOR THE INTAKE MANIFOLDS OF INTERNAL-COMBUSTION ENGINES; Bert N. Parrish, Jackson, Mich. App. filed April 9, 1917. May be easily and quickly adjusted to manifolds of different sizes and designs.
- 1,240,877. CONTROLLING MECHANISM FOR ELECTRIC MOTORS; Cleveland Redfield, Ogden, Utah. App. filed June 15, 1915. Improvements.
- 1,240,886. GALVANIC BATTERY; Richard Schuster, Puppling, Bavaria, Germany. App. filed March 3, 1917. Improvement.
- 1,240,901. ELECTRIC WELDING TOOL; Wilson E. Symons, New York, N. Y. App. filed May 22, 1917. Provided with means for the ready placing of the tool-carried electrode in different positions with reference to the tool itself.
- 1,240,907. ELECTRIC WIRING SYSTEM; Frederick A. Watkins, Chicago, Ill. App. filed Nov. 5, 1915. For electric illumination.
- 1,240,930. ELECTRICAL REGULATOR; Clarence A. Boddie, Pittsburgh, Pa. App. filed June 11, 1915. Single movable contact member that may be separately actuated by two electromagnets or similar devices, and which shall be simple in construction and effective in operation.
- 1,240,965. PLUG CONTACT MAKER; Henri Gallet, Puteaux, France. App. filed Dec. 26, 1916. Enables the length of a part of the internal connections to be considerably reduced by employing a rotary brush carrier comprising two or more brushes electrically connected and arranged at suitable angles apart.
- 1,240,975. COMMUTATOR; William T. Hensley, Boundbrook, N. J. App. filed Sept. 18, 1913. In which the conducting bars are securely held in place and spaced apart by suitable insulation.
- 1,241,030. SWIVEL ELECTRIC CONNECTION; Wilfred Schade, St. Louis, Mo. App. filed Feb. 5, 1917. Improvement.
- 1,241,063. ELECTRIC SIGNALING SYSTEM; Samuel M. Ward, Jr., Woodmere, N. Y. App. filed Dec. 15, 1916. Railway.
- 1,241,071. PORTABLE ELECTRIC LIGHT; William H. Zachmann, Woodhaven, N. Y. App. filed Jan. 19, 1917. Vest-pocket type.
- 1,241,077. PORTABLE ELECTRIC LIGHT; Walter Bauer, New York, N. Y. App. filed June 2, 1916. Improves the lamp-supporting and battery-containing casing.
- 1,241,106. ELECTRIC SIGN RECEPTACLE; Ronald A. Frydrychowicz, Stevens Point, Wis. App. filed Jan. 12, 1917. Protected from the weather.
- 1,241,115. STARTING INTERNAL-COMBUSTION ENGINES; Otto Heins, New York, N. Y., and Charles M. Wild, Springfield, Mass. App. filed June 12, 1915. Improvements.
- 1,241,151. ELECTRIC INDICATOR; Henry H. Riggs, Kharput, Turkey. App. filed Oct. 8, 1913. Means by which the positions of a lever, wheel or other rotating member may be indicated for observation at a point or points distant therefrom.
- 1,241,157. ELECTRIC SWITCH; Arthur Simon, Milwaukee, Wis. App. filed June 29, 1914. Adapted for use as current relays in alternating-current motor-control systems.
- 1,241,158. CONNECTOR FOR ELECTRIC WIRES; Alexander B. Simpson, Jersey City, N. J. App. filed May 6, 1916. Consists in combining with a threaded binding screw and nut a folded strip of conducting metal or material interposed between the nut and the head of the binding screw.
- 1,241,180. CONTROLLER FOR ELECTRIC MOTORS; George H. Whittingham, Pikesville, Md. App. filed Dec. 3, 1914. A torque switch is associated with the starter for admitting an abnormally large current to the motor armature for a short interval of time prior to the operation of the starter.
- 1,241,191. AUTOMATIC CONTROL FOR VALVES; Josef Bruckner and Franz Hamberger, Brooklyn, N. Y. App. filed March 9, 1916. Such as are commonly employed in connection with self-propelled vehicles.
- 1,241,197. METHOD AND APPARATUS FOR DETERMINING SUBTERRANEAN CONDUCTORS; Harry R. Conklin, Joplin, Mo. App. filed Nov. 6, 1916. Method and apparatus for detecting electrically conductive bodies below the surface of the earth, such as bodies of electrically conductive ore, the location of buried pipe lines and the like.
- 1,241,213. PROJECTILE-FUSE-TESTING APPARATUS; Charles L. Heisler, Schenectady, N. Y. App. filed July 13, 1916. Relates to means for automatically and accurately measuring and recording the time which elapses while burning a projectile fusing-timing powder train from the instant it is fired to the instant when it ignites or fires the fuse base charge.
- 1,241,234. ELECTRIC BATH CABINET; Honora C. Marrinan, St. Paul, Minn. App. filed Oct. 7, 1916. The cabinet is constructed with an electrical heating element, so that the inclosure formed by the cabinet is effectively heated without the damaging effects of burn-outs.
- 1,241,244. ELECTRICALLY HEATED WATER-CONTAINING RADIATOR; Otto A. Palmer, Wayzata, Minn. App. filed March 9, 1917. Can also be used in connection with the radiators of steam or vapor systems.
- 1,241,248. METAL-WORKING MACHINE; Theodore P. Payne, Newark, N. J. App. filed Jan. 26, 1914. Provides for automatic feeding and positioning of a beam or shape with reference to the perforating devices to receive successive perforations in proper position and automatically to feed correctly the beam between perforations.
- 1,241,264. MACHINE FOR MAKING TEMPLET STRIPS FOR METAL-PUNCHING MACHINES; John D. Morgan, Summit, N. J. App. filed May 14, 1915. Improvements.
- 1,241,267. METAL-PUNCHING MACHINE; Louis A. Hawthorne, Newark, N. J. App. filed July 10, 1915. Automatic means and devices for alternately traveling and stopping the work relatively to the punch or other tool-equipped means which are in successive desired positions to be punched by the machine.
- 1,241,268. MACHINE FOR MAKING DISTANCE-RECORD DEVICES FOR METAL-WORKING MACHINES; Theodore P. Payne, Newark, N. J. App. filed Aug. 10, 1916. Improvements.
- 1,241,269. METAL-PUNCHING MACHINE; Edward V. Wurts, Pittsburgh, Pa. App. filed Sept. 19, 1916. Relates to machines and mechanisms for automatically positioning or spacing and punching rivet holes in structural beams and like work.
- 1,241,270. PROJECTOR ARC LAMP; Ben Ferris, Lakewood, Ohio. App. filed June 13, 1916. Particularly adapted to so-called moving-picture work.
- 1,241,273. ROTABLE CONTACT BREAKER FOR MAGNETOS AND OTHER PURPOSES; Eric J. Pilbiad, Leicester, England. App. filed March 10, 1917. Improvements.
- 1,241,275. ELECTRICAL MEASURING INSTRUMENT; Willard E. Porter and Alvarado

Record of Electrical Patents

Notes on United States Patents
issued on September 25, 1917

L. R. Ellis, Lynn, Mass. App. filed May 6, 1914. Adapted for use with batteries on automobiles.

- 1,241,284. MEANS FOR AUTOMATICALLY REGULATING AUTOMOBILE HEADLIGHTS; Lewis T. Rhoades, Mont Clare, Pa. App. filed May 5, 1915. Operated by the draft of air to control the position of a contact and regulate the supply of energy to the headlights.
- 1,241,289. ELECTRICALLY OPERATED APPARATUS FOR ICE RINKS; Dudley H. Scott, Cleveland, Ohio. App. filed March 24, 1917. Electric tractor or motor-driven ice planer.
- 1,241,309. IGNITER MECHANISM FOR INTERNAL COMBUSTION ENGINES; Harry R. Van Deventer, Sumter, S. C. App. filed Dec. 31, 1914. Improvements.
- 1,241,310. ELECTRIC LIGHTING AND HEATING OF RAILWAY AND OTHER VEHICLES; Charles H. Vidal, London, England. App. filed Sept. 3, 1915. Improvements.
- 1,241,317. SYNCHRONOUS DYNAMO-ELECTRIC MACHINE; Frank P. Whitaker, Buggy, England. App. filed July 25, 1916. Provides the primary of the starting motor with two windings adapted to give different numbers of poles, one of which has a number of poles equal to the number of poles of the synchronous machine divided by the speed ratio, and the other has a number of poles less than that of the synchronous machine divided by the speed ratio.
- 1,241,333. GUN; Levi M. Bowman, Tulsa, Okla. App. filed Sept. 30, 1916. Electrically operated weapon for discharging a projectile at a high velocity.
- 1,241,351. ELECTRIC FURNACE; Joseph L. Dixon, Sheffield, England. App. filed Feb. 23, 1915. Proportion of current passing through the bath and lining is separately controllable, so that if desired there can be caused to flow through the bath and lining much smaller proportions of current than are possible with furnaces of other types.
- 1,241,373. SIGNALING DEVICE FOR ROAD VEHICLES; Charles O. Hall, New York, N. Y. App. filed Nov. 28, 1914. Instantaneous.
- 1,241,412. ROCKING DISTRIBUTER FOR IGNITION SYSTEMS; Charles T. Mason, Sumter, S. C. App. filed Nov. 16, 1916. Provides a distributor which may be mounted independently of the magneto shaft and operated therefrom, and which distributor is so constructed that it may be shifted with the circuit breaker or interrupter for advancing or retarding the spark for timing purposes.



1,241,351—Electric Furnace

- 1,241,421. SAFETY SIGNAL FOR POWER VEHICLES; William Murray, Brooklyn, N. Y. App. filed June 8, 1916. Improvements.
- 1,241,485. ELECTRICAL SYSTEM OF DISTRIBUTION; Gorham Crosby, Glen Ridge, N. J. App. filed May 12, 1916. System in which the generator is driven at variable speed is adapted to charge a storage battery and, if desired, simultaneously supply translating devices.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN

Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, OCTOBER 13, 1917

No. 15

War and Street Lighting

WE HAVE every reason to be thankful that war conditions are not likely to bring upon us the darkness which has settled on many French and English cities, particularly London. It is no joke to wander about unlighted streets finding an uncertain way by means of dead reckoning or the occasional use of a pocket flashlamp. The scare given to the American public in May by the unverified rumor of submarines has very properly died down. Lamps in the coast cities have not been extinguished, and the only effect at all notable has been the judicious use of projectors so placed as to guard important works from the activities of mischievous prowlers. In the present stage of the conflict the danger from hostile air planes or submarines is so insignificant as not to be worth serious consideration. Troubles are far more likely to come from within than from without. The chief effect of the war on street-lighting business, therefore, seems to be slight local differences in demand owing to hesitancy of the municipalities in allowing the normal increase which growth brings to the lighting system.

On the other hand, as we have frequently pointed out, the effect on stations doing lighting as well as other electrical distribution has been serious. The great increase in the cost of materials and labor and the increasing difficulties of the fuel supply are such as to bear hard on stations which have fairly long contracts for street lighting entered into at a time when peace conditions prevailed. Unless we are very much mistaken, there are a good many cities in the country in which were a contract now entered into anew prices would tend upward rather than downward. Any work on street lighting which requires considerable construction, as in the case of extensions in a suburban territory, brings a heavy burden of overhead expenses, and any fair reckoning of the costs will show that extensions may readily be a very dubious blessing at present contract prices. There is no likelihood that the war will bring any material decrease in the amount of the street-lighting business as a whole. It may very readily lessen new installations of "white way" lighting and effect other measures of municipal economy, but the average American city is so far from being brilliantly lighted even now that any decrease of illumination will prove itself generally unwelcome. The experience in London, for example, has shown that street accidents and crimes of violence have been considerably on the increase owing to the darkening of the streets, and there is no reason to expect any other result. Even if we should get a genuine U-boat scare, the only precautionary measures would be extremely lo-

cal and would hardly affect the situation one way or the other. In case of danger it is very easy to cut out the lighting circuits entirely, which is vastly more effective than any mere measures of reduction.

Buy a Bond for Liberty

A Little Chance for the Inventor

WE HAVE periodically suggested the really serious need of improvements in primary batteries. This need is just now sharply emphasized by the very wide use of electric flashlamps in the trenches. A flashlamp is practically indispensable as part of the equipment of all officers and of all men who have to share in the cave life of the western front. The advent of the tungsten lamp has given a very practicable source of light which does not make severe demands for current and is altogether successful for the purpose intended. But who shall say that the ideal battery for such service has yet made its appearance? The battery now almost universally used is of an old familiar type, somewhat improved in detail and really a wonderfully good article for its price, but it is essentially a battery strictly for temporary use and deteriorating on open circuit. The resources of the chemical engineer ought to be able to give us a source of electricity combining compactness, comparative freedom from polarization and reliability. Of course the cheaper the better, other things being equal, but it need not attempt to compete with the common type in the mere matter of first cost. Of chief importance is that it should hold up its voltage well and be free from serious deterioration when not in use. Surely the resources of invention at the present time ought to give us a battery much more suitable for hard service than the Leclanché type of cell which has heretofore had the field practically to itself. Nothing has been able to compete with this old-timer for general use, but its limitations are such as to point the need for a successor. The thanks of the men in the trenches and no small monetary reward are likely to come to him who first produces the battery required.

Liberty Asks Bond Subscriptions

Iron-Wire Transmission Lines

TWO papers in the current issue deal with the now somewhat important subject of iron as a useful substitute for copper in the construction of light rural lines. We have discussed the matter on several previous occasions, pointing out that on the whole the plan has worked well, and that with copper wire at present prices the situation is favorable for iron lines provided

the load is to be light. The two papers before us deal with two opposed phases of the matter, one with the effect of the use of iron on lines of construction, the other with the purely electrical phenomena which somewhat complicate the practical operation of the kind of system on which iron is useful. As to line construction L. P. Perry's paper gives a most sensible view of what can be done with iron wire, and as well points out what has been allowed by the Connecticut commission in the way of such construction. The fundamental point of the matter is that the very high tensile strength of high-grade iron wire is such that the pole spacing can be widened very considerably, giving thereby a large gain in cost of construction. We have repeatedly hammered away in these columns at the needless caution displayed in the design of very high transmission lines. The pole spacing customarily used is a mere inheritance from the old telephone and telegraph practice, in which from ten or a dozen to a hundred or more wires were carried on a single pole line with all the stresses from storm and sleet implied by their combined surface.

The practice of using long spans on wooden-pole construction by the help of hard-drawn copper wire really originated on the Pacific Coast, where so much has been done in the way of progressive engineering, and it has been gradually adopted all over the country, and almost uniformly with highly successful results. Mr. Perry's paper explains in detail the character of the construction used in economical iron-wire lines and the considerable advantage to be gained by using a liberal amount of sag, fairly high poles and wide spacing. It appears, as might be expected, that long spans paid, and it was found that a minimum cost of construction under present conditions is reached when using poles of about 35 feet (10.6 m.) and a pole spacing of 250 feet to 300 feet (76.2 m. to 91.4 m.), using, say, No. 4 iron wire. The resulting structure is both strong and cheap and the practical results are good. There is no reason to suppose, from long experience with telegraph and telephone wires, that conductors of this size will give material trouble from rusting out for a long time to come.

On the other hand, M. D. Leslie gives an extremely interesting report on the large charging current found on some iron-wire lines in practical operation. The systems considered were of 31 miles and 22 miles (49.8 km. and 35.4 km.) in length respectively, of No. 6 iron wire and intended to carry very moderate loads at a pressure of 22,000 volts. The lines are carried on steel poles, which probably rather increase the effects noted. As a practical matter it was found that the light-load current with the two lines connected in multiple rose to several times the theoretical full-load current and was in fact considerable enough to cause trouble from overheating the transformers. It was very soon found that current was leading in phase and therefore chargeable to capacity effects, probably all the worse for the interconnection of two lines having considerably different electrodynamic constants. Under these conditions the IR losses proved to be really formidable, although the situation was somewhat relieved by the installation of inductive load on the line. One measurement of the

power factor showed it to be as low as 13 per cent. The trouble is not in itself due to the use of iron, but the point of the matter is that these long and lightly loaded lines in which the use of iron is desirable are also the ones in which trouble from capacity current is most likely to be acute, and with light loads on high-voltage lines comparatively little relief is obtained by the distributed inductance of the iron.

It would be rather interesting to compare the figures here obtained with those found on similar lines carried on wooden poles which do not bring the earth potential close up to the conductors. In principle there should be some working load in which there would be considerable relief due to line inductance, although anything like complete compensation is probably forbidden by the comparatively high line losses which would be implied. It was found, as might be expected, that the computed and observed charging currents check fairly well, so that the phenomena observed were in no way of a character not to be expected. It is, however, evident that in building lines for very light service the charging current may become a serious item and ought to be carefully computed in advance. So little is known about the resistance and reactance of iron lines under conditions of use that it is not easy to reckon with the combination of these factors. Mr. Leslie's experience makes it clear that they cannot be depended upon for any considerable measure of relief as against the capacity effects at high voltage. The encouraging thing about the situation is that in spite of these operative difficulties the two lines considered pay well, while if it had been necessary to build them of copper they would not have been constructed at all.

For Humanity's Sake Buy a Bond

Street-Lighting Contracts

WITH the current issue we close James R. Cravath's excellent series of articles on street lighting. The last installment deals with the important matter of contracts. It is apparently a simple matter to adjust specifications and rates for the lighting of a city's streets. But as a matter of experience a just agreement protecting the rights of both parties is extremely difficult to formulate. If the relations between the city and the company are on a straightforward business basis, and not mutually predatory, the situation is simplified. The chief difficulty is that the thing bought and sold is practically not energy or light, but service. The attempts made a few years since to get street lighting on a basis of illumination furnished have failed, as was inevitable. Few cities care to undertake to purchase the energy and undertake its utilization themselves, so that when a contract for street lighting is drawn it practically is for the supply and service by the company of certain specified illuminants installed in accordance with the directions of the city authorities. This means that provisions have to be made for a proper specification of the lamps used, of their equipment, and of the care that must be exercised in their upkeep.

As Mr. Cravath indicates, the situation is further

complicated by the fact that street-lighting contracts, involving as they do an essential monopoly, are naturally and properly made for a reasonably long term of years. Otherwise the contracting company must in some way procure protection against the disuse of its equipment, unavailable for any other purpose, at an unreasonably early date. Now, any contract for lighting covering five or ten years inevitably runs a chance of being disturbed by changes in the art. Provision is generally made for the substitution of improved illuminants in case they should appear, but as a practical matter an equitable agreement is not easy to work out. The company must be protected against being compelled to charge off grave depreciation in much less than the time anticipated when the contract was made, and the city must have assurance that if changes in the art bring with them large economy in operation and improved service the advantage thereof shall not lie wholly with the company but shall be fairly distributed. Such difficulties have arisen repeatedly and have been the source of much litigation. Usually some such provision for changes is made which is of little practical service. A much more satisfactory plan is to provide for the possibility of changes and to refer a rearrangement of terms directly to an arbitration, in which, if the city is properly represented, a fair result can usually be reached.

Specifications to insure proper upkeep of lighting appliances are perhaps the most difficult item of a contract. Photometric specifications are found necessary in most large cities, and if their terms are reasonably precise offer a good way out of the difficulty. In the smaller places with which Mr. Cravath is specially dealing it is difficult to get the necessary technical service, although some cities employ an expert to make periodical examinations and report the conditions found. After all, the best guarantee of a fair and properly carried-out contract is a well-developed sentiment of fair play between the company and city. This, we are happy to say, is much more common than it used to be, so that on the whole contracts are made and carried out in good faith without mutual recriminations.

We cannot close this comment without calling to the attention of our readers the very valuable character of Mr. Cravath's admirable series. It is particularly important as dealing with conditions found in places of moderate size. These present exceptionally difficult problems in illumination and require, in order to obtain satisfactory results at an expenditure not impossible, the utmost finesse in laying out the system. Useful hints of this crowd Mr. Cravath's columns. No ordinary city

official or even central station man has as firm a grip on such practical details as the experienced illuminating engineer, dealing from time to time with both sides of the problem in hand and ready to see the rights of both parties to the contract. We are fortunate in being able to present the practical conclusions of just such an expert on the difficult technique of street illumination.

Invest Your Savings for Liberty

Fixed Charges in Power Cost

THE general public has very little conception of what fixed charges mean in the production and distribution of electrical energy. Business men with substantial sums invested in plant or equipment appreciate the influence of "overhead," but it is difficult for the layman to picture the less visible costs of electrical service unless a high class of publicity has been employed to bring some conception of these important charges to his mind.

It is quite useless to inform persons of little education that the steam turbine plant of a local central station represents, let us say, \$80,000 out of a total station investment of \$175,000; these sums mean less to them than the magnitude of the Liberty Loan means to ourselves. But by putting it at 45 cents for each dollar invested in the station we reach a plane of comprehension within reach of almost everybody; and it is worth while to seek to acquaint even the humble consumer who speaks little English with the principles upon which the property that serves him is managed.

Most operating executives can tell one offhand the latest unit costs of station service, but how many can immediately match these with corresponding fixed costs reduced to the kilowatt-hour basis? Not many, we fear, can give these offhand. It is true that within quite a range fixed charges may total a decidedly varying quantity, according to the rates of interest, depreciation, taxes, etc., assumed. But for a given plant investment the values of overhead which need be carried along for rough and ready reference are comparatively few. It is helpful to work out the fixed charges for a particular plant investment, for it proves in almost every case an eye-opener to one accustomed to thinking mainly of operating expenses. We fancy that not a few central station men will find the values exceedingly interesting. By applying the total fixed charge percentage to each of the main items listed on the basis of the dollar invested, it then becomes easy to show the layman the relative extent of the overhead charge attached to each important part of the system.

SO MANY companies are confronted with the problem of serving greatly increased loads without being able to secure deliveries on new generating equipment that any way in which all or part of existing equipment can be used to better advantage relieves the situation considerably. Operating boilers at overrating has been one means employed, but there has been some question as to what conditions permit the maximum flexibility of operation. In

The Coming Issues

the next issue of the ELECTRICAL WORLD this subject will be discussed by an authority in the operating field. Another article will dwell on the changes which were made in an old hydroelectric plant to permit utilizing the maximum amount of water available most economically. Formulas and charts for computing the diameters and relative dimensions of plungers for the cheapest, lightest and smallest solenoids and plunger magnets will also be printed.

Modernizing a Fifteen-Year-Old Steam Plant

Third Installment of a Series of Articles on the Rehabilitation of the Ashley Street Station of the St. Louis Company—Rearrangements Made to Double Boiler Capacity

BY JOHN HUNTER

Chief Engineer Union Electric Light & Power Company, St. Louis

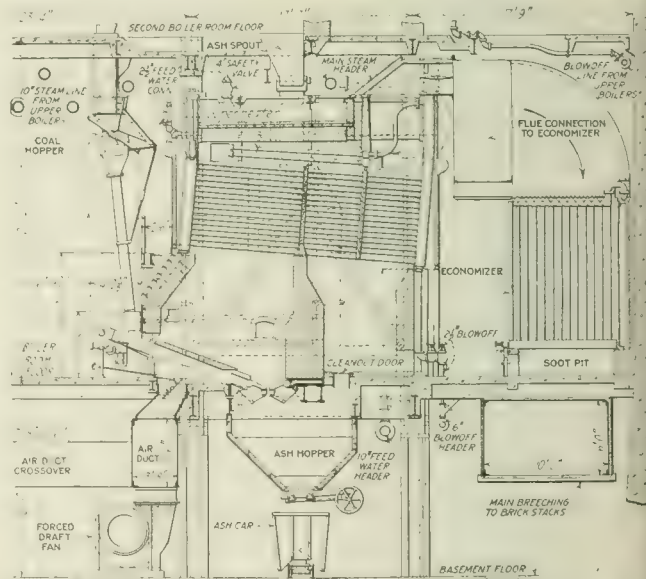
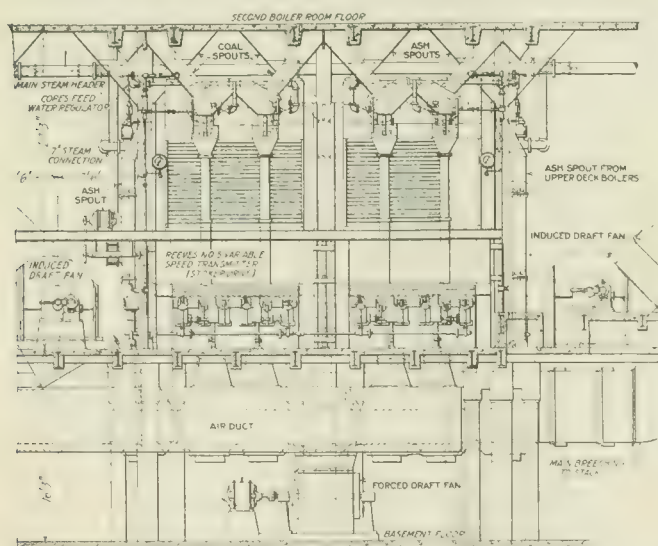
In the Aug. 4 and Sept. 20 issue of the *ELECTRICAL WORLD* were presented the two previous installments of this article. The first of these dealt with the effect that growth in load and developments in station apparatus have had on the Ashley Street station of the Union Electric Light & Power Company, St. Louis, and called attention to some extensive changes which have been made to modernize the plant. The second installment dwelt on the methods of overcoming certain construction difficulties encountered in building a circulating-water system to care for 300,000,000 gal. (1,135,600,000 l.) of water per day. In this issue the author explains how the building and equipment were rearranged to permit doubling the boiler capacity to care for 60,000 kw. more in turbines.

PRIOR to the installation of the new 25,000-kva. turbines in the Ashley Street station of the Union Electric Light & Power Company, St. Louis, the station generating capacity was 68,000 kw., steam being generated in fifty-two 508-hp. boilers equipped with chain-grate stokers operating on natural draft. The maximum continuous rating obtainable from these boilers was sufficient for the generation of approximately 52,000 kw. at the switchboard. To supply steam for an additional 60,000 kw. of station capacity called for the rearrangement of the building and equipment in such a manner as more than to double the boiler plant capacity.

The boiler equipment is installed on two floors or decks. The upper-deck boilers, of which there are thirty-

eight Scotch marine boilers with internally fired furnaces whose operation had not been a success owing to their being ill suited to the burning of the low-grade Western coals which must of necessity be utilized in the St. Louis district. These boilers had already been abandoned and a portion of them replaced by water-tube boilers with chain-grate stokers. The elevation of the floor of this lower-deck boiler room was such that it was entirely feasible to remove the old boilers and install new boiler equipment upon a new floor built 3 ft. (0.9 m.) lower than the old, thus permitting an increase of 3 ft. in the height of the furnaces, *i. e.*, 10 ft. (3 m.) from floor to bottom of front header instead of 7 ft. (2.1 m.). This height was considered the minimum advisable if boiler performances greatly in excess of rating are to be economically obtained. Consequently it was decided to remove all of the boilers in this portion of the plant and to rearrange the structural work so as to install in their place twenty-four 558-hp. boilers equipped with economizers, underfeed stokers and forced and induced draft.

The primary installation of ten of these boilers was completed in 1916 and put in service early in 1917 with the completion of the first of the three 25,000-kva. turbines. With the increased head room which was made available through the lowering of the general floor level



FIGS. 1 AND 2—FRONT ELEVATION AND CROSS-SECTION OF PART OF NEW BOILER INSTALLATION, SHOWING ARRANGEMENTS FOR HANDLING COAL AND ASHES, METHODS OF PROVIDING DRAFT, ETC.

four, occupy the space directly below the overhead coal bunkers and are so placed as to their clearances that any increase in size or rearrangement of stoker or furnace equipment for the purpose of increasing capacity was not feasible. Consequently all changes leading to increased capacity have been confined to the lower-deck boiler room. Here were originally installed twenty-

it was possible to install somewhat larger boilers than the water-tube units already in the station. Consequently the new boilers are sixteen tubes high instead of fourteen, as in the case of the upper-deck boilers. The fact that each of these boilers is capable of providing 3000 kw. at the switchboard indicates the successful results which are being obtained with the new

arrangement. The upper-deck boilers, which operate at 185 lb. (13 kg. per sq. cm.) will be reserved exclusively for driving the old 12,000-kw. turbines, whereas the entire lower-deck boiler room operating at 225 lb. (15.8 kg. per sq. cm.) will furnish steam for the new 25,000-kva. turbines.

The side-wall clearances necessary for the new boilers

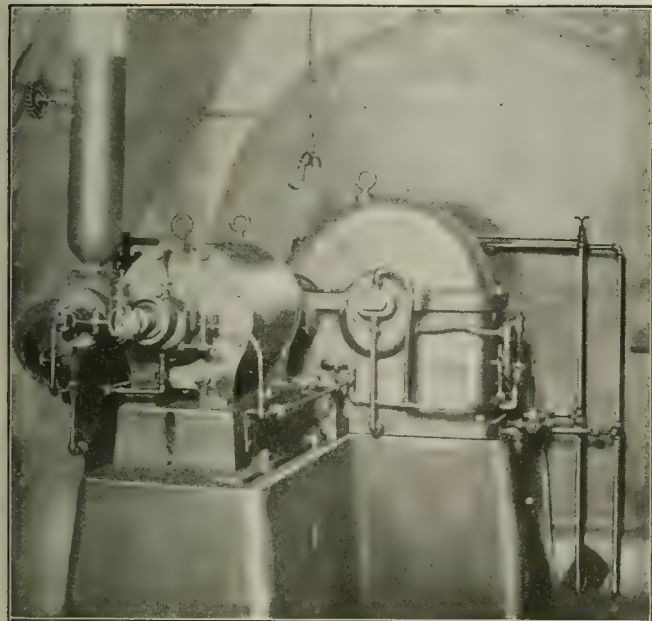


FIG. 3—GEARED TURBINE DRIVING INDUCED-DRAFT FAN

were such that it was necessary to remodel the cross bracing of the boiler house so that it would occupy about one-third of the space but still have its original strength. This was accomplished through the rearrangement of the structural shapes of which these building braces were made. The taking out of the steel work in an entire floor was a somewhat precarious proposition inasmuch as the main building columns not only have to support the entire upper-deck boiler house, but also the overhead bunkers, which have a capacity of 13,200 tons (11,880 t.) of coal. In removing the lower-deck floor steel the main building columns would be left temporarily unbraced throughout about 40 ft. (12 m.) of their length. It was therefore found necessary to brace all of the building columns temporarily in such a manner that there would be no possibility of lateral deflection due to the heavy weights supported. Telegraph poles were used for struts, being cut approximately to the length of the steel removed and tightly wedged into place throughout the entire length of the structure concerned.

Throughout the entire work of remodeling the boiler room it was essential first of all that the equipment on the upper deck be maintained in regular operation without interruption. This required the careful manipulation of steam and feed-water headers and numerous other piping systems when changes were being made. Such work necessitated a great many "cut-overs" which could only be accomplished during periods when the station load was low, for the most part on Saturday nights and Sundays. Despite the severe requirements, all work in connection with the installation of the ten boilers was successfully carried out without any interruption of the regular service of the plant.

The boilers which were selected for this installation

are equipped with underfeed stokers, superheaters and economizers and induced draft fans. The boiler side walls, which are somewhat novel, have the usual fire-brick lining 9 in. (22.8 cm.) thick opposite the furnace proper and are backed up with hollow 8-in. (19.3-cm.) building tile bonded with common red brick and sealed to prevent air leakage. Over the tile is placed a 2-in. (5.08-cm.) air-cell covering securely fastened and cemented into place and covered with canvas. Six months' operation of these boilers has proved that these settings are entirely satisfactory.

The installation of underfeed stokers in a power station which must of necessity use low-grade Illinois coal was a new and a somewhat radical departure, as there had been no extensive installations where fuel of this character had been burned. However, the success of this venture has been proved beyond a doubt by half a year's operation. Boiler ratings up to 200 per cent are being carried continuously with an over-all boiler and furnace efficiency 74½ per cent, compared with 65 per cent before.

The forced-draft blowers are driven by 100-hp. motors and are capable of delivering 40,000 cu. ft. (342.4 cu. m.) of air per minute. The blowers, which are connected by a very flexible arrangement of air ducts, are installed in the basement immediately below the center of the boiler room and receive air in a large measure from the ventilating ducts of the 25,000-kva. turbines. The latter discharge air at the rate of 60,000 cu. ft. (513.6 cu. m.) per minute into the boiler-room basement.

The new ash-handling equipment, consisting of a



FIG. 4—VIEW OF BOILER ROOM SHOWING STOKER DRIVE IN FOREGROUND

series of new ash hoppers for both upper and lower-deck boilers, is also installed in the basement, but in adjacent areaways and separated from the forced-draft equipment by tile partitions. One of the important considerations in connection with the rebuilding of the ash hoppers was the possibility that the underfeed stokers burning low-grade coal would make clinkers of too large

size to pass through the openings in the ash hoppers serving the chain-grate installation. Consequently, the new ash hoppers were equipped with 24-in. by 30-in. (61-cm. by 76-cm.) cast-steel sliding doors placed across the bottom and driven by rack and pinion. The ashes fall by gravity from the hoppers into 3-ton (2.7-t.) receiving cars driven by storage-battery locomotives,

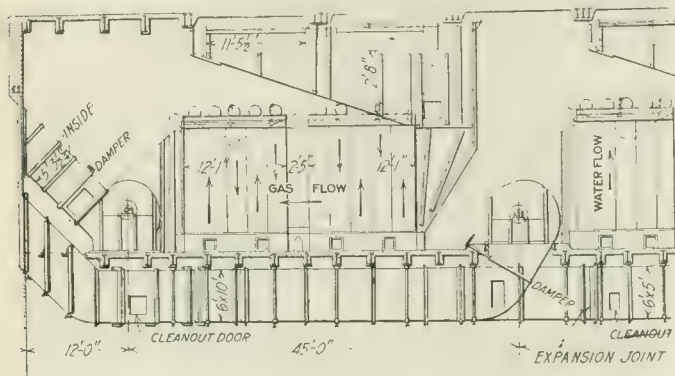


FIG. 5—ECONOMIZERS TAKE GASES FROM FLUE ABOVE AND DISCHARGE INTO INDUCED-DRAFT FAN

thence are delivered to a skip hoist from which they are discharged into the receiving ash bunker. A second ash bunker is to be installed outside of the building and will be arranged so as to deliver ashes to railroad cars placed beneath it.

Each economizer is arranged to receive the outgoing gases from a battery of two boilers. The induced-draft fans are driven by 56-hp. high-speed turbines. The stokers are driven by 15-hp. motors the speed of which is controlled by variable-speed transmission drive. These drives are working out very successfully and are permitting a range of ten to sixty strokes of the ram per hour.

Precision "three in one" air gages are used for indicating draft pressure in the blowers, furnace and up-

TYPES OF EQUIPMENT USED IN BOILER ROOM

- COAL CONVEYOR.—Bucket type, furnished by the Link Belt Company, New York.
- STOKERS.—Underfeed type, furnished by the Westinghouse Electric & Manufacturing Company, East Pittsburgh.
- BLOWERS.—Manufactured by the Buffalo Forge Company, Buffalo, N. Y. They are driven by 100-hp. Westinghouse motors through variable-speed transmission apparatus, furnished by the Reeves Pulley Company, Columbus, Ind.
- BOILERS.—Edge Moor Iron Company, Edge Moor, Del.
- SUPERHEATERS (Foster).—Power Specialty Company, New York. Designed for raising steam temperature 150 deg. Fahr.
- ECONOMIZERS.—B. F. Sturtevant Company, Hyde Park, Boston, Mass.
- INDUCED-DRAFT FANS.—B. F. Sturtevant Company. The motive power for driving the fans is furnished by turbines supplied by the Kerr Turbine Company, Wellsville, N. Y., and having a power range of 10 hp. to 60 hp.
- BOILER-FEED PUMPS.—Centrifugal type, furnished by the Alberger Pump & Condenser Company, New York, and driven by Curtis turbines, also furnished by the same company.
- FEED-WATER REGULATOR (Copes).—Furnished by the Erie Pump & Equipment Company, Erie, Pa.
- ASH-HANDLING EQUIPMENT.—Skip-hoist type, supplied by the Otis Elevator Company, New York.
- STEAM-FLOW METER.—General Electric, type F-S2.
- RECORDING THERMOMETERS (Tycos).—Taylor Instrument Company, Rochester, N. Y.
- FEED-WATER HEATER.—Hoppe's Manufacturing Company, Springfield, Ohio.

take, the average draft in the uptake being 1¼ in. (31.8 mm.) of water, with that in the furnace slightly below atmospheric pressure, while the available force of the air blast is 4 in. (10.1 cm.). With this equipment it is possible to obtain ratings in excess of 300 per cent for periods of one hour or slightly longer. Double-pen recording thermometers have been installed on the

economizers for the incoming and outgoing water. Each boiler is also equipped with an indicating flow meter calibrated to read directly in hundreds of boiler-horsepower. With the above instruments it is possible to obtain accurately all the essential information in connection with the operation of the boilers and stokers.

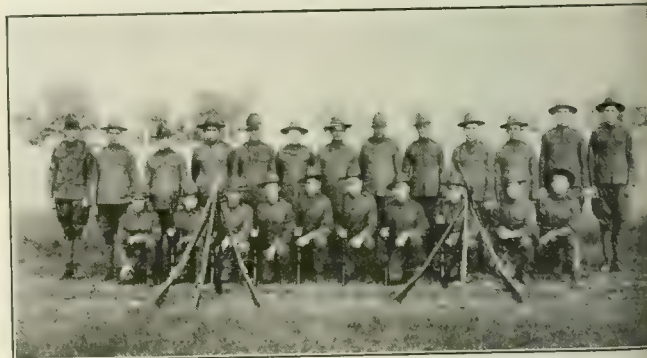
Centrifugal boiler-feed pumps which receive their water from feed-water heaters have been installed for the new boiler equipment so that a temperature of approximately 130 deg. Fahr. (54.4 deg. C.) is maintained at the economizer inlet. The increase in temperature through the economizers is approximately 100 deg. Fahr. (37.8 deg. C.).

To complete the boiler requirements necessary for the new turbine installation there are being installed this year three additional batteries of two boilers each similar to the ones described above. This will complete the installation of sixteen of the twenty-four high-capacity boilers which are to fill completely the space available in the lower-deck boiler plant. The remaining four batteries will be equipped with Riley stokers and will be installed in 1918.

In order to obtain the highest efficiency and maximum capacity from the new boiler and turbine installation, it was deemed wise to increase the operating steam pressure of the station from 185 lb. to 225 lb. (13 to 15.8 kg. per sq. cm.). This involved complication, inasmuch as a portion of the auxiliary apparatus already installed is designed for a maximum of 185 lb. (13 kg. per sq. cm.) pressure and will require the use of reducing pressure valves. However, in general the entire steam plant will eventually be operated at a higher pressure.

Military Company for New England Utility

The Rockingham County Light & Power Company, Portsmouth, N. H., has a military company of its own, which was conceived and organized about the time war was declared between the United States and the German government. It was assembled with the idea that if the government found it desirable to furnish guards for the local plant and its outside system, the existence of such a company would relieve the government of trouble and expense. In this way each member "does



NEW HAMPSHIRE PUBLIC SERVICE MILITARY COMPANY

his bit" in addition to the service rendered in supplying the territory with electric light and power. The organization is a voluntary one. The men drill on Wednesday afternoons, the company contributing half the time and the men half of their time. The company furnished the guns and paid half the cost of the uniforms. F. A. Belden, Portsmouth, is manager.

Practical Features of Street-Lighting Contracts

Points to Be Observed in Negotiations Between Municipalities and Utilities, with
Special Attention to Securing and Maintaining the Best
Public Relations

BY JAMES R. CRAVATH

A SERIES of articles on street lighting would be incomplete without consideration of the practical features of contract making between municipalities and electric lighting companies. The question of contract relations comes up in nearly every case where changes are being made in street-lighting systems. The writer, having represented both municipalities and companies in various negotiations of this kind, is in a position to present the viewpoint of both sides. It is a mistake to suppose that nothing but purely legal matters should be considered. All such street-lighting contracts involve matters of general public policy and engineering.

Strictly speaking, as far as street lighting goes the municipality is simply one of the large consumers on the company's lines. However, it differs from other consumers in a number of respects. Negotiations are necessarily with city officials, who are changed from year to year. The real consumer in the case is the general public, and for this reason wise central station managers are particularly careful not to stir adverse public sentiment in connection with street-lighting negotiations. In fact, this has been carried so far at times in the past that central station companies have taken street-lighting contracts at less than cost and considered the loss in the nature of a franchise tax paid to keep public good will. Such contracts taken below cost are not looked upon favorably in these days of commission regulation. The ultimate question involved, of course, is whether the consumers should all be taxed indirectly to support the street lighting of which all of the people of the community get the benefit. Where losses on a street-lighting contract are made up by profits on other business the rates on street lighting are likely to appear too low in comparison with neighboring communities. If the same corporation is serving a number of communities in the same district, this low rate is likely to make dissatisfaction and trouble for the company elsewhere in its district. In general it may be stated that any system of rates which tends to cover up true costs and conditions is contrary to the best public policy.

The question of street-lighting improvements may come up at the expiration of a street-lighting contract, or the existing system may become so antiquated during the life of a contract that the municipality gets restless and desires more efficient and effective lighting. There is a point beyond which it is an economic sin to maintain an old system in operation. Central station companies have generally been found willing to consider changes in street-lighting contracts before their expiration when changes in the lighting art make them worth considering. In fact, companies which pursue a broad public policy frequently call the attention of municipalities to possible improvements which are available.

Negotiations of this kind usually proceed more sat-

isfactorily to all concerned if the city is represented by a street-lighting expert. City officials are naturally unfamiliar with many of the technical points involved in street lighting and are obliged to proceed more or less in the dark and with lack of confidence unless represented or advised by some one understanding the business. Furthermore, it is more satisfactory to a company which is acting in good faith to deal with such a representative.

The principal obstacles in the way of street-lighting improvements are ignorance on the part of city officials, a fear on the part of such officials that they will make a change for the worse, the inertia which always seems to be hard to overcome in governmental circles where a number of officials have to be consulted, and the desire of lighting companies to leave well enough alone and keep on in the old rut without taking up troublesome and possibly expensive changes.

UNPAID DEPRECIATION

Assuming that a change of contract is to be made before the expiration of the existing contract, one of the first questions upon which there should be an understanding is that of unpaid depreciation on the present street-lighting equipment. For example, assume that the street-lighting contract is for a period of ten years and that it has run five years. Assume further that in the proposed new system the circuits will be the same but the lamps will be discarded. If the lamps were new at the beginning of the existing ten-year contract, they have only been in use five years, and if the contract was made upon the assumption that they would have a life of ten years, so that a 10 per cent rate of depreciation was included in the contract price, one-half of the total depreciation on the lamp will now remain to be paid. In such a case whatever new contract is entered into will not be just unless it includes in some form the unpaid depreciation on the lamps which are to be removed. On the other hand, it would not be fair to include any allowance for such depreciation where depreciation on the old lamps has been already paid. Of course, the determination of this latter question is likely to be rather complicated and to involve a rather thorough investigation such as is made by commissions for regulating purposes. In the case of small contracts it may be more feasible and less expensive to forego a lengthy investigation and to assume that if the lamps were new at the beginning of the contract and the contract is for a given period, the contract included a payment sufficient to cover complete depreciation on the lamps by the time the contract ends. If the lamps were not new at the beginning of the contract, the depreciation may be assumed to have been paid during the term of the first contract for which they were used.

From the standpoint of the city there is, of course, always to be considered the financial temptation of the company to continue in use at rates which include

enough to cover depreciation apparatus upon which depreciation has already been paid. Even if the company does not yield to this temptation to maintain things as they are, it may frequently be deterred from suggesting a change because of a feeling that unpaid depreciation may not be properly allowed for in any new arrangement proposed. Therefore to come to an understanding on this point early in the negotiations is likely to facilitate matters greatly.

PROVIDING FOR CHANGES AND IMPROVEMENTS

Obviously, from the city's standpoint a contract which is sufficiently flexible to provide or make possible changes with improvements in the art is very desirable. How to make such a flexible contract without leaving things so wide open that there is almost no contract at all is the problem. When the company enters into a street-lighting contract and puts money into a certain type and kind of apparatus with which to carry out that contract it must of course have some assurance from the contract that it will not, at the whim of the city, be forced to discard this apparatus without compensation from the city. On the other hand, the city should be assured that by entering into a contract it is not closing the door upon all possibility of improvement during the life of the contract if it is willing to guarantee that the company is to lose nothing by making such improvements.

Various methods have been suggested and tried to provide the desirable flexibility. Some of the principal ones will be discussed here, though the different methods can be combined in various ways to make a great variety of forms of contract.

The most common form of street-lighting contract is a flat-rate contract for so much per lamp per year, the entire service being included in the flat rate. Where the possibility of a change of lamps or systems is contemplated such flat-rate contracts have sometimes been drawn to provide for a change at the end of five-year periods during the life of the contract. One form provides for the substitution of one kind of lamp for another at the option of the city, provided the new lamps so substituted do not cost more to operate than the lamps displaced. Provisions may be made for arbitration to decide whether the proposed lamps are equivalent in cost to the old in the event that the city wishes to exercise this option. In some states where commission regulation is in force the commission could be asked to decide questions of this kind, and in fact in many states it is the legally constituted body established for deciding such questions. In many cases, however, it is not necessary for the city and company to go to the expense of arbitration or of hearings before the commission. An engineer representing the city and one from the company, both fair-minded, can frequently come to an adjustment of these matters without the expense of formal proceedings.

The purchase of electrical energy at a certain rate per kilowatt-hour for street lighting and ownership of the lamps by the city is another plan. This has been tried to a very limited extent and offers some of the desired flexibility of contract. Obviously, such contracts may be drawn with considerable variation as to where the city ownership begins and the company ownership leaves off. The city may simply own the lamps and lamp fixtures, all the other street-lighting

investment being made by the company, as at Bessemer, Mich., or the city may own the entire street-lighting distribution system, purchasing energy at the company's switchboard, as at Champaign, Ill., or the city may own the street-lighting lines, poles and conduits as far back as certain street-lighting distributing centers where energy is purchased from the company through special meters and transformers, as at Milwaukee, Wis. It is obvious that a plan which calls for duplication of pole lines on any given street is not the most economical. It is absurd to have one line of poles devoted to the street-lighting circuits exclusively and another line for general distribution purposes.

If the city owns the lamps and lamp fixtures and is purchasing electrical energy, it can change sizes and types of lamps whenever it desires without the expense and trouble incident to a change of contract, provided that the change is one which does not call for different characteristics of circuit. Thus, if the company agrees to furnish 6.6-amp., constant-current, 60-cycle alternating current, any lamp changes by the city would be limited by the necessity of conforming to this supply. In this respect such a contract lacks flexibility, but it is of course unwise to attempt to provide for all future possible changes in one contract. The tendency of street-lighting development, however, has been to conform to existing types of energy supply, and it is fair to assume that the most probable development of the immediate future will conform to present circuits so that a form of contract which allows changes of lamps without changes of circuits might provide a considerable flexibility.

If the city purchases electrical energy, the rate may or may not include lamp maintenance. The company may furnish all of the labor of maintenance and the city the lamp renewals or electrodes. This latter is generally the most feasible arrangement where such a contract is made, because changes in lamps by the city would change the renewal costs. It is not necessarily true that maintenance labor would be the same per kilowatt-hour regardless of the lamp changes made by the city, but for practical purposes the possibility of a sufficient change in kilowatt-hour cost to make necessary a provision for it in the contract is rather remote.

If the company sells the city energy for street lighting at the power station or at certain transformer distribution centers out on the line and the city owns part of the distribution system, the most simple way is to make a contract for electrical energy alone, leaving the maintenance of all apparatus belonging to the city to be done by the city or by the company under a separate maintenance charge.

The indeterminate street-lighting contract, like the indeterminate franchise, is one of the latest developments in the relations between utilities and the public. It recognizes as fundamental that service must be rendered continuously and that the growth of the system must keep pace with the growth of population continuously, without interruption due to uncertainties of franchise or contract renewal and without prolonged periodical controversies over franchise renewals, during which periods the service to the public almost invariably suffers. An indeterminate contract therefore must necessarily provide for adjustment of changes as they become desirable from time to time.

In states with commission regulation the commission offers facilities for such readjustments. In fact, even where the indeterminate contract is not enforced under such a name the conditions often approach those of an indeterminate contract, because the commission can review the rates and conditions of service at any time.

Under an indeterminate contract the city and company start out with an agreement that a certain number and kind of lamps are to be operated a certain number of hours per year according to a certain schedule at a certain price. The price for a given service is subject to revision from time to time by the public service commission or some other expert body named in the contract. If the city desires a change of lamps or any other changes in the street-lighting system, it can have it and the price for the new service is adjusted by the authorities named in the contract. This adjustment, of course, takes into account unpaid depreciation on the discarded equipment. After the annual allowance for depreciation on a given set of equipment has been paid during a sufficient number of years to cover the first cost of such equipment the depreciation charge is stricken out of the annual rate. The whole theory of this method of procedure is that street-lighting service shall be continuously supplied at cost plus a fair profit.

LAMP AND PERFORMANCE SPECIFICATIONS

So far we have considered only contracts in which there is a definite type of lamp stipulated. This is by no means the only kind of contract possible, although it is a kind rather generally used. There has been considerable discussion of the possibility of selling street lighting on the basis of illumination. The most definite attempt along this line in this country was in 1907 and 1908, when the National Electric Light Association adopted a report of its street-lighting committee recommending that the minimum illumination on a vertical object 200 ft. to 300 ft. (61 m. to 91 m.) distant from the lamp be taken as the basis of contract. This recommendation never made any headway in a practical way. If adhered to, it would have left the choice of illuminants to the lighting company.

The opinions of those who have given the most thought to this matter are reflected in the 1913 report of this committee, which recommended that contracts be entered into on the basis of the supply of definite types of lamps. In contracts where the company owns and maintains the lamps this seems to be the only satisfactorily definite starting point, no matter what provisions may be inserted also in the contract providing for later changes.

In making contracts to cover existing types of lamps about the only changes that can be definitely anticipated are those caused by improvements in lamp efficiencies. Thus in contracting to supply series tungsten lamps where it is the established practice of the manufacturers to adhere to the common standard current values, to maintain the lumens output of the lamp constant and to reduce the wattage of the lamp as improvements are made it is obviously the proper procedure to contract for a lamp of a certain lumens output. Contracts for series tungsten lamps on the basis of watts per lamp are likely to involve difficulties in getting lamps later if the manufacturers improve the efficiencies. Likewise, as explained in a previous article, when

contracting for multiple tungsten lamps where it is the established practice of manufacturers to leave the wattage constant and increase the lumens output, the basis of contract should be the wattage of the lamp.

After the type and size of lamp which is to be supplied are described in the contract an important question comes up as to the maintenance of the lamp and a specification of how near it is to be made to approach its rated laboratory output when new. The simplest way to handle this matter on small contracts is to specify the frequency of cleaning and also that lamps shall be operated at the current for which they are designed by the manufacturers to produce a given luminous output. This practically leaves the internal performance of the lamp with the manufacturer of the lamp, where it really is any way, contract or no contract. However, since the manufacturer is responsible to the central station company which purchases the lamp the city may well maintain the right to have some provisions which will prevent a general letting down of the standards of manufacturers.

From the city's standpoint the internal characteristics of tungsten lamps which may cause them to fall below their proper service performance are interior blackening and short filaments. Inaccuracy in the mounting of a series lamp filament so that the effective length of the filament between terminals is shorter than it should be will, of course, cause that lamp to take less power on a given current than that for which it is rated and the light output due to the filament shortening is correspondingly reduced. While we are assured by the manufacturers that series lamps average according to their rated wattages, the fact has been in times past that they vary considerably in wattage and lumens from their ratings. With such short filaments as are employed in series lamps it is obviously difficult to mount them so that the distance between terminals as measured by the length of filament included in the circuit will not vary by a considerable percentage more than the percentage variation in the longer-filament multiple lamp. It is not feasible for the municipality to insist upon a greater uniformity of candlepower performance of new lamps than commercial accuracy in lamp manufacture permits. The city may, however, reasonably ask that average candlepower or lumen values be kept within certain limits.

TESTS FOR PERFORMANCE AND MAINTENANCE

If the contract is large enough, say in cities from 20,000 population up, a specification as to lumens output in service may be worth while to save controversies later. If such a specification is made, it should be based on the average of a number of lamps, and the method of making the tests to determine the performance should receive rather careful consideration. Testing on the street in service to determine the candlepower of a lamp at one or more positions, while very instructive as to street service conditions and of value in studying the comparative merits of different systems, is hardly to be recommended for all types of lamps and accessories as a check on service performance, although such tests have a place in determining roughly whether more exact tests are likely to be worth while. With electric lamps photometric performance tests can best be made in a laboratory, as it is

entirely feasible to remove lighting units from the street to the laboratory without changing operating conditions or to bring a portable laboratory or a truck to the lamp. As a preliminary to such tests, of course the regular operating current in the street circuit must be checked so that the photometric test can be made at the same current value. Tests can then be made of the lumens output of the lamp without its inclosing globe refractor or other accessory and with its accessory, thus separating the losses due to internal depreciation of the lamp and dirt on the lamp and losses due to the accessory and to dirt upon it.

It is unsafe to place too much emphasis on candlepower measurements made in any one position. This is especially true of lamps in refractors, as a slight change in the measurement position will make a great difference in the candlepower observed. The simplest way to overcome these difficulties is to measure the mean spherical candlepower or lumens output of the unit by means of the integrating sphere. Since the effect of the globe or accessory in modifying the distribution of light is well known in advance, the total lumens or mean spherical candlepower measurement is the only one necessary to check depreciation in service and will eliminate many errors possible with point-by-point candlepower measurements.

To sum up, the three main points to be covered in drawing contracts to insure the maintenance of good service conditions by the company and to prevent the imposition by the city of unreasonable requirements in maintaining service conditions are as follows: First, the lumens output of the bare lamp should be kept above certain limits (80 per cent of rating is suggested) and the contracting company should take care that these limits are not impossible of attainment. The luminous output will depend, first, upon the efficiency and wattage of the lamp when new and, second, upon the internal depreciation due to bulb blackening. Second, the permissible depreciation or loss of light caused by dirt on the lamp bulb. Third, the permissible depreciation or loss of light due to dirt on the globe, refractor or other accessories.

As said before, all these involve photometric measurements by experts either by removal of the lamps and globes to a laboratory or by bringing a portable laboratory to the lamps on the street. For this reason such specifications are advisable only on the larger contracts, and on the smaller contracts for tungsten lamps a specification of the kind of lamps to be used and the frequency of cleaning is sufficient.

In contracts for magnetite-arc lamps the conditions affecting the service performance of the lamp are technically quite different from those for tungsten lamps. The street dust on the exterior of the globe, to be sure, will be about the same in either case. With the magnetite arc the interior of the globe collects deposits from the arc. While technically these deposits may be compared to the blackening of the inner surface of the tungsten lamp bulb, the method of treating the difficulty is very different.

Besides keeping the globes clean the company is directly responsible for the adjustment at which the arc is maintained. A magnetite arc on constant current can be adjusted over a considerable range of average voltage and the amount of light given varies with the voltage across the arc. About the only thing in

the operation of a magnetite-arc lamp which is beyond the direct control of the operating company is the quality of the electrodes.

If a magnetite-arc contract is to specify service performance, these specifications should include something as to the frequency of globe cleaning or specify the maximum permissible loss by dirt as shown by test. Naturally this frequency of cleaning should be that of trimming, to save labor. It is advisable to clean the globe at each trimming rather than every other trimming, or less frequently. A specification should be made as to the average voltage to be maintained across the terminals of the lamps during operation. This is a matter easily checked with a portable voltmeter on the street. The operating current should also be specified, and this is easily checked.

The specification as to electrodes is not so simple, but nevertheless can be handled without prohibitive complications. At the beginning of the contract a batch of sample electrodes can be placed on file for future reference, with the stipulation that with a lamp adjusted for a given current and voltage future electrodes shall give an arc the lumens output of which will average equal to the sample set. The performance of future electrodes can then be checked in the laboratory by operating a lamp at the given current and voltage and measuring the lumens output as compared with the standard sample electrodes.

Where contracts specify certain permissible loss of light due to dirt on globes, the company must see that the cleanings are sufficiently frequent to keep within this limit. Check tests for dirt can best be made in a stationary or portable laboratory using an integrating sphere and a small standard lamp for the arc.

On the less important contracts, where the time between cleaning is the only specification made to insure against depreciation due to external dirt, the proper time interval will depend much upon the location. In the cleanest districts cleaning every thirty or sixty days should be the minimum, and in districts where there is much dust and smoke from fifteen to thirty days.

Static Frequency Converter

Systems in which the *B-H* magnetization loop of transformers has been employed for producing a pronounced triple harmonic effect have long since been known in connection with frequency transformation. One outstanding difficulty has been that the resultant wave forms have been very unsymmetrical. In patent No. 1,215,820, to Tsunetaro Kujirai of Tokyo, Japan, the latter difficulty has been overcome, resulting in practically a pure sinusoidal emf. of triple frequency with respect to the fundamental.

By magnetically polarizing the center limb of a branched transformer core by using direct current two distorted waves of emf. are set up in the two magnetic branches of the transformer if such branches are wound for and served by a source of alternating current. The peaks of the wave forms of emfs. will be displaced oppositely with respect to a third emf., which latter, having a very peaked symmetrical wave form, can be made so to combine with the original two waves of right-hand and left-hand distortion as to give practically a pure sine wave of three times the frequency of the fundamental.

Iron-Wire Transmission for Rural Extensions

Allowed by Connecticut Commission for Certain Types of Extensions—Economical Pole Heights and Spans and Data on Sags Advisable for Different Spans at Different Temperatures

BY L. P. PERRY

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MANY sparsely settled communities are deprived of electric service because central station companies cannot afford to build the lines to serve them. In fact, from data which have been collected, some rural copper-wire lines built to the standard used in well-settled districts have been unprofitable to the operating companies because the revenue obtained did not even pay for the overhead charges on the investment. In such cases, or where service is required for only a short period of years and the wire must be subsequently taken down, companies have had to look for cheaper methods of construction. Iron-wire transmission has been tried extensively of late, as has been noted in the *ELECTRICAL WORLD* before, the companies taking advantage of the lower cost of conductors and the higher tensile strength which permits larger pole spacings and consequently smaller investment in poles and insulators.

Seeing the possibilities in the use of iron wire, but being confronted with a state law which compelled it to secure the approval of the State Public Service Commission before such construction could be adopted, the Central Connecticut Power & Light Company has taken up the subject with the commission and received permission to use iron wire for certain extensions. At the time the request was made several 2200-volt line extensions had been promised to customers along a 13,200-volt transmission line, it being the intention to put cross-arms on the existing pole lines to accommodate the proposed 2200-volt circuit. This construction has not yet been approved, however, presumably because it has not yet been ascertained whether the high-voltage wires might break and come in contact with the low-voltage wires beneath.

At the conferences which were held the commission was alarmed lest the proposed types of construction should be more dangerous to the public than the present standard. In support of the petition it was shown that No. 6 bare double-galvanized B. B. iron wire is about one size larger and very much stronger than the commonly used No. 6 B. & S. gage weatherproof copper wire. Iron wire has the further advantage of not having to carry a load of weatherproof insulation. Weatherproof copper wire is usually soft or medium drawn and much weaker than hard-drawn copper or iron wire.

If weatherproof copper wire is pulled up taut during hot weather it will contract and become so taut in cold weather that the wire draws out to a slightly smaller diameter. In the winter, when it is loaded heavily with sleet and subjected to high wind pressures, the tension may become so great that it will lengthen and sag until the tension has been reduced. During the following summer, owing to the higher temperatures, the wires will sag still further. Iron wire supported on poles placed 250 ft. (76.2 m.) apart to give 6-ft. (1.8-m.) sags is much stronger and much more likely

to retain its original length and position than copper wire, usually erected on more closely spaced poles.

Evidence in support of these statements was given the commission by showing photographs of a trunk telegraph line supporting many wires on poles spaced 125 ft. (38.1 m.) apart which had broken down during a winter sleet storm, while three iron wires erected three years before by the operating company for transmission purposes and supported on poles in two instances 480 ft. (146.3 m.) to 500 ft. (152.4 m.) apart were unaffected. While the commission seemed to appreciate that poles which were not strong enough to support forty wires on short spans would support three wires on long spans and that the pole loading was not excessive in the requested construction, approval has thus far been withheld for the long span.

In the three-year-old iron-wire line previously mentioned there have been no pole failures or broken wires,

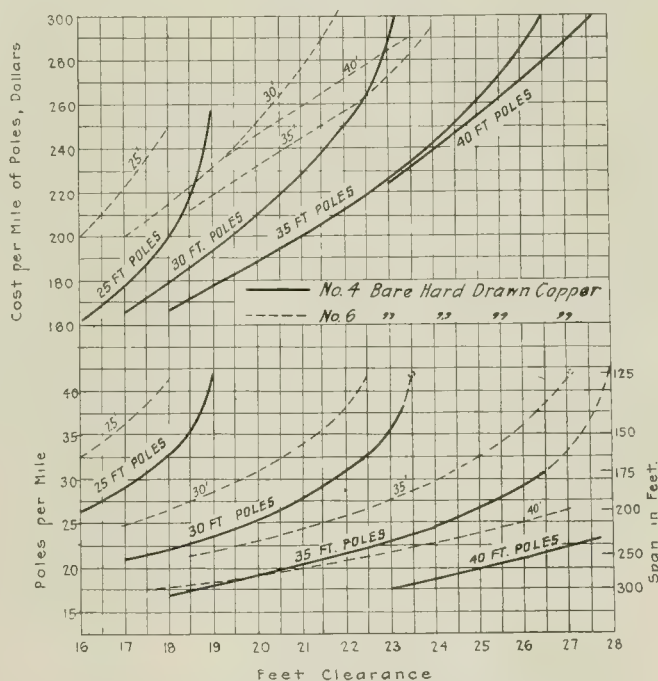


FIG. 1—COST OF POLES PER MILE WITH TWO SIZES OF WIRE AND DIFFERENT GROUND CLEARANCES

no insulators broken because of mechanical stress, and there has been only one cross-arm failure—that being due to a tree falling across the line and breaking the cross-arm off from the pole. The cost of this line, including substantial payments for purchase and cutting of right-of-way and a small charge against engineering, was \$517 per mile (\$323 per km.). It was composed of 35-ft. (10.7-m.) poles, two-pin cross-arms and two No. 4 double-galvanized B. B. iron wires.

In the opinion of the commission, there seemed to be no question as to the strength of galvanized iron wire when first installed, but the liability to rusting was

viewed with some alarm. The petitioner held that iron wire can rust considerably before its cross-section is reduced to the point where it would be seriously weakened. If a small iron telephone wire is safe for ten or twenty years, the larger wires proposed for transmission purposes will of course have a longer life, since the larger the diameter the less the relative surface exposed to rust compared with the weight. Furthermore, although practically all 600-volt trolley wires suspended over the heads of pedestrians in busy city streets are supported by stranded galvanized-iron wire, casualties due to the rusting away of these wires seldom occur. While the commission was apparently satisfied with the initial strength of the proposed iron wire, it demanded,

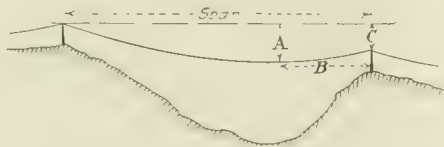


FIG. 2—MEASUREMENTS TAKEN TO ADJUST SAG ON LONG SPAN WITH POLES AT DIFFERENT ELEVATIONS (SEE TABLE II)

in granting permission for its use, that the operating company use extra vigilance during the semi-annual line inspection.

MOST ECONOMICAL POLE HEIGHTS AND SPACING

The results of the study made by the Central Connecticut Power & Light Company to ascertain the most economical pole spacings for the iron-wire line previously described are given in accompanying curves and tables. Selecting a given clearance of 18 ft. (5.5 m.) from the lowest point of the conductor to the ground, and using No. 4 bare conductors, it appears from Fig. 1 that seventeen 35-ft. (10.7-m.) poles are required per mile, whereas twenty-two 30-ft. (9.1-m.) poles must be used in the same distance. From the upper set of curves it can be seen that the 35-ft. (10.7m.) poles cost \$167 per mile (\$104 per km.), while the 30-ft. (9.1-in.) poles would cost \$178 (\$111 per km.), making the cost of poles for an 18-ft. (5.5-m.) clearance 6 per cent cheaper with 35-ft. (10.7-m.) poles than with 30-ft. (9.1-m.) poles.

With No. 6 bare conductors relatively larger sags would be required to keep the tension within safe

TABLE I—SAGS (IN.) EMPLOYED FOR DIFFERENT SPANS AT DIFFERENT TEMPERATURES
(No. 4 Bare Medium Hard-Drawn Copper Wire and No. 4 Double-Galvanized B. B. Iron Wire)

Temperature, Deg. Fahr.	SPAN (Ft.)						
	150	175	200	225	250	275	300
20	11	20	33	50	72	90	114
40	13	24	38	55	78	96	120
60	16	27	42	57	78	96	120
80	19	31	46	66	84	102	126
100	23	35	50	71	90	108	132

limits. Twenty-one 35-ft. (10.7-m.) poles or twenty-seven 30-ft. (9.1-m.) poles would be required per mile with an 18-ft. (5.5-m.) clearance from wire to ground. In this case the pole cost would be \$208 and \$214 per mile (\$130 and \$134 per km.) respectively, a difference

of only \$6 per mile (\$3.75 per km.); thus it would hardly matter whether No. 6 bare conductors were supported on 35-ft. or 30-ft. (10.7-m. or 9.1-m.) poles.

It was assumed when this study was first undertaken that the most inexpensive line would be that built with

TABLE II—DATA USED IN ADJUSTING SAGS WITH POLES AT DIFFERENT ELEVATIONS (No. 4 IRON WIRE)

Span (Ft.)	C (Ft.)	B (Ft.)	A (Ft.)	Sag from Low Arm (Ft.)
300	0	250	32.5	32.5
	10	213	37.8	27.8
	20	180	43.0	23.0
	30	148	48.0	18.0
	40	120	56.0	16.0
	50	98	62.0	12.0
400	0	200	19.5	19.5
	10	152	25.0	15.0
	20	110	31.0	11.0
	30	77	37.5	7.5
300	0	150	10.5	10.5
	10	85	16.1	6.1
	20	41	23.0	3.0
	30	13	30.8	0.8
275	0	138	8.5	8.5
	10	56	14.2	4.2
	20	23	20.2	0.2
	30	20	30.0	0

the shortest poles, but reference to the upper set of curves shows that for an 18-ft. (5.5-m.) clearance the 25-ft. (7.6-m.) pole line of thirty-three per mile (twenty-one per km.) costs considerably more than a 35-ft. (10.7-m.) pole line with seventeen per mile (eleven per km.). At the then existing cost of materials it is, therefore, evident that it is no more expensive to use No. 4 conductors with long spans than to use a smaller conductor with shorter poles.

POLE-TOP CONSTRUCTION

In Fig. 3 is shown the pole-top construction used on the Central Connecticut Power & Lighting Company's 13,200-volt three-phase line to Lyman Viaduct, Conn. This line has now been in successful operation for about four years. Thirty-five-foot (10.7-m.) poles are set 275 ft. (83.8 m.) apart on tangent right-of-way, farther apart over gulleys and closer together on angles. N. E. L. A. specifications were followed for telephone crossings, and the wires were made to clear paths and roads by 22 ft. (6.7 m.), the minimum clearance being 18 ft. (5.5 m.). In this way shorter poles are per-

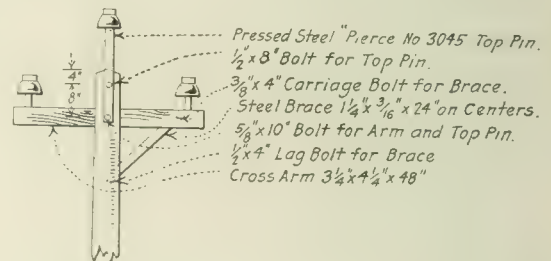


FIG. 3—POLE-TOP CONSTRUCTION USED ON ONE 22,000-VOLT IRON-WIRE LINE

mitted where the span has to be short and where poles are on knolls. Where the poles are set in earth they are allowed to extend 5 ft. (1.7 m.) into the ground, for 35-ft. (10.7-m.) poles. In rocky ground the holes are at least 4½ ft. (1.4 m.) deep.

Three wires are strung on the poles, one a No. 4 bare medium hard-drawn copper wire and the other two No. 4 double-galvanized B. B. iron wire. In stringing these conductors a target is attached to each arm to

CONDITIONS UNDER WHICH CONNECTICUT COMMISSION APPROVED USE OF IRON WIRE FOR RURAL EXTENSION

1. In the regular semi-annual inspections required by the rules of the commission, special attention shall be given to the inspection of any lines of iron wire constructed under the provisions of this approval in order to detect and correct deterioration.

2. This approval shall not be construed as authorizing the use of iron wire for transmission of electric current at normal voltage in excess of 4400 volts except that upon lines numbered 14 and 15 on said list (referring to 13,200-volt line to a quarry and an extension beyond the quarry to a ferry) current may be transmitted at a normal voltage not to exceed 13,200 volts, provided that line No. 14 shall be built entirely upon private right-of-way, and provided further that if iron wire be used for construction of line No. 15 of No. 4 size shall be used, it being understood that the use of such iron wire upon this line shall be temporary only and that copper wire shall eventually be substituted therefor.

3. The length of span between poles shall not in any case exceed 125 ft. (38.1 m.).

4. This approval shall not be construed as authorizing the use of such iron wire upon poles used jointly with any other company or upon poles to which are attached other wires of petitioner.

5. This approval shall not be construed as authorizing the construction of any of the lines herein enumerated except so far as such construction shall be completed within the calendar year 1917.

6. This approval shall not be construed as authorizing the construction of the line of poles by petitioner in any highway where there are already existing two or more pole lines carrying lines of wires.

7. All details of construction of the lines herein specified shall be in accordance with the specifications recommended in the June 2, 1911, report of the National Electric Light Association, except to the extent that the details herein specifically approved may be inconsistent therewith.

facilitate sighting along the line and securing the proper sag (given in Table I under column marked "275 ft."). The wire joints were made with copper sleeves and the conductors were tied to the insulators with galvanized-iron wire. Special care was taken to avoid injuring the galvanized covering on the conductors so that rusting would not ensue. The poles are guyed with galvanized No. 4 iron wire except at crossings.

A three-phase 13,200-volt iron-wire line with an aerial ground wire which was constructed more recently is shown in Fig. 3. This line is interesting in that the poles were cut somewhat longer than usual to allow a 5-ft. (1.5-m.) extension at the top for attaching the ground wire, thus making it unnecessary to use an angle-iron bayonet as is usually done. The top of this extension, even if as small as 4 in. (10.2 cm.) in diameter, is stronger than the customary angle-iron extension. Furthermore, it involves no extra expense and eliminates considerable additional material and labor.

The method of "sagging" long spans where one supporting pole is higher than the other is shown in Fig. 2. This particular section is on a 13,200-volt line and is 500 ft. (152 m.) long, three No. 4 iron wires being spaced 6 ft. (1.8 m.) apart on the cross-arms. All of the sags are adjusted on assumption that the temperature will not exceed 80 deg. Fahr. (26.7 deg. C.). To measure the sag a carpenter's level was held against the lower pole and shifted vertically until a line of sight along its upper edge was just tangent with the lowermost point of the span. (See Table II.)

SOME DIFFICULTIES WITH IRON-WIRE TRANSMISSION

Experiences with 80 Miles of 22,000-Volt Iron-Wire Line in Kansas—Charging Current Is an Important Point

BY M. D. LESLIE

Chief Engineer Midland Water, Light & Ice Company, Dodge City, Kan.

The recent extensive development of long transmission lines of iron wire to serve small loads has introduced some problems which are as yet unsolved. The information contained in this article is submitted in the hope that it will bring forth a discussion of the points in question and will be of assistance to plants contemplating such extensions.

The transmission lines under consideration consist of two distinct lines originating from the same set of transformers at Dodge City, Kan. One of these lines, described in the Feb. 10 issue of the *ELECTRICAL WORLD*, is 31 miles (49.9 km.) long and goes to Bucklin, Kan. Briefly it consists of three No. 6 E. B. B. iron wires spaced 4 ft. (1.2 m.) apart horizontally, on Bates steel

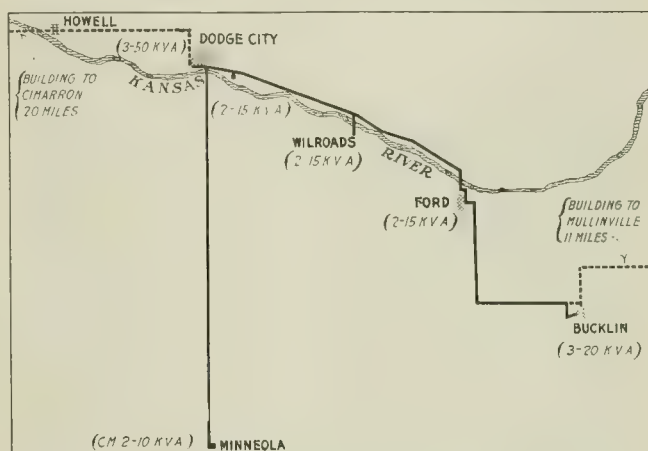


FIG. 1—IRON-WIRE TRANSMISSION SYSTEM ON WHICH OBSERVATIONS WERE MADE

poles set 300 ft. (91.4 m.) apart. The other line, which goes to Minneola, Kan., is 22 miles (35.4 km.) long, and consists of three No. 6 B. B. iron wires spaced triangularly 40 in. (101.6 cm.) apart on Franklin steel poles set 375 ft. (114.3 m.) apart. The first line has no transpositions and the second has three, 7, 14 and 21 miles (11.3, 22.5 and 33.8 km.) from Dodge City. Both lines operate at 22,000 volts.

In the design of these lines an exhaustive study was made of all the available information on the resistance of iron wire. Of course, the information was then and still is quite meager. However, it was decided that the maximum rating of the line should be about 2½ amp. (primary current). This would mean an effective resistance on the 31-mile (49.9-km.) line of about 12½ ohms per mile of single conductor, a total rating of 95 kva. and a loss of about 9 per cent. On the 22-mile (35.4-km.) line it would mean an effective resistance of about 12½ ohms per mile of single conductor, a total rating of 95 kva. and a line loss of about 6.5 per cent.

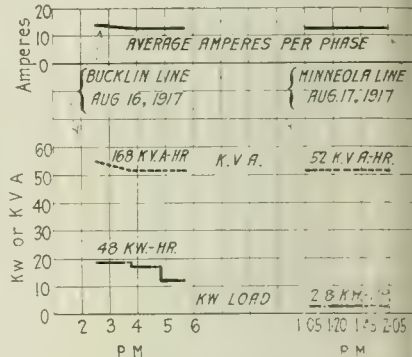
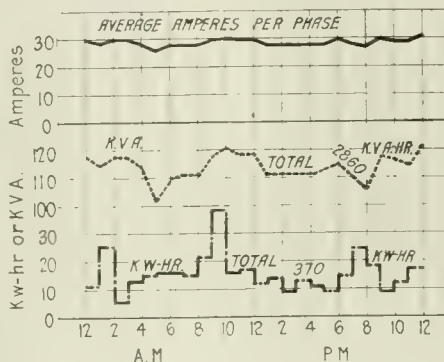
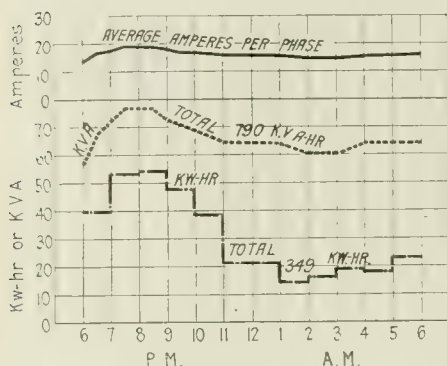
A peak load of about 50 kw. was anticipated on the 31-mile (49.9-km.) line, so three 20-kva. transformers were installed to supply it. The 22-mile (35.4-km.) line was a later development, and as a peak load of only about 15 kw. was anticipated this line was tied in on

the 31-mile (49.9-km.) line on the same bank of transformers. In the operation of the 31-mile (49.9-km.) line no attention was paid to the charging current as it caused no inconvenience except in creating a high voltage at the delivery end of the line. When the second line was "cut in" difficulty from this source became apparent at once. The switchboard instruments were overtaxed, and it was soon discovered that the transformers were overheating. At this time three 50-kva. transformers were on the ground to replace the 20-kva.

Dodge City with the Bucklin line connected than was possible without it.

OBSERVATIONS MADE FROM USING IRON WIRE

In reviewing these facts the following points were observed: Long, light-loaded iron-wire transmission lines on steel poles require a heavy charging current in proportion to the load that they are supposed to carry. It is a disadvantage to the generating station in that large-capacity ammeters, automatic switches and trans-



FIGS. 2, 3 AND 4—OBSERVATIONS MADE AT SUPPLY ENDS OF BUCKLIN LINE, APRIL 4, 1917, OF COMBINED BUCKLIN-MINNEOLA LINE ON JULY 10, 1917, AND OF BUCKLIN AND MINNEOLA LINES SEPARATELY ON AUG. 16 AND 17, 1917, RESPECTIVELY

transformers, which were transferred to a third extension of 20 miles (32.2 km.). These transformers were substituted for the 20-kva. transformers, but, as will be seen from the following analysis of conditions, they are really small for the work they are intended to perform.

When the current was turned on the 31-mile (49.9-km.) line the ammeter indicated about 18 amp. per phase on the 2300-volt side with very little change with a variation of load. When the 22-mile (35.4-km.) line was added this was run up to about 33 amp. per phase, but was later reduced by the installation of two 15-kva. transformers near Dodge City on the 31-mile (49.9-km.) line. The transformers are seldom loaded and furnish some lagging current. The current on the two lines is now about 30 amp. per phase. It is sometimes reduced to about 26 amp. by a pumping motor running at Bucklin. From the above figures the Bucklin line requires about 75 kva. on full load, including full-load line and transformer losses. The combined lines require 120 kva. The load curve for July 10 shows an output of 370 kw.-hr. and 2860 kva.-hr., or a power factor of 13 per cent. The curve for April 4 shows an output of 349 kw.-hr. and 790 kva.-hr., or a power factor of 44 per cent.

The calculated charging current on these lines would amount to 13 amp. on the 2300-volt side of the Minneola line and 21 amp. on the Bucklin line, or a total of 34 amp. on the two lines, which is not far from the actual current.

It appears that the heavy current experienced produces a leading power factor, although it is possible that it is lagging, owing to the high reactance of the iron wire and the low power factor of the transformers under such light loads. The first indication that this current was leading was observed during Christmas week under severe overload conditions, when it was found that a higher voltage could be maintained in

formers are required for a relatively small load. This means a high investment in all equipment. In addition, it is a disadvantage to the line in that it operates at a high line loss irrespective of the load that is carried.

Apparently more inductive load at the delivery end of the line would improve the situation. It would be necessary for this load to be on the line continuously, but this does not appear to be practicable. An inductive load at the plant end of the line would reduce the load on the transformers, but it would require a special set of transformers and nothing would be gained by this duplication. A synchronous motor operated at the plant end of the line with reduced field excitation has no appreciable effect on the line. No doubt it would be possible to design a synchronous motor for the end of the line that would provide the necessary lagging current. This appears to be rather an expensive method for such small propositions. It would be a matter of interest to know the effect of more inductive load on these lines; in other words, to know at what point of load the line loss would constitute the smallest proportion.

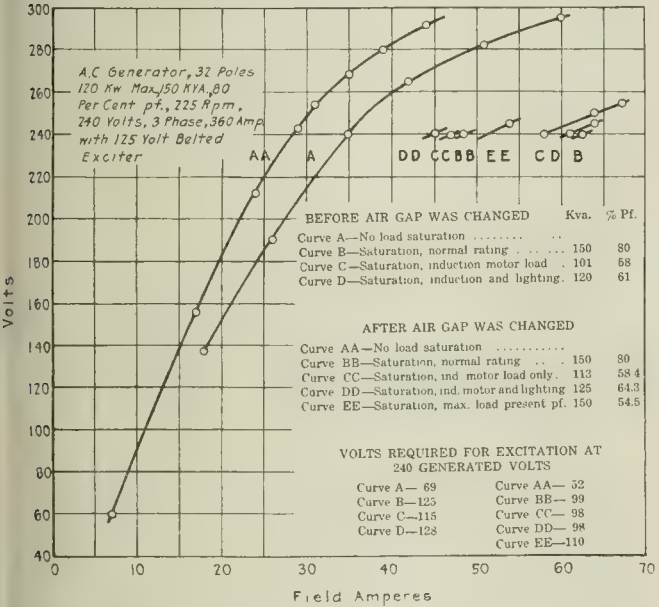
One thing is certain, and that is that the suitability of iron wire for transmission purposes where light loads are to be carried considerable distances is dependent on the charging current and not on the load current to be carried. This statement should not be taken as a serious argument against iron wire in a general way, but as one of the difficulties encountered. In the operation of these lines it has been found that they return a fair average rate on the investment. None of the lines built or contemplated would pay if copper wire were used at the present prices. In fact, they would not be built. Outside of the difficulties experienced and cited, the service of these lines has been all that could be expected. Both of the lines have been through severe storms without a single case of trouble, although neither line is equipped with a ground wire. The steel poles apparently give ample protection.

SHIMMING FIELD POLES CURES TROUBLES WITH ALTERNATOR

How a Standard Generator Was Changed After Installation to Take Care of Low Power Factors Without Overheating the Field

BY E. HAGENLOCHER

Trouble was experienced in a certain weaving mill because a generator would not maintain its rated voltage even when all the resistance in both the generator and exciter fields was cut out. In a search for the trouble the engine and exciter speeds were checked but found satisfactory. Furthermore, the air gap was found uniform. However, it was noticed that the poles were not lined up exactly central with the frame, a few of them being 1/4 in. (0.63 cm.) out of line. This was thought to have some effect on the saturation of the machine as the total length of the core was only about 8 in. (20.32 cm.). As the load measured only 126 kva. (75 kw. at 59.6 per cent power factor) and the ma-



DATA OBTAINED BEFORE AND AFTER AIR GAP WAS CHANGED

chine was rated at 150 kva. (120 kw. at 80 per cent power factor), it was decided that the difficulty was not due to armature drop but to the excessive amount of excitation required by the low power factor. Therefore it was decided to make a test to determine the saturation curve of the generator, as it was evident from the high voltage being impressed on the slip rings that something was wrong with the field. The saturation curve A which was obtained showed that a very high degree of saturation was required to give the desired voltage. While it appeared that lining up the poles with the stator iron would help somewhat, it could be seen that it would not help to the extent desired.

It was then decided to shim up the poles, as it was not practicable to increase the number of ampere turns on the field coils without a great deal of expense and loss of time. Shims made of electrical steel were added to a total thickness of 0.039 in. (0.99 mm.), bringing the air gap down to 0.116 in. (2.94 mm.). Another saturation curve AA was taken. This showed the great effect of reducing the air gap 25 per cent. The

readings which were taken before and after the air gap had been reduced are given in Tables I and II.

EFFECT OF CHANGE IN AIR GAP

On account of the decrease in air gap, the regulation was made slightly worse because the field due to the armature ampere turns was a larger percentage of the

TABLE I—ORIGINAL EXCITATION REQUIREMENTS

A. C. Volts	Kw.	Kva.	P. F.	Field Current	Field Volts	Remarks
240	52	101.8	51.1	58	115	With motor load only, low voltage at bus.
240	73	120.4	60.5	61	128	With motor load and lights, low voltage at bus.
245	75	126.0	59.6	64	139	With motor load and lights, proper voltage at bus.

total field. (It is the armature field which, tending to displace and buck the main field, causes the drop in voltage as the load increases.) Owing to the reduced main-field current the effect of the armature flux is greater both because of its greater relative strength and the lesser distance through which it reacts. The total resultant effect, however, was so small that it is not noticed in ordinary operation.

Decreasing the air gap is not always a desirable thing to do, because if the bearings are not ample there is danger of their wearing excessively and allowing the rotor to touch. As a result more care must be exercised in keeping the machine lined up. Also there is a greater tendency for the magnetism to pull the rotor and stator together if the air gap is small and not uniform. The core loss of the machine is practically the same, but the copper loss is reduced because of the smaller field current that is required for a given field flux.

However, the advantages and saving in expense gained by the shimming up of the poles will more than counterbalance the small amount of extra attention which the machine should receive when, after a long period of operation, the bearings have become badly worn. The reduced field loss can also be considered as a saving, as because of it the generator will become more efficient.

It must be kept in mind for similar problems that as the load increases (if an induction-motor load) the power

TABLE II—NEW EXCITATION REQUIREMENTS

A. C. Volts	Kw.	Kva.	P. F.	Field Current	Field Volts	Remarks
245	80	125.8	63.9	51	104	With motor load and lights.
245	64	117.9	54.3	50	104	With motor load only.
240	120	150	80	48.5	99	Calculated from above test results for guaranteed conditions.
245	82	150	54.5	54	110	Calculated from above test results for maximum load obtainable on generator working under present conditions of power factor.

factor increases, unless the motors are overloaded. This in addition to the lighting load will tend to give the generator somewhat additional capacity as the load becomes greater.

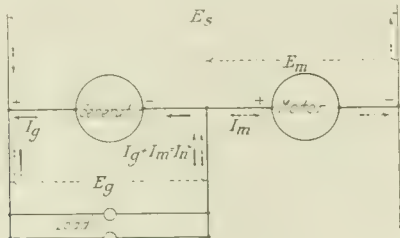
STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

AN EFFICIENT METHOD OF TRANSFORMING D.C. VOLTAGE

Balancer Set Can Be Used to Reduce One Direct-Current Voltage to Another More Efficiently than When Using a Generator Set

While balancer sets are used principally for the derivation of the neutral in three-wire systems and for taking care of the unbalanced portion of the load, it is not generally appreciated that they may also be used to advantage in transforming from one direct-current voltage to another where there is no objection to having the two circuits electrically connected. In comparison with an ordinary motor-generator set a considerable reduction in the size of the units, as well as an increase



ARRANGEMENT FOR OBTAINING DIFFERENT DIRECT-CURRENT VOLTAGES EFFICIENTLY

in efficiency of transformation, may be effected, as will be shown in an example to be given later.

The accompanying diagram indicates the direction of current in a balancer set, the load being assumed to be on the left-hand side of the system, in which case the machine on the left acts as a generator and the one on the right as a motor. The generator current is indicated by full arrows and the motor current by dotted arrows.

To illustrate the advantage of a balancer set over a

RELATIVE ADVANTAGE OF BALANCER SET FOR REDUCING VOLTAGE

E_s	50	125	200
E_m	200	125	50
I_n	2500	1000	625
I_m	590	553	520
I_g	1910	447	105
Motor rating, kw.	118	69.2	26
Generator rating, kw.	95.5	56.	21
Total rating, kw.	213.5	125.2	47
Efficiency (per cent).....	84.8	90.5	96.2

motor-generator for transforming voltages, assume that it is desired to obtain 125 kw. from a 250-volt supply circuit at 50, 125 and 200 volts respectively. For convenience in comparison it will be assumed that an efficiency of 90 per cent is obtained with the individual machines in the several sets, and the motor rating will be based on the current input.

In case an ordinary motor-generator set is used a 125-kw. generator wound for the desired voltage and a 154-kw., 250-volt motor will be required, giving a total machine rating of 279 kw. and an efficiency of 81 per cent for any ratio of transformation. If a balancer set is used, the efficiency of transformation and the rating involved can be obtained as given in the accompanying table by the substitution of the assumed quantities in the following equations:

$$I_n = I_1 + I_2, \quad E = E_1 + E_2,$$

$$I_2 = E_1 I_n (YZE_2 + E_1), \quad X = (YZE_2 + E_1) E.$$

From the table it will be noted that the increase in efficiency and decrease in capacity is more marked as the desired voltage approaches that of the supply circuit in value.

Invest Your Savings for Liberty

CAUSES OF THE JERKY NOTCHING OF MOTORS

Short-Circuited or Reversed Resistance Grids Responsible in Many Cases—Importance of Tagging Disconnected Wires

BY E. C. PARHAM

One of the commonest causes of jerky notching of motors is short-circuits in the resistance by means of which the motor is accelerated. Such short-circuits may be due to buckling of the resistance grids or to metallic foreign objects lying upon them. In either case acceleration will not be smooth. Another cause of unsatisfactory notching is the turning end for end of the frames of which the resistance as a whole is composed. The effect of such a reversal is to cut out small blocks of resistance on the lower controller positions and large blocks of resistance on the higher controller notches, where the motor is more sensitive to circuit resistance changes.

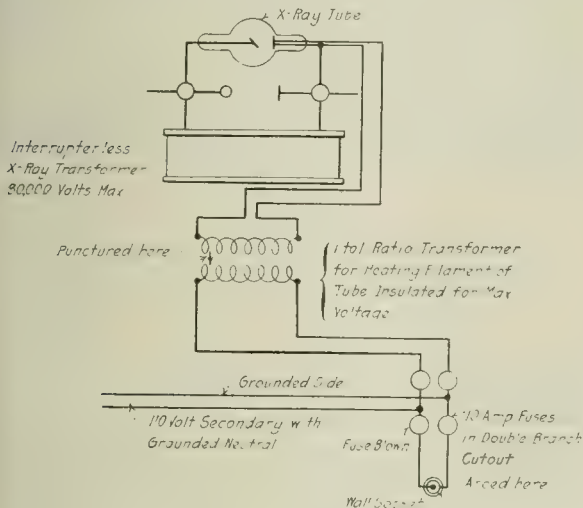
In one instance the resistor of a three-phase induction motor was disconnected for repair because some of the resistance grids were broken and others were distorted until they touched one another. The electrician who did the disconnecting was as familiar with the connections as he was with his own name, therefore he did not bother to tag any of the removed wires. When the time came for installing the repaired resistance frames the man who had disconnected the apparatus was on sick leave and no one else knew anything about the connections. Serious trouble resulted.

The moral of this experience, and of many other similar experiences, is that when disconnecting any electrical device (it matters not how familiar one may be with the connections) the disconnected ends should always be marked or tagged in a very evident manner.

REPEATED BLOWING OF FUSES TRACED TO PECULIAR CAUSE

Insulation of Electro-Heating Transformer of X-Ray Outfit Punctured, Allowing High Voltage to Short-Circuit an Outlet

BY L. A. TUCKER.
Superintendent Municipal Light and Water Plant, Houma, La.
A peculiar case of trouble occurred on the Houma, La., electric service system recently, which indicates that it would be advisable when faults cannot be located in line transformers to investigate high-voltage equip-



CONDITION WHICH CAUSED TROUBLE ON LIGHTING CIRCUIT

ment connected with the system, such as X-ray equipment in doctors' offices. Repeated blowing of fuses occurred on a lighting circuit from no apparent cause, but finally the trouble was located on another circuit feeding a special X-ray transformer, the insulation of which was punctured between the two windings.

Referring to the accompanying diagram, the high-voltage from the X-ray apparatus backed up across the puncture in the X-ray electrode-heating transformer, following the lighting circuits on the ungrounded side to a wall socket, where it jumped over to the grounded side. The line current followed it, blowing the fuse. This trouble was not found until the physician casually mentioned that the fuse blew only when he happened to use the X-ray machine. After repairing the puncture there was no further trouble.

PREVENTING OIL FROM PASSING INTO BOILERS

Importance of Separating Oil from Steam Before It Condenses—Emulsion Difficult to Coagulate and Remove

One of the most effective methods of preventing oil from passing over into boilers is to install an oil separator in the exhaust steam line. Once the steam has been condensed, however, and oil allowed to mingle with it, an emulsion is formed which is very difficult to remove. While the free oil which floats on the surface can be skimmed off, the emulsified oil remains in suspension in very minute particles, much smaller than the pores of any commercial filtering or straining medium. In fact, the emulsion will pass through the finest filter used in

the chemical laboratory. Emulsified oil appears to have some of the characteristics of a colloidal solution, the particles of which appear to carry negative charges of electricity. They can be coagulated by introducing into the water a suspension of some substance, such as fuller's earth, carrying charges of the opposite polarity. This method has been attempted in the Davis-Perret system, in which the positive ions are obtained by passing a current between iron electrodes suspended in the water which has been made conductive by a small amount of soda ash. Filtration through powdered serpentine rock to remove suspended oil is impracticable because the resistance to flow of water increases rapidly. Cloth filters have been employed for removing cylinder oil from boiler-feed waters, but cannot absorb much oil.

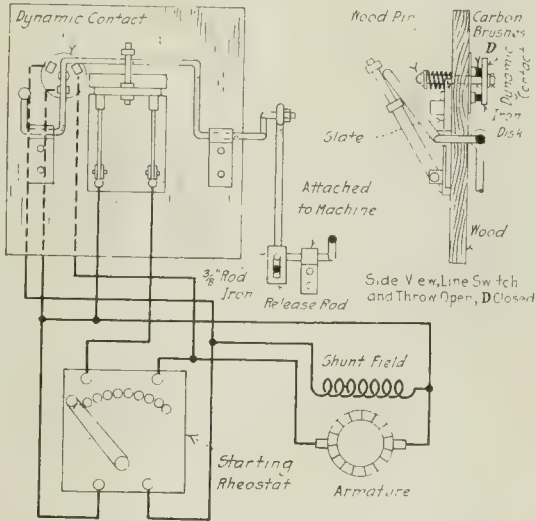
For Humanity's Sake Buy a Bond

AUTOMATIC GUARD DESIGNED FOR USE ON DRILL PRESSES

Double Dynamic Brake on Direct-Current Motors Brings the Press to Rest Without Delay or Strain

An automatic guard for drill presses was recently built for use in the plant of the Commonwealth Steel Company of Granite City, Ill., after one of the operators had been killed. This guard extends horizontally just above the drill table so that when struck or touched the main-line switch to the drill motor is opened, thereby causing a dynamic brake to stop the drill in one-quarter of a turn. This is practically instantaneous as the speed of the drill is 150 r.p.m.

All of the machine operators are instructed in shutting down the machines to do so by applying the dyna-



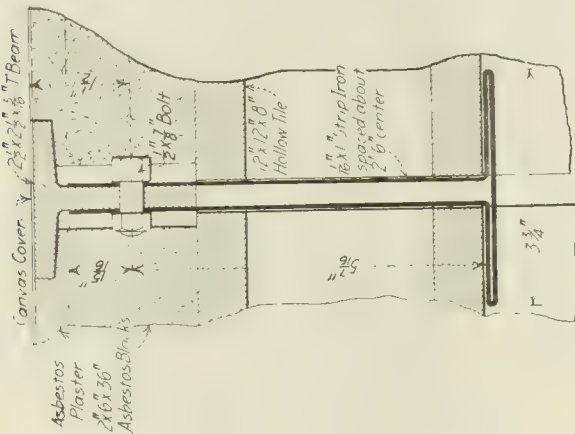
ARRANGEMENT FOR STOPPING DRILL QUICKLY

mic brake by touching the guard instead of by walking to the switch box and opening the circuit manually. In this way they become so accustomed to using the dynamic brake that in case they were pulled into the drill at any time it would be almost second nature to them to strike the guard in some way. A diagram of connections for this device is shown herewith. The device was perfected by William Schwieder and H. E. Howey.

MINIMIZING RADIATION FROM BOILER SETTINGS

Ordinary Firebrick Next to Furnace, with Hollow Tile, Asbestos Blocks and Canvas Outside, Makes a Good Protection

Since radiation losses in furnaces amount to from 4 to 9 per cent if the boiler setting is not properly protected, the Union Electric Light & Power Company of St. Louis in its remodeled Ashley Street station is taking measures to eliminate these losses. The boiler



HOW AIR-CELL COVERING AND TILE IS HELD IN PLACE

side walls have the usual XX firebrick lining, 9 in. (22.8 cm.) thick, next to the furnace and are backed up with 8-in. (19.3-cm.) hollow building tile bonded with common red brick and sealed to prevent air leakage. Over the tile is placed a 2-in. (5.08-cm.) air-cell covering fastened and cemented into place and covered with canvas. Six months' operation of these boilers has proved that this setting is satisfactory. Attention is called to the method of holding the building tile in place. Strips of iron 1/16 in. by 1 in. (1.6 mm. by 2.54 cm.) are fastened as shown to "T" beams, which run vertically through the boiler walls.

COOLING UNDERGROUND CABLES

Placing Ice in Manholes Has No Effect on Temperature—Water Most Effective Medium

During the last summer a central station company in the Middle West which operates a rather extensive underground cable system tried several experiments with the hope of discovering an effective means of reducing the operating temperature of its lead-covered cables. While none of the experiments developed any particularly successful method, the results of the experiments may be of some value to other companies contemplating similar tests. The first experiment, in which an attempt was made to cool the manholes and conduits by placing ice in the holes, was a failure. Each day for three days 200 lb. (90.71 kg.) of ice was placed in each of three manholes. The center manhole was on the top of a hill, and at that point a recording thermometer was stationed. The ice seemed to have no effect on the temperature, so the quantity of ice in each manhole was doubled. This did not affect the temperature, and the experiment was discontinued.

A forge blower fan was then placed in the previously mentioned middle manhole and was connected to a 6-in.

(15.24-cm.) sewer tile vent, which extended a distance of about 10 ft. (3.04 m.) to the inside of the street curb. This fan was kept running twenty-four hours a day, exhausting approximately 300 cu. ft. (8.66 cu.m.) of air per minute. Although the fan exhausted a considerable quantity of warm air, the recording thermometers did not show any appreciable effect on the temperature of the manhole.

Following these experiments it was decided to try cooling the cables by water. It was found that with a stream of water at 82 deg. Fahr. (27.8 deg. C.) flowing at the rate of one gallon (3.7 l.) per minute the temperature at the discharge end, which was 251 ft. (76.5 m.) distant, was 108 deg. Fahr. (42.2 deg. C.). On account of the condition of the cable in the district where this experiment was tried, further investigation was considered unwise. It was therefore impossible to follow this apparently most successful investigation to a point that would give definite results.

No Scrap of Paper—It Is a Bond

EMERGENCY SUBSTATION LIGHTING ARRANGEMENT

Pacific Coast Company Uses Low Voltage Relay and Storage Battery in the Operation of Its Automobile Spotlights

For the last two years there has been installed in the Colton substation of the Southern California Edison Company an automatic substation lighting system consisting of an Edison storage battery and several automobile spotlights. These spotlights are switched on automatically by a low-voltage relay, and operate the instant the station lighting is out of order. This lighting system was installed after what might have caused a serious accident to the operator. There was a short-circuit on the line which opened the automatic switches; the operator rushed across the station with a hand lantern, stumbled and fell, put the lantern out and was partially stunned, with the result that this substation was out of service for ten or fifteen minutes. The operation of this system has been so satisfactory that it is now being installed in all of the important stations of the company.

CORROSION OF STEEL STACKS

Sulphuric Acid Arising from Combination of Soot and Rain Often Injures the Upper Sections

BY T. W. REYNOLDS

Corrosion of steel stacks is more rapid in the upper sections than in the other portions. This is due to the presence of sulphuric acid resulting from combined soot particles and entering rain. A cap or hood is a partial protection and for equal life of stack and hood should be of heavier construction than is customary. Use of steam jets to increase draft or the introduction of steam in the furnace, which is sometimes done to prevent clinker trouble, augments deterioration of steel stacks, the first-mentioned practice being most serious in this respect. Steel stacks 1/4 in. (0.6 cm.) thick will last only a brief period under such conditions.

CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

CO-OPERATION OF CENTRAL STATION AND CONTRACTOR

Discussion Before Washington Dealers and Contractors on Relations That Should Exist Between Different Branches of the Industry

At a recent meeting of the Washington State Contractors and Dealers' Association O. B. Coldwell, general superintendent of the Portland (Ore.) Railway, Light & Power Company, presented a paper on the relations that should exist between the electrical contractor and dealer and the central station.

He pointed out that co-operation and organized effort between the two sides is to be desired by both and must exist before the industry can reach its fullest development. Frequent meetings of respective societies should be held at which the problems of both parts of the industry should be considered. The wiring of new buildings opens an important field for co-operation through the proper inclusion of special circuits, base-board outlets, etc. The loosely drawn specification was condemned as proving a disadvantage to all in the long run. Furthermore, both the central station and contractor can co-operate by assisting the architect and the consumer in the proper layout and selection of the lighting equipment in store, shop and home.

We Must Win the War—Buy a Bond

MONEY SAVING EFFECTED AND COMPLAINTS REDUCED

Advantages and Disadvantages of the Continuous-Reading Plan as Seen by a Company Which Recently Changed Over to It

When a central station company reaches that stage in its growth at which "discount day" means a small riot in the front office it generally looks about for a way of relieving the jam. The way which is most frequently considered consists of replacing the plan of reading all meters at approximately the same date each month with another plan that provides for reading about one twenty-fifth of the meters each day. With the latter plan the discount day for about one twenty-fifth of the customers comes with each successive business day. When consideration of the change comes up the company's officers usually inquire as to what are the advantages and the disadvantages of the new plan. C. Irwin of the Decatur (Ill.) Railway & Light Company, who has recently seen his company effect the change, analyzed the situation as follows, at the request of the ELECTRICAL WORLD:

The company had about 9000 electric and gas accounts. Each month it was the plan to read the meters within a space of two days, if possible, to get the bills out, and then to endeavor to collect all bills over the

counter at the cashier's cage before the close of the last day on which discount was allowed. This plan was unsatisfactory for several reasons. First, customers were discommoded and annoyed by being forced to wait in line to pay bills. Many got the idea that the company, if it took in money at such a rate, must be rolling in wealth. Complaints multiplied and were intensified as waiting customers discussed grievances among themselves. Second, the meter-reading situation was a serious one, for it was difficult to get competent men for such temporary jobs and it was frequently necessary to disorganize construction and trouble-shooting forces to get the meters read. The situation was nearly as annoying in the office billing department. These were the main reasons why a new method was sought.

Now that the continuous reading system has been in operation for some time it is seen to have some distinct advantages. First, the company gets better meter reading because the men who do the reading are specialists. Two meter readers are regularly employed at \$50 a month. The city is laid out into twenty-four districts. These meter readers cover one district each day. The largest number of meters read by a single man on any day is 160. These men do nothing but read meters. At first it was expected that they would assist in the stock rooms after they had finished their routes, but when it was learned that this plan prevented the men from completing their outside work as rapidly as possible it was abandoned. Now they are free to quit at any time they finish, and it frequently happens that the work is completed early in the afternoon. In months which have thirty-one days the meter readers may have a free day or may be required to take a few readings not obtained on the regular routes.

Another advantage is that there are fewer mistakes in figuring bills. Each bill passes over the desk of a single individual, who is familiar with all special conditions and who knows how customers want bills handled. The new plan has produced a steady load on the cashier's office and has practically eliminated standing in line. This has automatically reduced the customers' complaints to an irreducible minimum. Besides this, the change has been a big help on collections, because it is possible when comparatively few bills become overdue each day to get after the delinquents promptly and get the money while the memory of the obligation is fresh. Moreover, the new method does not necessitate taking business and trouble men off their regular jobs to read meters, and office clerks need not be temporarily made into billing clerks once a month. The bills which are made out each day are delivered by a carrier boy who works one-half day every day for 50 cents. This cuts the expense of delivering the bills to one-fourth what mailing would cost.

The continuous-reading plan has some disadvantages, a part of which may be overcome. There is one ob-

jection from the engineering viewpoint in that the total of the customers' meter readings for any one month cannot be compared with the total of the station readings to determine the distribution losses. It is possible to check up these losses on a yearly basis, however, with a considerable degree of accuracy. There are, in addition to this, two sorts of objections to the continuous plan that come from customers. First, there is the customer with two meters in different districts and who therefore gets two bills which probably will have to be paid at different times. He objects to making two trips to the office. This objection can be eliminated by asking the customer to authorize his bank to pay one or both bills. Then he will not need to come to the office except as he desires. The second objector is the large factory which wishes all of its items of expense to coincide with the calendar months. This difficulty was eliminated at Decatur by making a special meter-reading route taking in the large customers who brought up this objection. A minor and partly fanciful objection to the plan is that for the first month in which it is in effect the company's revenue showing may not be up to standard, owing to the shorter periods covered by some of the bills. This apparent decrease in earnings is, however, made up in the succeeding month.

Taken all in all, it is the opinion of the officers of the Decatur company that the continuous-reading plan is a marked improvement over the old system. M. L. Harry, general superintendent, is particularly enthusiastic over the manner in which it has reduced complaints.

It Is the Liberty Bond Issue

PAYING BY MAIL HELPS

EMPLOYEES SAVE MONEY

Detroit Edison Company Sends Checks for Its Men to Their Homes for Delivery First Thing Monday Morning

The Detroit Edison Company, after various experiences in paying its men, adopted the plan of sending checks to them at their homes. It has continued this method and is pleased with the results. The pay roll week ends on Wednesday night, and the pay checks are put in the mail on Saturday, so that they are delivered to employees in the first mail on Monday morning.

Formerly the company found it necessary to use six or seven automobiles every pay day in order to reach its men. This was not only inconvenient but it involved also much work and some risk. Under the present method the greater part of the work is done in the payroll department at Detroit.

As there are now 3500 employees and they are scattered over a large area, it would be a problem to pay them promptly and easily by any other method than through the mail by check. Some of the towns served by the company are 40 miles (64 km.) from Detroit, and the physical difficulties in the way of paying cash would be considerable.

Officials of the company feel that it is better for the men to get their wages in the form of checks. They have made arrangements with all of the Detroit banks to cash checks, and one result of this has been that

employees have been encouraged to start savings accounts. Careful observation leads to the belief that the men have handled their money more prudently since the change was made. The men like the plan of paying by check. Before the change from the old method was made it was approved by 81 per cent of the men in a postal card ballot.

The addressograph is used for printing the name and address as well as the date on the pay check. The same plates used for printing payrolls are used also for printing checks, the date being eliminated by means of a cut-off. The checks are mailed in window envelopes. This saves the time of addressing envelopes and eliminates any chance that the check for one person would be mailed in an envelope addressed to another.

A special payroll check writer made by the Defiance Check Writer Corporation is used. A signagraph made by the Signature Company makes it possible for A. F. Klute, paymaster, to sign his name with seven pens at once so that the burden of actually signing the checks is a light one.

To Protect Our Land Buy a Bond

SUCCESSFUL SALE OF PREFERRED STOCK LOCALLY

Nebraska Power Company Places Securities at Par on Part-Payment Plan, with More than 500 Subscribers in One Month

The movement to place company securities with the local public seems to be growing and to be highly successful wherever tried. One of the latest properties to undertake the sales of its securities in this manner is the Nebraska Power Company, Omaha, Neb., which early in August made available a block of 7 per cent cumulative preferred stock to its patrons in that city and to the citizens of Council Bluffs, across the Missouri River.

This stock, advertised by an investment company of Omaha, was offered in small denominations at par and for cash, or on a part-payment basis, with the privilege of reservation. Dividends thereupon are payable quarterly, and it was pointed out by the power company, as well as by the brokers, through circular letters to users of electricity and by a series of advertisements in the daily newspapers, that the purchase of such stock offered an unusual opportunity for safe and sane saving, and at considerable profit as well.

The part-payment feature of the offer closed on Aug. 31, and at that time more than 500 subscribers to the stock had been accommodated, and more than 50 per cent of the employees of the Nebraska Power Company were included in that number. There were also many reservations of stock, and at the end of September the total number of subscribers was continuing to grow with no appreciable slackening. It is anticipated that the list will have doubled before many months have passed.

Through the advertising columns of the Omaha newspapers attention was called to the fact that interest accruing on one share of this stock is sufficient to pay the annual electric bill for energy of a small consumer, and exact figures were provided demonstrating a graduated scale along these lines, showing the yearly

statement that could be receipted by the interest on two shares, on three shares and so forth.

While this indisputable statement had an advertising "pull," it was the savings feature that proved the most attractive, in the opinion of the investment concern handling the stock, coupled with the effect of a previous invitation by the power company to its patrons to become partners in fact as well as in name for the betterment of the service.

Before the appearance of this stock upon the market in Omaha, the company had adopted the slogan "Your electric service company." The whole advertising campaign, both by the power company and the brokers, was based upon the theory of an active partnership between the producers and the customers.

The result of this stock disposition, especially that portion of it conducted on the part-payment plan, during August is believed to have left the patrons of the company, whether purchasers or not, in a very amicable spirit. This judgment is based not only on the number of subscribers, but on the hearty response of the employees to General Manager J. E. Davidson's request for assistance in creating interest in the proposition, and on expressions reported from various sources among the small consumers of the company's electrical energy.

It is a matter of particular gratification to the Nebraska Power Company that a great majority of the subscriptions were for the smallest denomination of the stock made available, indicating that those of meager means, constituting a still greater majority of the whole number of patrons in this territory, fully appreciated the opportunity for saving upon which the advertising campaign was really based.

It Is Lending, Not Giving

ADVERTISING ELECTRIC RANGES AND COOKING

Some Suggestions on the Way in Which the Idea Can Be Sold to the Average Housewife Through Publicity

In the sale of any new production idea advertising plays a leading rôle. The electric cooking idea is comparatively new and consequently is an advertising proposition. At the recent convention of the Northwest Electric Light & Power Association L. S. Gilliam presented a paper on electric range advertising in which he made a number of suggestions embodied in the following:

It is the lack of a message on the success of electric cooking, which, in turn, means the success of electric ranges, from electric range manufacturers to housewives, that is responsible to a large degree for the lack of confidence, the lack of understanding and the lack of appreciation of electric cooking which central station salesmen encounter in so many homes.

I believe the ideal way to accomplish the desired result would be for the manufacturers of electric ranges to start a joint advertising campaign to sell primarily the success of electric cooking, and secondly, the practicability and success of electric ranges, and I am still of the opinion that such an advertising campaign should be on an association basis, just as the various lumber associations, milk, butter and creamery men and others have combined to put their stories before the public, letting the sale of their individual products follow in the wake of the wide interest and con-

fidence generated by means of such associated advertising campaigns.

If joint electric range advertising of this nature is impracticable, then let the manufacturers of electric ranges appropriate sufficient money each year to go into the advertising pages of magazines and newspapers of general circulation, reaching housewives, and tell their own stories, making 60 per cent of the advertisements tell the success of electric cooking and 40 per cent of the advertisements sell the individual products.

I believe that the housewives want to hear direct from the men who make these ranges the central stations are urging them so strongly to buy; I believe the housewives have been taught to expect the manufacturers' guarantee and advice and suggestions on all other lines in the kitchen—and that right now they are waiting similar word from the manufacturers of electric ranges. And on this foundation of manufacturers' publicity and advertising can then be reared a superstructure of proper and adequate and effective co-operation in the supplementary advertising that will have to be done by both manufacturers and the central stations.

Then, too, will the central station be able to take its proper place in the scheme of marketing electric ranges and exercise its natural function of helping the housewife to select the size and type of electric range best suited to her individual needs, of helping and aiding her in the operation of the electric range, and of keeping the range on its lines year after year; while each such range by its own success and word-of-mouth advertising will in its turn sell other ranges.

For the central station's end of the effort toward co-operative electric range advertising I believe a certain amount of newspaper space along educational lines, backed up by a strong series of personal letters to housewives, to builders, architects and every one else who figures on placing an electric range in the kitchen, will best bring the desired results.

The successful advertising of electric ranges in any local community is predicated on a single condition—that condition being the extent to which the central station customers in the community are convinced of the success, practicability and economy of electric cooking. In other words, if a good deal of educational work has been done with the customers of the central station, and the customers have reached that point where they are pretty generally ready to accept electric cooking as a success, then the central station may proceed to sell its electric ranges on their individual merits and as a means to attain an end.

If, however, very little educational work has been done, the central station's advertising efforts must begin at the very foundation and first sell the absolute success of electric cooking—before any attempt is made to sell electric ranges on their individual merits. First sell the woman on electric cooking—then sell her the range to cook with!

You have a straight road to the heart of almost every woman when you can offer her some practical suggestion to help keep her young—to help preserve her good looks—help keep the worry lines out of her face. Therefore, when you thoroughly impress the woman with the fact that an electric range in her kitchen is going to help keep her young and help keep her good looks and disposition—by doing away with the work, the heat and the ashes and dirt and endless drudgery of the ordinary cookstove—you have in nine cases out of ten won her actual interest in your proposition. Then it remains for you to convince her of the practicability of this easy, heatless, odorless, economical cookstove—all of which follows as a matter of course when the preliminary impression has been made.

When it comes down to the actual sale of the range, the central station salesman could help the woman pick the range that will fit the size of her kitchen and family requirements and then let the different makes of ranges fight out the battle on their individual merits.

This viewpoint is, of course, the viewpoint of the salesman for the central station—the man interested primarily in convincing his "prospect" that electric cooking as a whole is successful and practical. The style or make of the electric range he will later sell his customer is a detail and not the vital issue which he has to contend with. That issue is to sell the electric cooking idea.

power that was handled was 600,000 kva. and the highest interrupted short-circuit power 450,000 kva. The conditions of the tests were somewhat less exacting on the switch than they would be under normal service,

TABLE I—TESTS ON EFFECT OF NUMBER OF GAPS IN SERIES

E	I ₁	I ₂	SINGLE-PHASE SHORT-CIRCUIT POWER		Duration of Arc in Half-Periods	Arrangement
			Maximum Kva.	Interrupted Kva.		
5100	2500	950	12,800	4850	16	a
5100	2400	1100	12,200	5600	5	b
5100	1600	1080	8,150	5500	3	c
6050	3500	1000	21,200	6050	21	a
6050	3150	1000	19,000	6050	11	b
6050	1800	950	10,900	5750	8	c
6950	3150	1400	22,000	9750	23	a
6950	3500	1250	24,300	8700	17	b
6950	2500	1050	17,400	7300	15	c

as the switch was caused to open sooner after the occurrence of the short circuit than would be the case in practice, and owing to the fact that the leads between the generator and the switch were considerably shorter than they would be likely to be in a generating station. Taking these facts into consideration, it may be estimated that the tests correspond to the case of a generating station with turbines of a capacity of 75,000

TABLE II—SINGLE-POLE OIL SWITCH, 100,000 VOLTS, 400 AMP. WITH DOUBLE BREAK AND EXTINGUISHING CHAMBERS, MEAN VELOCITY 3.23 M-S.

E	I ₁	I ₂	SINGLE-PHASE SHORT-CIRCUIT POWER		Duration of Arc in Half-Periods
			Maximum Kva.	Interrupted Kva.	
70,000	550	360	38,000	25,300	7
80,000	580	360	46,500	28,700	8
80,000	500	330	40,000	26,500	9
80,000	500	410	40,000	33,000	7
80,000	440	440	35,000	35,000	8

kw. to 100,000 kw. protected by choking coils with about 5 per cent voltage drop. The new oil switch shortens the duration of the arc to 0.01 second, and the destructive gases produced in the oil are rendered innocuous by containing them in closed chambers where they do useful work in blowing out the arc that is formed.

Generators, Motors and Transformers

Mechanical Oscillations of Synchronous Machines.—

A. DINA.—The author describes this phenomenon and shows experimentally that it is due to the resistance of the armature windings and of the line connecting the machines. He reaches the conclusion that any transformer between the line and synchronous machine makes the latter independent of the line as regards oscillations.—*Science Abstracts*, Section B, Aug. 30, 1917 (abstracted from *Elettrotecnica*, June 15 and 25, 1917).

Generation, Transmission and Distribution

Use of Low-Grade Mineral Fuels and the Status of Powdered Coal.—F. PARKMAN COFFIN.—Second installment of a series on ways of combating the fuel problem, including the following: (1) More extensive development of water power; (2) utilization of the less concentrated sources of kinetic energy, such as tides, waves, wind, solar heat and terrestrial heat (although these cannot be utilized on a large scale during the present emergency); (3) utilization of by-product fuels, such as coal-mine waste, coke-oven and blast-furnace gas, and wood waste; (4) utilization of local resources of low-grade fuel in territory now dependent upon transportation of high-grade coal from distant sources; (5) more efficient means of utilizing the latent energy in fuel for generating heat and power; (6) concentration of the production of power from fuel in central stations where the most economical methods may be utilized and its distribution electrically to consumers, and (7) the use of electric vehicles, charged by central-station power, to help relieve the great demand for gasoline for urban transportation. This particular article refers to use of peat, lignite, bituminous coal, colliery refuse, producer gas, powdered coal and anthracite coal. The author points out that low-grade fuel may be burned on grates in furnaces of special construction for each class of fuel, and mechanical stokers are available for burning high-ash coal and lignite. It is probable, however, that low-grade solid mineral fuels of all kinds can be burned to better advantage in pulverized form. Lump coal, when burned on the grate in a hand-fired furnace, usually requires about 100 per cent excess air. With modern mechanical stokers the usual practice is to use about 50 per cent excess air. With most kinds of pulverized fuel 25 or 30 per cent excess air is sufficient, and with proper attention the amount may be reduced almost to zero. However, the resulting temperature of the fire is a limiting factor. Other factors having a bearing on this are the construction of the furnace, the proportion of heat radiated directly to the tubes and the fusibility of the ash. A properly constructed furnace and burners should be able to burn any form of pulverized fuel which has sufficient volatile content. In the case of peat and high-grade bituminous coal rich in combined nitrogen the value of nitrogen as a fertilizer makes the by-product gas producer worthy of very serious consideration for large installations. The gas generated may be burned under boilers feeding steam turbines as the large gas engine has not proved commercially attractive.—*Gen. Elec. Review*, August, 1917.

Traction

Electric Traction Upon Canals.—A. TUMERELLE.—The author confines himself to the method most widely adopted—that of using tractors running upon rails and depending on continuous current at less than 550 volts—and compares, for the conditions that present themselves on French canals, operation with a single motor and operation with two motors in series or in parallel. He also discusses the relative merits of tractors and capstans in the lifts.—*Revue Gén. de l'Elec.*, Aug. 18, 1917.

Electric Tractors in Municipal Service.—BERLIT.—Data on the operation of three tractors in Wiesbaden.—*Science Abstracts*, Section B, Aug. 30, 1917 (abstracted from *Zeits. Vereines Deutsch. Ing.*, April 28).

Installations, Systems and Appliances

Electricity in the Steel Industry.—C. D. KESTER and W. H. RUNNER.—Outline of the growth and development of electrical applications in the steel industry, calling attention to some of the latest types of equipment in actual use.—*Elec. Journal*, September, 1917.

A Swiss Hydroelectric Central Station.—A description of a power house erected in the valley of the Plessur, Switzerland, to take care of increased demands upon the central station at Coire and to furnish energy to a new electric railway running from Coire to Arosa. Advantage was taken of a total fall of 220 m. (722 ft.). Between the intake and the pipe lines it was necessary to provide filtering basins to rid the water of sand, mud and pebbles, and the conformation of the surroundings made the whole hydraulic construction difficult. The pipe lines entering the station are divided into three branches of 450 mm. (1.47 ft.) inside diameter, which feed three Pelton turbines. Two 1500-hp., 500-r.p.m. turbines drive three-phase, 50-cycle, 10,000-volt, 1300-kva. alternators, and one 750-hp., 420-r.p.m. turbine is coupled to a direct-current 520-kw., 2100-2300-volt generator. A similar generator is driven by an asynchronous motor that can be excited by the power generated in the power house or from the old central station, where three-phase current transmitted at 10,000 volts is stepped down to 2000 volts. There is room for the future installation of two other groups of machinery at 2000 hp. or 2500 hp., and provision has been made to enlarge the hydraulic installation to take care of this when it becomes necessary.—*Zürich Schweiz. Bauzeit*, January, 1917, abstracted in *Revue Gén. de l'Elec.*, Aug. 11, 1917).

Wires, Wiring and Conduits

Capacity Test for Localizing High-Resistance Break in Short Lengths of Submarine Cable.—H. V. HIGGITT.—The test described is a discharge test taken with a ballistic suspension. Two readings are taken of one discharge, the first throw and the immediately following throw in the opposite direction. This latter reading is taken in order to eliminate the effect of the current from the break due to polarization and primary battery effect, and also any earth current. The current from the break, although falling in magnitude, is considered in the test as being constant during the short period in which the two readings are taken, with apparently little error. Examples of its application are given.—*London Electrician*, Sept. 7, 1917.

Electrophysics and Magnetism

Influence of Temperature on Electrical Resistivity and Thermo Emf. of Steels.—EDWARD D. CAMPBELL.—The total electrical resistivity of steel is made up of two components, that portion due to the solvent iron and that portion due to solutes in solution, the two portions not following the same laws so far as the temperature of measurement is concerned. The temperature coefficient of the electrical resistivity due to carbides in solution is positive, but only about one-fourth as great as that of pure iron. The temperature coefficient of the electrical resistivity due to silicides, as well as that portion due to tungsten and nickel in solution, is small but negative. The thermo-electromotive potential of a single solute in solution is dependent upon the chemical composition and concentration and is a linear func-

tion of the temperature. When two or more solutes are in solution at the same time the thermo-electromotive potential due to these solutes is not a linear function of the temperature and not dependent upon the total molecular concentration. To account for the observed phenomena of thermo-electromotive potential, the hypothesis is advanced that the thermo-electromotive potential of solutes in metallic solution is analogous to the solution tension of electrolytes in aqueous solution.—*American Electrochemical Society*, Oct. 6, 1917.

Units, Measurements and Instruments

Balancer Used for Testing Purposes.—For some years the balancer of which the diagram of connections is shown has been in use for the testing of motors and dynamos. With the use of this machine on a supply of 500 volts pressure any direct-current motor from 50 volts to 500 volts may be tested up to a limited horsepower. One of the chief features about it is that the pressure can be regulated with ease to suit any motor. The three armatures shown are connected in series with each other across the 500-volt supply. The shunt windings of all three machines are connected in parallel across 500 volts, and, as will be observed from the dia-

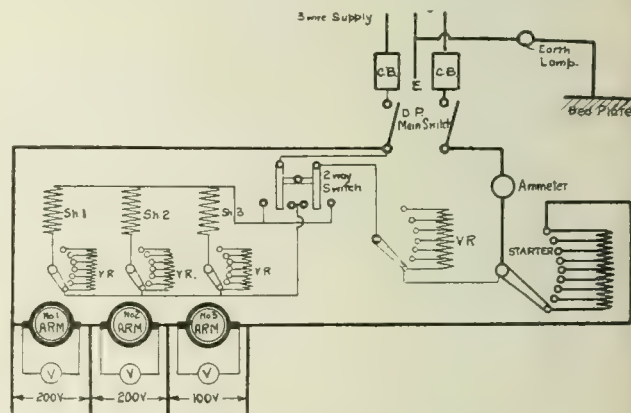


FIG. 4—CONNECTION OF THREE-ARMATURE BALANCER SET FOR OBTAINING DIFFERENT TEST VOLTAGES

gram, they have a variable resistance in circuit with each one. As the armatures are in series with each other, any alternation of shunt resistance alters the voltage on all three armatures, and when the volts are reduced on one armature the volts subtracted are added to the volts on the other two armatures. The other variable resistance shown in the diagram is for the purpose of increasing or decreasing the speed of the balancer, and so increasing or decreasing the load of any motor which may be tested by being belted to the balancer.—*London Elec. Review*, Aug. 31, 1917.

Wave Lengths and Radiation of Loaded Antenna.—BALTH. VAN DER POL, JR.—Mathematical treatment of the subject, in which it is pointed out that the radiation resistance of a loaded antenna and also the radiation depend not only on wave length, but also on current values at the top and bottom. The paper also discusses directions in which energy is most strongly radiated under different conditions. Formulas are given for the radiation from an antenna with different loadings at the top and bottom at a constant wave length and for the radiation resistance of an antenna vibrating in a half-wave length.—*London Electrician*, Sept. 7, 1917 (abstract of paper read before the Physical Society of London).

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

TARIFF COMMITTEE OF THE ASSOCIATED MANUFACTURERS Standing Committee Formed to Study Conditions with Particular Reference to Period Following End of War

A standing committee, which will be known as the tariff committee, has been created by the Associated Manufacturers of Electrical Supplies to study tariff conditions with particular reference to tariff protection needed by the members of the association in the period immediately following the end of the war. The members are: L. Livingston, Edward F. Caldwell & Company, Inc., New York City; F. H. Chapman, Yost Electric Manufacturing Company, Toledo, Ohio; E. F. Wickwire, Ohio Brass Company, Mansfield, Ohio; C. E. Dustin, secretary, New York City; J. E. Way, R. Thomas & Sons Company, New York City; S. H. Blake, General Electric Company, Schenectady, N. Y.; R. C. Buell, Johns-Pratt Company, Hartford, Conn., and John J. Gibson, chairman, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

A letter which Mr. Gibson, chairman of the committee, has sent to the chairmen of all of the sections of the association says that the importance of this subject cannot be exaggerated and that the gathering and compilation of information necessary to a comprehensive view of the situation will involve a great deal of labor. The committee will therefore need assistance from every member who is in a position to render it. Mr. Gibson says in part:

Every one feels in an indefinite way the serious nature of this matter; few have given it very much thought, and none can state clearly what is to be expected or when it will come. All agree, however, that foreign manufacturers are likely to flood the United States of America with cheap apparatus and material. All of Europe, even including England, will be in a position to produce with low cost, high efficiency and long hours, while we shall be found struggling with high cost, low efficiency and short hours. This character of competition may be expected from Japan and the Far East, as well as from Europe, but Europe will be in desperate need and its labor will be glad to sell its services at very low rates under the spur of dire necessity.

The home markets in Europe will not be sufficient to provide completely the necessary support for the laboring millions. They cannot live entirely upon themselves, but must, in their exhausted and debilitated state, sell abroad the products of their labor in order that there shall be a balance of trade in their favor. In that way and in that way only can the continental European nations again get upon their feet. Of all the world the United States of America will provide the best markets for the products of that labor, but unless the subject is thoroughly analyzed and proper steps are taken so that this influx of cheap goods from abroad shall be regulated the effect on American industry will be very disastrous.

The tariff committee therefore requests that your section appoint a committee of not more than two members to make a study of this subject with respect to the apparatus or material handled by your section and to report thereon at your next meeting. Comparative cost analysis will indi-

cate those articles with which Europe can undersell us in our own markets, and such analysis will be necessary in order to show the amount of protection needed. Differences in methods of figuring commercial costs involving overheads based on labor or material, or both, must be taken into consideration. Obviously, good judgment must be used in making corrections to cover differences between basic costs at present and basic costs after the war.

In connection with the work of your section tariff committee it would be well to know that the general secretary of the association is gathering information such as copies of tariff schedules and tariff laws of this country and of Canada, which will be available upon application to the general secretary. Canada's laws are included because of the anti-dumping provisions in her laws, which give protection additional to that which is obtained by the tariff itself.

The present plan of the association tariff committee is to make a careful study of the desires of the individual member of the association as expressed in the reports of the section tariff committees of the various sections, and also of such other information as it will be able to gather.

It Is Our Liberty and Our Loan

THEODORE N. VAIL ON BUYING LIBERTY BONDS

The Government Loan Presents Both an Opportunity
and a Duty to Millions of the Citizens
of the United States

The Liberty Loan is a wonderful opportunity to millions of Americans to perform a patriotic duty and save money that might otherwise be spent needlessly, according to Theodore N. Vail, president American Telephone & Telegraph Company. Mr. Vail said:

The Liberty bonds, as authorized by Congress and offered by the Treasury Department of the United States, present both an opportunity and a duty. There are millions of Americans who by reason of their rigid economy have saved money which can be wisely invested in these bonds. For such people the safety of their savings is the first consideration, but they also owe it to the nation to keep their money, however small the amount, at work rather than stowed away.

There are millions of people also who are making exceptionally large earnings on account of war work. For such the Liberty bonds present an opportunity for performing a patriotic duty and of saving money that might otherwise be needlessly spent.

There are millions of people to whom the Liberty Loan will primarily offer an opportunity, by possibly a little sacrifice of their immediate comforts, to help meet their country's necessities and provide for the future necessities of themselves and their dependents. Such sacrifices, if you can term them sacrifices, are necessary if we would maintain our country and our liberty intact and maintain the economic independence of our personal future.

The money which the people thus lend to their government for the common good will be needed to supplement whatever sums it is possible to raise by taxation. We may rest assured that taxes will be imposed to the limit of our tax-paying ability, and that we of to-day will carry our full burden and pass on to the future only what we cannot bear without breaking. For this is the price of war with victory.

CONFERENCE CLUB MEETING HELD AT NEW ORLEANS

Publicity for Electrical Contractors, Code of Practice
and Bare Grounded Return Wiring Are
Discussed by the Delegates

The Conference Club of the larger electrical contractors doing an interstate business held its fall meeting at New Orleans on Oct. 7, 8 and 9 just preceding the National Electrical Contractors' Association convention. This place and date were selected in order to express the Conference Club's interest in co-operating with the national body. The meeting of the club was marked by a full attendance of its membership from New York to California.

Among the reports presented was that of progress by the club's Washington committee on cantonment construction, an outline of which was given in the *ELECTRICAL WORLD* of Sept. 8, 1917. This committee was continued with full powers.

W. L. Goodwin reported on the progress of the co-operative movement among the contractors of New Jersey, Massachusetts, Michigan and other states.

G. E. Stewart of L. K. Comstock & Company, New York, presented the report of the committee on publicity, outlining a general plan for promoting the relations of the contractor within the electrical industry as well as with the public he seeks to serve based upon research work and knowledge of conditions.

A code of practice for electrical contractors was also read and discussed by the Conference Club. This code provided that bids be submitted on condition that a full set of plans and specifications be furnished without charge, the standard form of contract of the American Institute of Architects be used, the contractor be paid monthly at least 85 per cent of the value of materials and labor, the contracts be paid in full within thirty days of completion of the work, and that differences between contractor and buyer shall be settled by arbitration. The contractor shall not be responsible for delays for which he is in no way at fault. Any miscellaneous items of cost are not assumed to be included in an estimate unless agreed upon in advance. The contractor shall not be required to cut or alter any work except his own. Unless specifically provided an extra charge will be made for variations from standard materials. Changes in or additions to contract plans shall be made the subject of a special estimate. An interference or interruption charge shall be made by the contractor if his work is held up by causes over which he has no control. Drafting or engineering services shall be charged for at a fair price. Contractors shall not include temporary work in estimates unless quantities are distinctly stated. Costs shall be understood to mean cost of material and labor and the administrative or overhead expense.

In discussing this code F. W. Lord, New York City, suggested that if adopted a reference to such a code be placed on the letterheads of all contractors using it.

C. E. Corrigan, Pittsburgh, chairman of a sub-committee on bare grounded return wiring systems, read the report of his committee recounting experiences with such systems. The committee concluded that the chance of securing by the use of bare grounded return conductors a satisfactory system of

wiring which can be installed at sufficiently less cost than the present standard systems to make it attractive is very remote. Regard for life and property was also cited as among the serious drawbacks to the use of such systems of wiring.

Our Men Are There—Send the Cash

ELECTRICAL CONTRACTORS IN WAR-TIME CONVENTION

War Conditions and Constitutional Revision Receive
Careful Consideration at the Large
New Orleans Meeting

With a registration of 350 on the opening day, including contractors and representatives of other branches of the industry from every section of the country, the seventeenth annual convention of the National Electrical Contractors' Association, held at New Orleans on Oct. 9 to 13, proved one of the most important meetings ever held by the association.

The effect of war conditions on the electrical industry and on the electrical contractor was dwelt upon by speakers of national importance, sweeping changes in association organization were discussed, new plans were proposed for affiliation with local contractors' associations and broad measures were outlined for constructive co-operation with central stations, jobbers and manufacturers. The benefit accruing to the contractor who takes up merchandising sales was emphasized and remedies for the ills that have beset the electrical trade were discussed by men from all branches of the industry.

FEATURES OF THE OPENING SESSION

Opening the first convention session on Wednesday morning, President Robley S. Stearnes introduced Mayor Behrman of New Orleans, who welcomed the members in a gracious speech, to which W. K. Tuohey, vice-president of the association, responded eloquently.

S. E. Doane, chief engineer of the National Lamp Works, Cleveland, told of some of the economies in material and design which are being effected in European supplies and equipment as a result of war conditions. Surplus material is being saved, all scrap is being utilized and substitutes are being developed which will long affect the industry here as well as abroad. The return of the American army at the close of the war will bring back many young electrical men with ideas embodying the economies of current European practice, in turn reacting on American conditions.

William J. Clark, manager of the traction department General Electric Company, compared the phenomenal electrical development of America with that of Europe, and predicted a rapid growth in contracting and merchandising activity in this country in the years to come. Already America has more people employed in the electrical industries here than have all the countries of Europe combined, and American central stations produce more electrical energy than all the plants of Europe taken together. The speaker cited Germany's efficient standard of electrical plants, which has been of the greatest service to her during the war. Several small power stations, for example, are tied together to operate a single great 100,000-kw. nitrogen-

fixing plant. In contradistinction, the mistake of America's wasteful water-power policy is now severely felt in these days of coal shortage.

THE CONTRACTOR AS A MERCHANT

Samuel Adams Chase, supply department of the Westinghouse Electric & Manufacturing Company, discussed "The Electrical Dealer from the Manufacturer's Standpoint," and declared that if the electrical contractor will become a real merchant there is no department of selling in which the manufacturer and jobber will not be ready and anxious to help him in every way that all may journey together down the road of business prosperity. Mr. Chase pointed out the sales possibilities in home labor-saving and cost-saving appliances. In conclusion he suggested for the N. E. C. A. a trade promotion committee of four—a seasoned buyer, a mature but popular salesman, a financial man and an advertising man to advise concerning trade developments.

J. Nelson Shreve, Electric Cable Company, New York, spoke of the contractor's obligation during war time. No contractor can go far by his own efforts, declared Mr. Shreve, for teamwork is needed for success in any line. The electrical contractor knows how to install equipment, but he needs to make further use of merchandising principles and to know how to sell. The contractor who will devote his time to going after new business can select the most profitable business with greatest benefit to himself. Mr. Shreve expressed every confidence that the electrical contractor will do his part during the war and in the years of prosperous peace thereafter.

J. M. Wakeman, general manager Society for Electrical Development, told of the relations of the society to the electrical contractor-dealer, and declared that if he were an electrical contractor he would boost the "Goodwin movement." Mr. Wakeman recounted what the trained staff of the organization is doing to sell the idea of "doing it electrically" to the general public.

MR. GOODWIN'S ADDRESS

Following the important report of the resolutions committee, presented by James R. Strong, chairman, Earnest McCleary and William L. Goodwin, which opened the session of Thursday morning, Mr. Goodwin addressed the convention on "The Ills in the Industry and Their Remedies Through the Proposed National Association of Electrical Contractors and Dealers."

Mr. Goodwin recounted his personal experiences on the Pacific Coast with a plan for co-operation between dealer-contractors, central stations, jobbers and manufacturers which has proved itself a solution of former difficulties caused by lack of proper co-operation, business methods, cost data, accounting systems, etc. His recommended plan of co-operation he illustrated by means of a Wheatstone bridge diagram, and showed how the new proposed organization plan of the national association would result in the co-operation of national, state and local associations. An outline of this plan appeared in the *ELECTRICAL WORLD* for Sept. 15, 1917, page 540. Mr. Goodwin emphasized the importance of this plan of co-operation to the central station, jobber and manufacturer as well as to the contractor-dealers.

In closing Mr. Goodwin disclaimed any particular

originality for his conclusions, declaring them to be only the collective thought, study and experience of the thoughtful men of the industry summarized and presented in understandable form.

G. M. Sanborn followed with the report of the universal data and sales book committee.

At the business sessions of Friday other routine reports were discussed and attendance badges were presented to members present at all sessions.

ENTERTAINMENT PROGRAM

An elaborate entertainment program, arranged by President Robley S. Stearnes and C. S. Barnes, chairman of the local committee, was a feature of the New Orleans convention.

The annual reception and dance was held in the gold room of the Hotel Grunewald on Wednesday evening. On Thursday the local Jovians, headed by W. J. Aicklen and W. Clement Pree, provided entertainment and a dinner at "Spanish Fort," and on Friday evening the annual banquet was held, with James R. Strong as toastmaster. For the ladies there were numerous automobile rides and sight-seeing trips, closing with a theater party for all on Saturday afternoon.

Others Feel It—Buy Your Share

ELECTRICAL SERVICE AT THE BATTLE CREEK CANTONMENT

Co-operation Between Government and Engineering
and Operating Forces of Consumers' Power
Company in Completing Construction

Electrical service for the army cantonment at Battle Creek, Mich., is furnished by the Consumers' Power Company. A statement regarding the work of the company in furnishing this service has been given to the *ELECTRICAL WORLD* by C. W. Tippy, general manager.

The first negotiations took place on July 1, and service was given on Sept. 2. The substation has three 900-kw. transformers. The connected load at the cantonment aggregates 1700 kva., divided as follows: Pumps, 570 kva.; laundry, 300 kva.; piping plant, 95 kva.; general lighting, 735 kva.

Mr. Tippy gave the following description of the line:

Service is rendered to Camp Custer from the general transmission system of the Consumers' Power Company backed by 100,000-kw. plant capacity. The line through the camp is a 40,000-volt, three-phase line on poles. This line existed at the time the site was chosen. The large transformers were in stock as spare apparatus, the switches on the 40,000-volt line were made by the construction department from stock parts, and the lightning arrester was taken from our own temporary construction substation supplying power for one of our hydroelectric developments.

Two engineers with experience in distribution work were loaned to the government for the purpose of designing and supervising construction of the distribution system for the cantonment. All electrical plans and layouts were checked by the engineering department of the Consumers' Power Company. Care was used to select apparatus of standard design for distribution work, and government orders—stating military necessity—were responsible for prompt shipment from manufacturers of distribution panels and other apparatus which were installed by the government. The substation was installed by a regular crew of the power company's construction department.

NATIONAL CONVENTION OF THE JOVIAN ORDER

New York League Members Plan for Entertainment of the Delegates—Constitutional Amend- ments to Be Considered

Arrangements are being completed for an unusual and interesting national convention of the Jovian Order to be held at the McAlpin Hotel, New York, on Oct. 22 to 23.

At noon on Monday, Oct. 23, the local Jovian League will entertain visiting Jovians at luncheon. Dr. Carl Wallis Petty will deliver a patriotic address. Special entertainment features are being arranged for this luncheon under the leadership of George Williams.

The business sessions will be opened on Monday afternoon by H. L. Doherty, Jupiter. On Tuesday morning the business sessions will be opened by an address by John W. Lieb, president National Electric Light Association. Mr. Lieb will speak on general conditions in the industry.

Of the thirteen constitutional amendments to be presented several embody vital changes in the existing method of operation of the order. For this reason more than usual importance is attached to the annual gathering.

Patriotism Calls to You—Invest

EMPIRE STATE MEMBERS IN ANNUAL MEETING

War Conditions Form a Large Part of the Program— Affiliation with National Electric Light Association

Problems of war conditions occupied much of the time of members of the Empire State Gas & Electric Association at their annual meeting in the Engineering Societies Building, New York, on Oct. 5. Matters of coal supply, economy, interconnection of transmission systems and labor conditions were discussed in the all-day conference.

In his opening address President Stuart Wilder, Westchester Lighting Company, said that the last year, with increasing costs and scarcity of labor and materials, had been a strenuous one and that probably the coming year would be as bad or worse. He spoke of the increase of 10 per cent in membership and said that open meetings had been held by the association or committees at different points throughout the State, on an average, once a month. The association is willing to affiliate with the National Electric Light Association on certain conditions which have been discussed with the representatives of that body. The national association, however, has not yet acted. Mr. Wilder suggested that in taking up questions with the authorities at Washington members use the National Committee on Gas and Electric Service.

The report of the treasurer, C. A. Graves, Southern New York Power Company, showed that the association is in excellent financial condition. It is proposed to raise the dues of the larger companies.

F. H. Patterson, assistant auditor Rochester Railway & Light Company, read a paper on "The Bonus Plan Applied to Public Utility Properties." The plans es-

tablished in this company contemplate the division, so far as is possible, of the department concerned into a number of groups. A certain percentage of the results of increased efficiency effected by each group is prorated monthly to the individuals composing it on the basis of the wages paid. Bonus systems have been established in three departments—the consumers' book-keeping department, including meter-reading, bill delivery and turning on and shutting off meters; steam station No. 3, and the gas works. Mr. Patterson expressed the following conclusion:

"The systems are not advanced and advocated as a panacea for ills. On the contrary, they are in many respects imperfect in their application and inadequate in scope. They are in reality but experiments in their present form. But the principle of an incentive wage is just to employee and employer alike, because increased effort yields its monetary return. Therefore this method of compensating labor seems destined to become more popular. The difficulty lies in properly applying it to our peculiar industry."

Among those who discussed the paper by Mr. Patterson were J. T. Hutchings, J. C. DeLong, H. W. Peck, C. G. M. Thomas and H. M. Edwards.

A resolution was passed indorsing the Liberty Loan.

At the afternoon session the subject of depreciation was discussed by W. J. Meyers, secretary United Electric Light & Power Company, New York, formerly chief of the division of statistics and accounts of the New York Public Service Commission, Second District. Mr. Meyers, who prepared the classifications of accounts introduced by the Second District commission, discussed the subject of depreciation in its application to the accounts of electric and gas utilities.

The address of Mr. Meyers was discussed by R. A. Carter, J. T. Hutchings, G. W. Curran and H. C. Hopson.

A special committee on war measures, of which C. A. Graves is chairman, made an extended report. It dealt with various phases of the problem of coal scarcity. Among the suggestions advanced was that of interconnection of large and small generating systems of the State. Even if no energy were interchanged by such means, the existence of a comprehensive system of transmission lines would safeguard the supply of every company participating. The suggestions for interconnection by transmission lines covered both large and small steam plants and also hydroelectric systems, which would find this system of great value in periods of low and high water. Suggested methods of reducing the consumption of electrical energy were also discussed in the report. Executives of manufacturing companies were urged to give more attention to their plants so as to develop greater efficiency and economy in power.

The report was discussed by H. W. Peck, H. M. Edwards, J. C. DeLong, C. G. M. Thomas and F. W. Smith.

J. T. Hutchings, who with C. G. M. Thomas is acting as a special committee in regard to coal conditions, outlined what has been done to present the views of association members to the Washington authorities.

J. W. Lieb, chairman of the National Committee on Gas and Electric Service, presented a full statement concerning the work of that committee at Washington.

F. C. Bates, General Electric Company, discussed the effect of war and business conditions on the electrical manufacturing industry.

Officers for the ensuing year were elected as follows: President, E. H. Palmer, Empire Gas & Electric Company; first vice-president, H. M. Beugler, Central-Hudson Gas & Electric Company; second vice-president, H. W. Peck, Schenectady Illuminating Company; treasurer, C. A. Graves, Southern New York Power Company; secretary, C. H. B. Chapin, New York; members of executive committee to serve three years, J. T. Hutchings, Rochester Railway & Light Company; S. J. Magee, Ithaca Electric Light & Power Corporation; H. L. Mann, Buffalo General Electric Company; Stuart Wilder, Westchester Lighting Company; member of executive committee to serve one year, F. A. Stoughton, St. Lawrence Transmission Company.

Buy Liberty Bonds—War for Peace

OPPORTUNITY FOR CHINA

LIES IN THE WORLD WAR

M. A. Oudin Sees Promise in Announced Intentions of United States to Safeguard Commercial Interests of Its Citizens Abroad

M. A. Oudin, manager of the foreign department of the General Electric Company, made an address before the American Manufacturers' Export Association in New York on Oct. 10 on "China's Opportunity in the War." Mr. Oudin returned recently from a trip to China, Japan and Russia.

"The war has given China the most promising opportunity to free herself from the shadow of foreign domination that has arisen since the first shock resulting from political contact with European countries," said Mr. Oudin. "It has placed within her reach the means by which she may recover rights and concessions extorted by foreign nations, and, if wise in her future policy, by which she may deal with the world on a basis of equality and not as an inferior nation, forced dumbly to submit to the indignities and the ultimatums of any opportunist power."

In speaking of the friendship of America for China Mr. Oudin said:

There is in the province of Hunan an ancient seat of learning reputed to antedate the founding of the earliest European university by 250 years. In front of this institution is a tablet on which is recorded the humiliations China has suffered at the hands of foreigners. The characters are large and deeply cut in the stone that the young students may heed and remember. The story of greed and aggression of the principal commercial nations is thereon truthfully set forth. The name of only one great nation is missing. That nation is China's traditional friend, seeking no territory, no special interests or concessions and no political control.

What other nation or nations besides America can China count on to befriend her at the peace conference? The answer to this question is of interest to America as well as to China, for in it is involved the future of equal commercial opportunity for all. To this policy the United States is committed by the action of successive administrations now for eighteen years. One of the principal objects of this war, to use the words of an illustrious representative of one of the Allies, is to secure "for the world the blessings of liberty, justice and lasting peace." But it is certain that the belligerent nations, while fighting for these principles, are marshaling their forces for an economic struggle after the war. Where China is concerned possibly the lessons of the war are yet to be fully learned and the trend of the times to be fully appreciated by these nations.

Mr. Oudin, after recounting experiences of China with other powers, declared that the announced intention of the United States to safeguard the commercial interests of its citizens abroad will result in maintaining throughout the world a fair field for the legitimate activity of the American manufacturer, merchant and banker. China is now properly regarded by Americans as a promising field for their enterprises and a sphere for a strong economic development.

Leaving out of calculation entirely all the foreign settlements in China, said Mr. Oudin, the marks of progress are very remarkable.

The powers would do their part by China and conform to the new world conditions, Mr. Oudin said, were they to refrain from secret opposition to the commercial activities of one another and renounce all pretensions the exploitation of which would be derogatory to the material interests and honor of that country. If not now, these things are very likely to come to pass at the end of the war, when the struggle against ruthless militarism, universal dominion and economic imperialism is won and governments are actuated by the principles of democracy and justice. At the peace conference the weak and undeveloped countries will demand restitution and the protection of their right to independence and the free development of their national life. If the entrance of the United States into the war means anything, if the recent utterances of the allied nations as to their aims mean anything, if the Russian revolution has any significance, the case of the weak and undeveloped countries will receive a fair and just hearing. The war is China's opportunity.

Mobilize Dollars—Help Uncle Sam

ANNUAL MEETING OF THE MECHANICAL ENGINEERS

At Convention in New York on Dec. 4 to 7 Many Subjects Connected with Industries in War Time Will Be Considered

The American Society of Mechanical Engineers will hold its annual meeting in New York on Dec. 4 to 7. Among the features that have been announced for this meeting are:

Address by former President William H. Taft, in conferring honorary membership upon Major-Gen. George W. Goethals.

The service of the engineer to the public will strike the keynote of the all-day meeting, with Dr. Ira N. Hollis giving the opening address on "Universal Public Service in Peace and War."

Management and social service—vital problems in these days of high potential in industry—will have at least one session. One topic to be considered is the employment of women in skilled industries.

A public hearing by the power-test committee, preliminary to an extensive revision of the power test code, will give an opportunity for bringing together the expert opinion of the country on research and testing methods.

A smoker as usual on Wednesday evening, when all will get together and join in the entertainment provided by the local committee, supplemented, it is expected, by Past-presidents Brashear, Swasey and Freeman, who will contribute accounts of their recent trips to the Orient.

Dr. Brashear is expected to give his famous lecture on "The Beautiful in Commonplace Things" on Thursday evening.

PITTSBURGH MEETING OF THE ELECTROCHEMICAL SOCIETY

Papers of Interest in the Application of Electric Service in Electrochemical Plants Presented at Large Gathering

A number of papers of value to central station engineers and others interested in electric service and the application of electric service in electrochemical plants were presented at the thirty-second general meeting of the American Electrochemical Society, held at Pittsburgh on Oct. 3 to 6.

President C. G. Fink presided over the opening session. He introduced Dr. John A. Brashear of Pittsburgh, who gave an address of welcome to the 325 members and guests present. Lawrence Addicks and Prof. J. W. Richards, who are the society's representatives on the Naval Consulting Board, reviewed briefly the work of that organization.

In a paper on "Copper Castings for Electrical Purposes" W. M. Corse and G. F. Comstock of the Titanium Alloy Steel Company, Niagara Falls, the authors, reviewed Addicks' work on the effect of impurities on electrical conductivity of commercial copper and contrasted the possibility of getting copper wire of high conductivity with production of casting of equally good conductivity.

The first Thursday paper, "Hydroelectric Power," was presented by H. E. Randall, electrochemical engineer Shawinigan Water & Power Company, Montreal. It described the development of electrochemical industries at Shawinigan, and its availability for further electrochemical plants. The author pointed out that at present 511,000 hp. is installed, of which 100,600 hp. is available for immediate use. There is also 580,000 hp. as yet undeveloped which also is available for electrochemical industries.

The author pointed out that with its low power costs, cheap labor and advantageous export rates it offers a strategic location for serving the European market. At the moment it is one of the few localities in Canada where power in quantity can be obtained quickly and cheaply and where the necessary labor for plant operation can be obtained without excessive importation. The author thinks it almost certain that Shawinigan will continue the electrochemical center of Canada.

In a paper on "The Substation Problem of the Electrochemical Plant," J. L. McK. Yardley, general engineer Westinghouse Electric & Manufacturing Company, discussed the relations between the electrical apparatus conditions and the electrochemical conditions; that is, between the factors conditioning efficiency or inefficiency of the electrical installation and the factors imposed by the nature of the electrochemical cells and their arrangement into plant units.

The paper by Robert Turnbull, electric furnace engineer of Welland, Ont., Canada, was an interesting discussion of "Electric Pig Iron in War Times."

Frank Thornton, Jr., in a paper entitled "A Resistance Furnace," described experiments on an electric resistance furnace with various resistors placed inside the furnace, either on the hearth of the furnace or on a shelf around the walls.

"The Electric Furnace in the Norwegian Iron Industry" was an interesting paper by Haakon Styri of the Husey-Binns Steel Company, Charleroi, Pa.

T. F. Bailey, president of the Electric Furnace Company of America, Cleveland, Ohio, presented a paper on "A Resistance Type Furnace for Melting Brass and Bronze."

"Pure Alloys for Magnetic Purposes" was the title of a paper by Trygoe D. Yenson of the University of Illinois,

E. D. Campbell, emeritus professor at the University of Michigan, presented a paper on "The Influence of the Temperature of Measurement on the Electrical Resistivity and Thermo-Electromotive Potential of Solutes in Steel."

"Calorized Iron as an Element for Thermocouples" was the title of a paper by Prof. O. L. Kowalke, University of Wisconsin.

An illustrated address was presented by Alex Dow, president Detroit Edison Company, on "The Production of Electricity by Steam Power." An abstract of this paper is given elsewhere in this issue. Carl Hering of Philadelphia presented a paper on "Suggested Reforms in Some Chemical Terms," and W. H. Coggeswell a paper on the "Trend in Electric Furnace Design."

Make the Liberty Loan a Success

PRODUCING ELECTRIC POWER FROM STEAM

Alex Dow Considers Subject from Viewpoint of Electrochemical Needs in Address Before Electrochemical Society

"The Present Status of the Production of Electric Power from Steam" was the subject of an address by Alex Dow, president Detroit Edison Company, at the thirty-eighth annual meeting of the American Electrochemical Society at Pittsburgh on Oct. 3 to 6. Mr. Dow considered his subject from the viewpoint of electrochemical needs.

He pointed out that in a close network, such as one serving a big mill owning its own power plant, the difference between the actual delivery to the points of use may be 8 to 10 per cent. In complex works, covering a large area and delivering power in different forms, the order of difference is more likely to be 20 per cent and upward.

Fuel cost is the one figure on which comparisons can be made, and fuel cost must be expressed in heat units to meet the comparison. These show year in and year out an approximation of 20,000 heat units per kilowatt-hour, with periods below and periods above it. In no case do they exceed the 20,000 figure, and when they get below it it is at very favorable seasons of the year. The adaptation of the stoker and the furnace to the fuel has been carried to the limit of our present knowledge.

Mr. Dow pointed out that where electric heating is used and the origin of the electricity is in fuel, one is absolutely applying that heat wastefully, considered as an application of heat, and the wastefulness is hopeless. The loss overboard in the condensing water is the big thing. All other losses, radiant losses from boilers and engines, are minor in comparison.

The total cost is the fixed cost plus operating. It makes a division into standing and running cost, the standing cost being the station rate for service and the

running cost being the added cost due to service. Mr. Dow emphasized the point that the fixed element is so very large that at poor load factors it is controlling.

"You gentlemen are in the habit of telling us you have 100 per cent load factor. Ninety per cent is going strong, and the eighties are more frequent. On the other hand, a mixed service is doing well if it shows 40 per cent. Any central station with the load factor above 40 per cent is doing well indeed," said the speaker. He added:

"The cost of money plus the investment plus the taxes means that the central station must figure on a return never less than 12 per cent and sometimes exceeding 15 per cent. So your first figure, based on the central station method, is to figure 12 to 15 per cent as a figure on an investment per kilowatt, which was between \$50,000 and \$60,000, and which now is between 90 and 110 per cent.

"Now assume we have the problem put to me by some of your members, that you want a power plant, the object being low total cost of power, and that you have some choice of location. The first thing to consider is how the location may affect the power plant, and that leads into those engineering problems I wish to put to you.

"With electrochemical industries, of course, you must consider your raw material and your markets. You must have good shipping points, you must have fairly good labor conditions, etc. These conditions would have a large influence in determining the location; but if you leave us free to transmit the power from a satisfactory location for the power plant, we can forget these considerations for the present."

Transmission is dear. It has a definite measure as to its capacity and a high figure as to its unit cost. The right-of-way of a transmission line is another item of high cost. The line loss may be a high cost.

There is a chance for betterment in gas fuel. The mixture can be controlled and no carbon lost through the ashes and have higher transmission values. But gas as a commercial proposition in almost all of the United States is entirely dependent for its cost upon the by-product market, and that is anybody's guess. In the meantime gas producers as an addition to boilers cost too much. No combination in present or recent conditions can be made that will allow gas fuel to be used in steam boilers.

In closing Mr. Dow said: "It is not good to prophesy, but I know some of you expect to hear from me whether I anticipate any great change in the art. I do not, just now. All I can say is: There is not in sight any great change. Unless we can find the materials to take us into higher temperatures, we need not expect much change. Many of the losses are commercial, which cannot be saved profitably. The losses necessary to give you the necessary draft and the big losses of heat thrown overboard—they seem to be inherent in steam."

Lawrence Addicks, in the discussion, said that as a result of investigation he had reached the conclusion that if coal could be secured at \$1.25 per ton at the mouth of the mine, power could be generated for \$15 per horsepower-year, excluding interest on the investment. This approximates the rates at Niagara Falls, but there is still hope that water power will show better costs than the steam plant is now doing.

F. A. Lidbury said that in an address and discussion about eighteen months ago in Washington Mr. Addicks took the view that we had better stop speaking of the water powers that existed in this country and turn our attention to steam, because, as he then pointed out, it was going to be as economical to generate steam as to use water power.

Mr. Lidbury then said that what we see to-day is the continuation of the process we have been watching for a number of years in an increasing degree, and will continue as far as we can see at present; and that is the expatriation of industries which exist primarily for the need of this country. He added:

"There is a national aspect to this matter. In the broad point of view it is very doubtful to what extent this country should permit the migration of industries which are as fundamental to its life as any others that can be mentioned. The most sensible course is to permit and to insist upon and to enforce the thoroughgoing utilization of our natural water-power resources, which could solve this whole question inside of two or three years."

Others Give—Will You Not Lend?

ANNUAL MEETING OF THE ELECTRICAL WORKERS

International Brotherhood, in Atlantic City Convention, Points to Closer Relationship Between the Workers and the Contractors

Labor questions respecting both wages and working conditions have been the least of the considerations of the annual convention of the International Brotherhood of Electrical Workers, which was in session at Atlantic City, N. J., from Sept. 17 to Oct. 10. The convention was concerned chiefly with matters pertaining to the internal workings of the brotherhood, questions of administrative policy and procedure.

The attitude of the 500 delegates toward the employer and respecting wages and working conditions is clearly defined, however. The electrical workers are fully satisfied with conditions throughout the country at this time, and the wages are regarded as meeting the needs of the workman. If there is to be any change of attitude, it will be brought about by a rise in the cost of living. This was explained by Charles P. Ford, the general secretary of the brotherhood, in an interview for the ELECTRICAL WORLD.

There is a decided tendency apparent throughout the country at present toward closer relationship between electrical workers and electrical contractors, and it is viewed in a very sympathetic way by the executives of the brotherhood. It will probably result in annual conferences between representatives of the brotherhood and of the National Electrical Contractors' Association for the discussion of all questions mutually affecting these organizations.

While there were some radical delegates at the convention, they were decidedly in the minority. The vast majority of the men have no sympathy with radicalism, and one of the "high lights" of the convention was the adoption of resolutions couched in the very strongest language condemning the Industrial Workers of the World and other "spurious" labor organizations.

AN INTERESTING A. I. E. E. MEETING ON RESEARCH

Growth Among Small Industrial Companies, Shortage of Researchers, and College, Commercial and Industrial Laboratories Discussed

The increased interest which has been taken in research by electrical engineers since the war began was manifested by the unusually large attendance at the research meeting of the American Institute of Electrical Engineers in Philadelphia on Oct. 8, about 300 being present. Many of those attending were local engineers, but the rest of the country was well represented, especially by professors from technical colleges. Papers were presented by Dr. A. E. Kennelly, C. E. Skinner and Major F. B. Jewett.

Among the important points brought out in these papers and the discussion which followed their presentation were the growth of research among the smaller industries, the shortage of properly trained men to carry on all the investigations needed, and the fields of research to which colleges, private laboratories, industrial companies and the government should confine themselves. It seemed to be the consensus of opinion that the primary function of colleges should be to train men undertaking only such research as would help in the fulfillment of this duty and would permit intellectual freedom. Scientific research and only such industrial research as would not have to be kept secret would fall in this category.

While many colleges are conducting industrial research regarding which they have to pledge secrecy, it seemed to be generally agreed that such research should be conducted by the industries themselves or by commercial laboratories. Certain investigations of general interest could be conducted advantageously by co-operative laboratories or by the government.

Special emphasis was laid on the danger of over-emphasizing the need of industrial research. It might lead men unqualified for research to enlist in such work; it might be the cause of research being started on unimportant subjects; attention might be drawn away from scientific research, which is the necessary basis for industrial research.

The opinion was expressed that where industrial research is carried on by colleges the expense should be defrayed to a certain extent by the industries benefited or else by the government. Some manufacturers' representatives claimed that they are unable to secure the scientific advice they require from colleges. In reply to this it was contended that manufacturers do not acquaint the colleges with their problems.

Several speakers warned against giving students the impression that they should be researchers, it being the contention that scientific investigators are born and cannot be developed. It was also brought out that formulation of research problems is just as important as carrying on the research.

Correlation and co-ordination of scientific and industrial research to avoid duplication of effort and make the results available to the maximum number was strongly urged. This is being undertaken by the National Research Council. Many controversial problems exist which should be thrashed out once for all to avoid the necessity of dragging along countless ideas that only make future research more difficult. It was also urged that intensive research be conducted

along definite lines until conclusions are reached. Some manufacturing companies are encouraging this procedure by offering scholarships to graduate students on the condition that they enter the employ of the company following their investigations.

Among those taking part in the discussion outlined above were the following: Prof. V. Karapetoff, Capt. E. B. Craft, Prof. Alexander Gray, Dr. E. P. Hyde, L. F. Morehouse, Dr. C. H. Sharp, Prof. W. I. Slichter, Dr. Harold Pender, H. A. Hornor, Ralph Pope, Prof. Charles B. Scott, B. A. Behrend, Prof. Comfort A. Adams, Dr. William McClellan, L. W. Chubb and W. L. R. Emmet.

At the close of the last session Professor Scott made a motion that was unanimously carried to the effect that a special committee be appointed on research.

W. L. R. Emmet, chairman of the submarine committee of the Naval Consulting Board, addressed the members at the banquet on "How Engineers Can Assist in the War," bringing out the point that the government is not fully organized for research and must depend to a great extent on private research bodies. Referring briefly to the program of the Naval Consulting Board, the chairman pointed out that suggestions are being contributed by civilians, but most of the ideas are so incomplete that it is impossible to make use of them. This is due to the very small amount of time available for investigations on subjects which do not give evident assurance of success. If ideas are contributed, they should be accompanied by working drawings, specifications and results from practical experiments.

Money is available for experimentation when the expense is justified. In fact, the National Research Council has considerable money which has been subscribed privately. A great deal of the money has been spent on the development of wireless transmission and some promising results have been obtained.

Support the Right—Buy a Bond

ELECTRICAL SHOW MORE INSTRUCTIVE THAN EVER

Much Space in New York Show Taken Up by Red Cross and by Departments of the Federal Government

As in former years, the exhibits shown at the New York Electrical Exposition and Motor Show in the Grand Central Palace, which opened last Wednesday to continue through next Saturday, have been arranged to exemplify a broad education in the use of electrical appliances and apparatus. Among the popular exhibits, that of the Red Cross has probably attracted most attention. This exhibit, which occupies almost all of one floor, includes workrooms, an instruction center, a tea room, exhibition of the Allies' flags and interesting motion pictures on the work of the Red Cross. The booths of the various departments of the government are very instructive. The exhibits include the following: Army Signal Corps, naval recruiting station, submarine, torpedo and battleship models, lighthouse work, forestry, road and rural engineering, Census and Weather Bureaus.

Comprehensive exhibits are shown by the electric service companies operating in New York City.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Protecting Aviators.—The tops of all the poles of the Southern Illinois Light & Power Company near Belleville, Ill., are being painted white in order that they may easily be seen and avoided by aviators from the nearby camp.

Big Joint Holiday Meeting at Chicago.—Plans are under way for a joint meeting of the American Institute of Electrical Engineers and the Electric Club-Jovian League of Chicago during the holiday season. The American Institute of Electrical Engineers, which instituted the movement, suggests that the meeting be held at one of the Electric Club-Jovian League regular luncheons. The suggestion was received enthusiastically by the latter organization at its meeting on Oct. 4.

Electrical Engineering Course Popular at Purdue.—Although no report was received from Purdue University, Lafayette, Ind., of the estimated enrollment for publication in the issue of the *ELECTRICAL WORLD* for Sept. 15, returns are now available from registration. These figures, which were supplied by Prof. C. Francis Harding, indicate that an unexpectedly large freshman class is recorded in electrical engineering, numbering ninety-seven, as contrasted with fifty-five sophomores, thirty-seven juniors and thirty-six seniors. The latter figures represent about 65 per cent of a normal class. In mechanical and civil engineering the percentage of seniors is slightly lower, while 70 per cent of the normal class is registered in chemical engineering. While the total enrollment for the entire university to date is approximately 75 per cent of normal, the courses in electrical and chemical engineering show the least reduction of all of the engineering schools.

Exchange of Philadelphia Stock.—A special meeting of stockholders of the Philadelphia Electric Company will be held at the general office, Camden, N. J., on Oct. 17, for the purpose of considering and taking action upon a proposed plan providing for the exchange by the stockholders of their shares of stock of the Philadelphia Electric Company of New Jersey for a like number of shares of stock (same par value) of the Philadelphia Electric Company of Pennsylvania, and upon such other matters as may come before the meeting. President Joseph B. McCall says in a letter to shareholders: "In our judgment the time has arrived when the interests of the stockholders require that the final step of exchanging your stock in the New Jersey company for the stock of your Pennsylvania company be taken, in order to complete

the plan of unification and reorganization. This final action will eliminate the operation of these properties through the medium of a holding company, involving as it does a complicated system of accounting, considerable duplication of taxes and much unnecessary expense, which is becoming increasingly cumbersome and burdensome. The result of this exchange will be that you will own the same number of shares of a like par value of the Philadelphia Electric Company of Pennsylvania as you now own shares of the Philadelphia Electric Company of New Jersey."

Doherty Cadets Come from Fifty-five Engineering Schools.—Fifty-five engineering schools are represented in the Doherty organization. The cadets now in the organization received their engineering education at the following institutions. The list takes into consideration only those schools which have contributed ten or more men to the organization: Purdue University, 18; University of Missouri, 16; University of Wisconsin, 16; University of Kansas, 14; University of Colorado, 13; Kansas State Agricultural College, 11; Georgia School of Technology, 10; Pennsylvania State College, 10. R. G. Griswold, chief technologist of the Doherty organization, announces that 81 per cent of the cadets who have gone into the organization are still in it. Since the schools were organized as now constituted in 1906, the organization has hired 375 men, of whom 305 are still in some part of the organization or have left recently to join the army or navy.

Examination for Radio Inspector.—The United States Civil Service Commission has announced an open competitive examination for the position of radio inspector to be held on Nov. 7, 1917. A roll of men will be prepared from this examination to fill vacancies that may occur in the positions of radio inspector and assistant radio inspector in the service of the Bureau of Navigation. Entrance salaries range from \$1,200 to \$1,600 a year, depending on qualifications of the appointee. Applicants must have received a bachelor of science degree from a school of recognized standing, such educational training to have included a special course in radio or kindred sciences, or show that they are senior students in such institutions, or that they have had the equivalent of a high school education and in addition not less than two years' experience in special radio work, such as the manufacture, installation or adjustment of commercial or governmental wireless apparatus. It is desirable but not essential that they be wireless telegraph operators. Applicants must have reached their twentieth birthday on the date of the examination. They should apply for Form 1312, stating the title of the examination desired, to the Civil Service Commission, Washington, D. C., or to the secretary of the United States Civil Service Board at any place in the various states.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Apportionment of Charges Between Operating Departments.—It is decided by the South Dakota Board of Railroad Commissioners, in a case affecting the Estelline Telephone & Electric Company, that a public utility furnishing different kinds of service, such as telephone and electric light, should institute a system of bookkeeping or accounting which will result in the segregation of all revenues and expenses between the different departments and should by the use of work and material reports assign as between the different departments all expenses, whether for material, supplies, labor, accounting or supervision, in such a manner as to charge against each plant its proper proportion of the operating expenses, according to the work done or material furnished.

Pennsylvania Specifications for Overhead Crossings.—The Pennsylvania Public Service Commission has issued an order governing the regulation of construction of the crossing of the wires of a public service company over or under the facilities of another public service company. It prescribes specifications which are effective from June 1, 1917. These specifications were prepared at the request of the commission and under the direction of its chief engineer, F. Herbert Snow, by a joint committee representing different classes of utilities. The committee consisted of Paul Spencer, United Gas & Improvement Company, Philadelphia (chairman); R. E. Chetwood, Western Union Telegraph Company; Nathan Hayward, Bell Telephone Company of Pennsylvania; D. B. Heilman, Philadelphia & Reading Railway; J. S. Jenks, West Penn Traction Company, Pittsburgh; J. F. Skirrow, Postal Telegraph-Cable Company; Thomas Sproule, Philadelphia Electric Company; R. P. Stevens, Mahoning & Shenango Railway & Light Company, New Castle; Joseph F. Stockwell, Keystone Telephone Company, Philadelphia; S. M. Veile, Pennsylvania Railroad; G. E. Wendle, Lycoming Edison Company, Williamsport, and J. S. Francis, Bell Telephone Company of Pennsylvania (secretary). The specifications are intended to cover the crossings of overhead conductors of any utility and the overhead conductors of any other utility, or the tracks and right-of-way of railroads. They are, as far as possible, complete for all types of conductors, and cover definitely the general requirements at the points of crossing, without stating the type of construction in such specific details as to limit it to any particular method.

Kansas State Convention.—The Kansas Public Service Association will hold its annual meeting at Salina, Kan., on Oct. 19 and 20. J. B. Nicholson of Newton, Kan., is president, and W. W. Austin, Cottonwood Falls, Kan., is secretary-treasurer.

Louisiana Engineering Society.—“Louisiana Waters and Their Industrial Possibilities” was the subject of a paper presented by Welman Bradford of Alexandria, La., at the regular meeting of the Louisiana Engineering Society held Oct. 8 at New Orleans.

Schenectady Section of the A. I. E. E.—The one hundred and eighty-ninth meeting of the Schenectady Section of the A. I. E. E. was held Oct. 5. Dr. Charles Alexander Richmond, president of Union University, addressed the meeting on “The Higher Law of Efficiency.” L. F. Millham is secretary of this section.

New York Section, A. S. M. E.—The first regular meeting of the New York Section of the American Society of Mechanical Engineers will be held Oct. 16 at the Engineering Societies Building. T. Kennard Thomson will give an illustrated lecture entitled “The Evolution of Manhattan from an Indian Village to a Metropolis.”

Ohio Electric Light Association.—A general meter conference of the Ohio Electric Light Association will be held at Dayton, Ohio, on Nov. 23. The subject to be discussed at this meeting is “Demand Meters.” Chester Hall of the General Electric Company and William Bradshaw of the Westinghouse Electric & Manufacturing Company will present some very interesting papers on the history and development of demand meters. Charles P. Garman is secretary of the meter committee.

Prominent Public Men Address New York Jovians.—At the regular New York Jovian luncheon held Oct. 10 the members were addressed by Robert Adamson, Fire Commissioner of the city of New York, and Judge William L. Ransom, chief counsel of the Public Service Commission for the First District. Mr. Adamson told of how electricity has helped him make New York's fire department the most efficient in the country. Judge Ransom discussed several of the important activities of the Public Service Commission for the First District.

New Officers of the Commonwealth Section, N. E. L. A.—The annual election of officers of the Commonwealth Edison Company Section of the National Electric Light Association was held in Customers' Hall, Edison Building, Chicago, on the evening of Sept. 25. The officers elected for the ensuing year were: President, A. G. de Clercq, assistant construction superintendent; vice-president, W. L. Sees, overhead foreman southern district; treasurer, William A. Fox, vice-president Commonwealth Edison Company; secretary, Ernest S. Butt, assistant to the editor of the *Edison Round Table Weekly and Electric City Magazine*. William S. Kline is the retiring president of the section.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Recent Meeting of Automotive Electric Association.—The Automotive Electric Association held its summer meeting at Fishers Island, N. Y., Sept. 6, 7 and 8. The papers presented were: “Why We Should Standardize Business Forms and Practices,” by C. C. Miniger; “Patents,” by Victor S. Beam, and “Advertising,” by J. C. McQuiston. The next meeting of the association will be held in New York City, Jan. 3 and 4, 1918.

Terrell Croft Addresses St. Louis Engineers.—The associated engineering societies of St. Louis, Mo., held a joint meeting under the auspices of the St. Louis branch of the American Institute of Electrical Engineers on Sept. 26. Terrell Croft, electrical engineer, University City, Mo., presented an illustrated paper on “What Electricity Is,” giving a popular exposition of the electron theory. The talk was of a nature equally interesting and comprehensible to laymen and engineers.

Philadelphia Section of Iron and Steel Electrical Engineers.—The following meetings and papers for the season of 1917-18 are announced by the Philadelphia Section of the Association of Iron and Steel Electrical Engineers: Nov. 3, “General Ideas and Discussion,” to be open to all members; Dec. 1, “Some Recent Investigations in Arc Welding,” by O. H. Eschholz, research division, engineering department, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; Jan. 5, “Electrically Operated Bridges,” by John C. Reed and Merwyn J. Hocker, electrical engineers of the Bethlehem Steel Company, Steelton, Pa. (this paper will be illustrated with lantern slides); Feb. 2, “Mill-Type Transformers,” by Harry G. Steele of the Pittsburgh Transformer Company, Pittsburgh, Pa.; March 1, “Standardized Mill Table Controllers,” by John S. Rowan, Rowan Controller Company, Baltimore, Md. (illustrated); April 6, “Electricity as Used in Modern Shipyards,” by C. M. Hensen, chief electrician of the shipbuilding plant of the Bethlehem Steel Company, Sparrows Point, Md.; May 4, “The Application of Roller Bearings to Cranes,” by P. B. Liebermann, chief engineer of the Hyatt Roller Bearing Company, Newark, N. J. The last-named paper will be illustrated, and a number of prominent engineers have been invited to discuss it. At the May meeting announcement will be made of the results of the election of officers for the coming season and details concerning the annual outing on June 1 will be given. All meetings will be held in the Majestic Hotel, Broad Street

and Girard Avenue, and will start promptly at 8 p. m. They will be preceded by an informal dinner at 6 p. m. Linn O. Morrow, Nineteenth and Hamilton Streets, is secretary of the section.

American Association of Engineers.—The secretary of the American Association of Engineers has completed a tour of the East and will submit a report to the board of directors on the feasibility of a plan for national affiliation of local engineering clubs and societies. This trip was with the idea of ascertaining from the engineers in the Eastern cities whether they are in favor of a national organization to promote business interests in a business and professional way. The officers of the local societies in Pittsburgh, Washington, Baltimore, Brooklyn, Boston, Cleveland and Detroit expressed general approval and hearty support of the program as set forth in the national plan of organization and co-operation by the American Association of Engineers. Many of the local societies have asked for written proposals to be submitted and considered by their board of directors. Many of the societies agreed to co-operate in work of a national nature until details of affiliation could be worked out. The increased demands for engineering service largely due to the worldwide war demonstrate a greater need than ever for national co-operation between engineering societies and activities to handle the great problems of national distribution of engineering service and national publicity.

St. Louis Jovians Appoint Committees for the Ensuing Year.—Announcement of the appointment of chairmen of the various committees of the St. Louis Jovian League of Electrical Interests was made by the league's president, W. N. Matthews, at a luncheon meeting held Oct. 2. The appointments are: Speakers' committee, H. J. Pettingill; entertainment committee, Thomas H. Bibber; publicity committee, W. R. Joyes; assembling committee, Charles A. Dostal; development committee, Martin J. Wolf; public affairs committee, Fred B. Adam; finance committee, Horace Beck; membership committee, Jules A. Baker; door committee, R. E. Stewart; visiting and relief committee, Cliff R. Croninger; resolution committee, Ell C. Bennett. J. Lionberger Davis, president St. Louis Chamber of Commerce, addressed the league on “The New Liberty Bond Issue” and advocated that holders of the first issue of Liberty bonds who contemplate exchanging them for the second issue sell their bonds through their bankers or brokers and buy the new issue with the proceeds. He explained that the cost of selling the bonds would be small and their course would be aiding the government more than that of exchanging. Owing to their exemption from taxation, the bonds of the first Liberty Loan will be purchased by large investors, while the second issue, which bears a higher rate of interest, is more desirable for small investors. Charles A. Dostal presided as chairman of the meeting.

J. P. Ohmer, the president-elect of the Indiana Electric Light Association, was born at Mishawaka, Ind., in 1874. He is a practical public utility operator who has been in the employ of the Indiana & Michigan Electric Company and its allied interests continuously for thirteen years. In 1895 he was employed in the power house of the South Bend Electric Company. After serving there three years he accepted a position with the Oliver Chilled Plow Company of South Bend, where he had general supervision of all of the firm's electrical equipment. After six years in that capacity he again returned to the allied interests of the South Bend central station company as manager of



J. P. OHMER

the Charles A. Chapin Company, which operated a water-power plant at Buchanan, Mich. In 1906 he was transferred to Elkhart as manager of the Elkhart property of the Indiana & Michigan Electric Company. This position he still holds. Mr. Ohmer has been active in state association affairs for a number of years and is a member of the National Electric Light Association. As a result of his local civic activities he has been made president of the Elkhart Board of Education.

William S. Gould, assistant electrical superintendent of the Marin district of the Pacific Gas & Electric Company, has resigned to accept a position in Texas.

Joseph J. Jacobs has been transferred from the post of chief engineer of the Paducah (Ky.) Light & Power Company to the engineering department of Stone & Webster.

A. F. Chamberlain, New York manager of the Robbins & Myers Company, has been elected chairman of the fan section of the Associated Manufacturers of Electrical Supplies. Mr. Chamberlain was formerly secretary of the section.

Russell E. Sard, president of the Rathbone-Sard Electric Company, Inc., is leaving his home in Albany, N. Y., this week to go to Washington to work for the government in the Navy Department. Mr. Sard answered the call for men of special business training to aid in the administration of the complex business of the navy.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

F. W. Hall of the Sprague Electric Works of the General Electric Company has been elected secretary of the fan section of the Associated Manufacturers of Electrical Supplies.

Prof. George B. McNair is acting head of the department of electrical engineering of Colorado College, Colorado Springs, Col., during the absence of Prof. George B. Thomas.

E. H. Palmer, president of the Empire Gas & Electric Company, Geneva, N. Y., was elected president of the Empire State Gas & Electric Association at the annual meeting held last week in New York City.

W. E. Blackwell, formerly superintendent of the municipal light and water plant at Afton, Okla., is now connected with the Southern Oil Corporation, Yale, Okla., as chief of the electrical department.

C. O. Dunton, who was formerly connected with the sales department of the General Electric Company, has been placed in charge of the commercial department of the Central Illinois Public Service Company of Mattoon, Ill., to succeed J. Paul Clayton.

J. Paul Clayton, who was formerly contract agent for the Central Illinois Public Service Company of Mattoon, Ill., has taken charge of the commercial department of the Middle West Utilities Company of Chicago, succeeding Sidney G. Vigo, who was the commercial manager of the company.

Brigadier General Charles McKinley Saltzman, who was raised to this rank from that of colonel in the Signal Corps, was born in Iowa in 1871 and is one of the youngest general officers ever appointed in the regular army. He graduated at West Point in the class of 1896 and was assigned to the First United States Cavalry, with which regiment he participated in the Santiago campaign during the Spanish American War. As first lieutenant in the Ninth Cavalry he was appointed aide-de-camp to General H. C. Merriam and was appointed captain in the Signal Corps in 1901 on account of knowledge of electrical matters. In the Philippines he was assigned to duty as signal officer on the staff of Major General Leonard Wood, commanding the Department of Mindanao, and was charged with the maintenance of all land and ocean cable lines of that department—a difficult undertaking on account of the depredations of hostile Moros of that part of the Philippines. While serving in that department this officer participated in the campaigns against hostile Moros in 1903 and 1904. On returning to the United States in

1905, Major Saltzman was sent to the United States Army Signal School at Fort Leavenworth as senior instructor and had general charge of the electrical instruction of officers at that school. From 1908 to 1913 he was in charge of the electrical division of the Signal Corps in the War Department at Washington, with general supervision over the design of radio and other electrical equipment used by the Signal Corps and in the fire control systems of the Coast Artillery. In 1912 he went to London as a delegate of the United States to the International Radio Conference and later served as a member of the interdepartmental board which formulated rules for the regulation of



C. M. SALTZMAN

radio-telegraphy in the United States. In 1915 he was sent to Panama as the army signal officer and had general charge of the installation of the radio, telegraph and telephone systems on the Canal Zone. On the outbreak of the present war, Colonel Saltzman was recalled to Washington and made executive officer in the office of the chief signal officer of the army.

Sidney G. Vigo, formerly commercial manager of the Middle West Utilities Company, Chicago, has taken charge of the commercial department of the American Public Service Company, with headquarters in Dallas, Tex. Prior to going to Chicago Mr. Vigo was in charge of the motor-service business of the Consumers' Electric Light & Power Company of New Orleans, his previous connection having been with the contract department of the Commonwealth Edison Company of Chicago.

Obituary

William J. Wood, recently appointed a member of the Public Service Commission of Indiana, died at his home in Indianapolis on Oct. 3. Most of Mr. Wood's experience was in the railroad field. He was at one time a special examiner for the Interstate Commerce Commission. Upon the creation of the Railroad Commission of Indiana in 1905 he was appointed a member and later he became chairman of the commission.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

ELECTRIC GLASSWARE MARKET CONDITIONS

Prices Are Higher, While Scarcity of Labor Supply Curtails Production with Consequent Effect on Deliveries

In the more expensive grades of electrical glassware—globes, shades, bowls, etc.—the market is firm, and deliveries are leaning toward uncertainty of date. The factories are accepting orders subject to three months' time shipments, with an indefinite continuance predicted. This ware, depending on whether it is plain or decorated, has been advanced from 10 to 100 per cent within six to nine months. The trend is still upward, and 25 per cent increase over and above these figures, to take effect Oct. 1, has been under discussion for some time and may be said to be impending. Raw material seems to be in satisfactory supply, but labor is the troublesome factor. One of the largest plants is running about one-third capacity on this account, and consequently should a further mark-up in price ensue it will be due to being short-handed in skilled operatives. The company in reference has not solicited an order in nineteen months through its traveling staff, its entire road force having been called in long ago.

Medium-priced ware has not been advanced since Sept. 1, when 10 per cent was announced on bowls and globes. Plants are running to capacity and increased facilities are needed and discussed; but owners of the properties do not feel strongly inclined to make a further investment in view of the uncertain future. Government orders are heavy but as yet have not interfered with private trade. Deliveries are two and three months behind, and with existing and anticipated labor disturbances no relief is counted upon either now or for months to come. Raw material, if stocked with an idea of what was to be expected from the current outlook, is in satisfactory supply, and unless an embargo intervenes no embarrassment is expected. Street-light ware is normal in demand, and the breakage is fairly approximated by the yearly record and therefore provided for in the usual quantity.

Do Your Bit—Buy a Liberty Bond

EFFECT ON DEALERS OF FIXING STEEL PRICES

Manufacturers State That Purchases Are Being Delayed in Expectation of Lower Prices When Conditions Do Not Justify It

The recent announcement of a voluntary agreement made between the War Industries Board and producers of steel concerning a reduction of steel prices, which was approved by President Wilson and made public on Sept. 25, has caused merchants and consumers to expect immediate reductions in all articles in which iron and steel are component parts. Such expectations on the part of retail merchants, and even consumers, are causing them to hold off in their purchases. The manufacturers of steel and iron products are now busily explaining to their dealers that they cannot expect to receive the benefit of government prices on steel and iron for some time to come.

All of the mills are loaded with orders, and the agreement allows contracts between the mills and purchasers to stand as originally made. If the manufacturer asks a mill for quotations to-day he is informed that the present congested condition of the mill precludes quotations. By

exempting existing contracts from the operation of the prices for steel fixed by the President, steel concerns will be enabled for a good part of next year to realize considerably higher prices than those fixed by the government. Manufacturers producing a product for sale to retail dealers of which steel is a component part, even though they have contracts for their steel at prices considerably higher than those fixed by the government, may expect to have difficulties in securing deliveries. The War Industries Board, through its priorities committee, has classified industries for the purpose of securing a more economic distribution of steel and steel products. Priority certificates are to be issued so that the manufacturers producing war materials and articles necessary to the public welfare and interest shall receive priority in deliveries of steel. Those manufacturers whose products do not come under these two headings may experience considerable difficulty in getting deliveries of iron and steel products at any price.

Since every efficient manufacturer contracts for his materials at least several months in advance, dealers cannot expect to get advantage of a government reduction in price, at least until the manufacturers begin to receive deliveries of materials for which the government price is to be paid.

You Want a World of Liberty

MATERIAL SHORTAGE CREATES STANDARDS FOR 1918 FANS

Use of 8-Ft. Cord and Four Blades, Except for Certain Sizes, and Similar Plans for 1918 Fans Mark Desire to Conserve Supplies

Because of the scarcity of raw materials of every sort due to war conditions, and because of the necessity of conserving the materials available, the electric fans of 1918 and the sales methods used with them will show some marked differences in comparison with past years. Fan manufacturers have long had in mind furnishing fans complete with cords as is done with heating appliances. Some manufacturers, not all, have already done this. There was, however, no standard length. The trade has been very desirous of having cords furnished and of a standard length. When the matter was first talked of in the trade about a year or so ago it became evident that there was a strong jobbing element in favor of 10 ft. Since that time, however, the material situation has become much worse, the United States itself has entered the world war, and the jobbers have generally come around to the point of view that 8 ft. will be ample, thus conserving 2 ft. of wire a fan. Consequently most of the more important fan manufacturers will market their 1918 fans, both oscillating and non-oscillating, with not more than 8 ft. of standard black cord attached.

Along this same line of material conservation it has been learned that the plans of most of the manufacturers for 1918 include six-blade fans only in the 12-in. and 14-in. alternating-current oscillating type. No other six-blade fans, it is understood, will be listed or stocked. The other types of fans that are manufactured will have only four blades.

A number of the leading manufacturers have discontinued the 32-in. ceiling fan. However, where there is demand these fans will be furnished. With the exception of one or two companies that have a sufficient demand for this type, they will not be listed in catalogs, nor will they be stocked. The same condition is true of ornamental-type ceiling fans, for which not more than one or two companies

have any appreciable demand, and for special fans—fans designed to meet a special trade.

The result of such plan is, of course, to further the tendency toward standardization, besides helping the government in the conservation of raw materials by cutting down wherever possible.

It has been learned also that a number of fan manufacturers, on account of the war conditions, are not planning to issue any but the most simple and inexpensive of purely descriptive catalogs.

Stand Back of the Army and Navy

BRASS MANUFACTURERS ARE INCLINED TO BE BULLISH

Factors of Great Influence in the Prevailing Situation as It Affects Copper, Labor and Spelter

Manufacturers of special brass appliances for electrical purposes are inclined to be bullish in their prices. This is credited to the copper situation, which is having an appreciable effect in their understanding of the situation. The future for finished goods from this standpoint is practically settled, and no marked reduction is being considered. It is admitted that no figuring on probabilities is being indulged in, and this is borne out by the non-acceptance of orders to extend over three months. When the government buys 3,000,000 lb. of copper and the Allies come into the American market and begin placing their orders, Eastern brass men declare, no one can tell what may happen. The pronounced restlessness in labor circles is also a serious consideration. They believe, however, that the ultimate buyer of finished goods will get what is left over; he is a negligible quantity, so to speak. Spelter is now 100 per cent higher than formerly, and this is also a factor in the situation.

METAL MARKET CONDITIONS

Copper Producers Allowed by Government to Make Shipments on Contracts

Prices held generally firm in the metal market this week. Old metal stiffened around half a cent.

The most important event was the announcement that the government, having found that its copper requirements will not be so large as had been expected, has given permission to producers to supply customers on contract. Notices therefore were sent to the trade on Monday of this week asking for October specifications and stating that it was in a position to take care of contract customers to a reasonable degree and to make deliveries.

There is no business in the open market, everything being at a standstill.

NEW YORK METAL MARKET PRICES

	Oct. 1			Oct. 8		
	£	s	d	£	s	d
Copper:						
London, standard spot.....	110	0	0	110	0	0
Prime Lake	Govt. price	23.50		Govt. price	23.50	
Electrolytic	Govt. price	23.50		Govt. price	23.50	
Casting	Govt. price	23.50		Govt. price	23.50	
Wire base	30.00	to	32.00*	30.00	to	32.00*
Lead, trust price.....	8.00			8.00		
Nickel, ingot	50.00			50.00		
Sheet zinc, f.o.b. smelter.....	19.00			19.00		
Spelter, spot	8.37½			8.05	to	8.30
Tin, Straits	61.00			61.25		
Aluminum, 98 to 99 per cent..	37.00	to	39.00*	37.00	to	39.00*

OLD METALS

Heavy copper and wire.....	23.00	to	23.50	23.00	to	24.00
Brass, heavy	14.00	to	15.00	14.50	to	16.50
Brass, light	11.00	to	11.50	11.50	to	12.00
Lead, heavy	6.50	to	7.00	7.00	to	7.25
Zinc, old scrap	6.00	to	6.25	6.00	to	6.25

*Nominal.

THE WEEK IN TRADE

FROM everywhere comes word that the fall season for heaters has opened with an unexpected rush. Cool weather has been experienced generally earlier than usual. Also the incandescent lamp demand seems to be heavier than was anticipated at this time, and in certain sections of the country the supply is decidedly inadequate.

A significant note is sounded for the Middle West with regard to credit conditions. Here it is found that the jobbers are more and more renewing notes rather than paying their bills. This is owing to the unliquid state of their accounts receivable. Their customers among the contractors are getting into a very unfortunate position.

Building construction, except in the South and certain industrial centers, appears to be getting less and less. Utilities are not buying, and almost the entire demand is from the government and industry.

NEW YORK

Buying keeps up in volume in almost every line. The cool weather of the last week or two coming before the heat has been turned on in the apartments has created such a demand for luminous radiators that local stocks are about depleted. Household appliances are selling better than ever because of the difficulty in securing domestic labor. Except for appliances, which are advancing, prices have remained fairly steady. Another advance on flatirons is expected around the first of the coming year.

The copper situation is causing no small concern to the wire buyers. Stocks are being depleted, since, while waiting for the government to make known its requirements to producers, manufacturers have been unable to obtain more copper. Collections are in a very satisfactory condition and credits show no change.

WIRE.—Following the readjustment announced last week, prices are firm. Most manufacturers are working on a 35-cent basis with a few at 34 cents. Local distributors are feeling the effect of the government order to copper producers to hold up deliveries until government needs are determined and provision made therefor. Inquiry on Monday for a quantity of wire brought forth either no desire to bid or bids away too high. Many wire manufacturers are living from hand to mouth on copper supply and the curtailment of supply finds the local market destitute of certain sizes in many places. The situation is expected to clear up as the government early this week allowed producers to make shipments on contracts.

HEATING APPLIANCES.—Luminous indicators have been in such large demand that local stocks so far as could be learned have been cleaned out. Buying in the regular stock is noticed to be picking up. Department-store orders are coming in better and stronger. An order for forty-eight sterilizers for the army was placed this week. It is felt in the local trade that the outlook for this fall's business is exceptionally good. Within the next ninety days the local utilities and big holding companies are expected to place orders for from 40,000 to 50,000 electric irons for next year's supply. There is a strong feeling locally that another advance on irons, bringing all up to \$5.50, can be expected around the first of the year. Last year the advance took place on Jan. 15. All advances have been as of the fifteenth.

VACUUM CLEANERS.—There are two seasons in this trade, the spring and the fall, the latter now in full swing. In the principal houses, where up-to-date constructive selling methods are followed, trade is spoken of as excellent. One prominent firm, which specializes on wide publicity for its goods, making a recent campaign on cleaners, is well oversold. So far deliveries are, on an average, prompt, but beyond holiday shipments or after the first of the year this satisfactory state of affairs is likely to assume a different complexion. Prices on some lines were advanced 15 per cent on Oct. 1, and no further increase is anticipated until the close of the year. On some other makes a revision of price will take place Nov. 1, covering 5 to 15 per cent upward.

WASHING MACHINES.—All sizes are selling freely at steadily advancing prices. This has prevailed for quite a while, the discounts being shortened or the list marked up at regular intervals. A further advance is looked for from day to day. On Oct. 1 10 per cent was bulletined in some lines. Deliveries are behind a month, and accepted orders are now subjected to a delay of shipment of from thirty to sixty days. Where copper is used, as it is liberally in large-size apparatus, additional postponements in deliveries are anticipated.

SMALL MOTORS.—With the recent Hebrew holidays the sale of small motors, ranging from 0.2 hp. to 5 hp., was slow and dull. In fact, this period is the quietest of the year for jobbers of motors for use in the garment-making and allied lines in New York City and throughout this part of the country. This territory is the strong end of the business. Prices are steady, but another increase is looked for in certain qualities. Motor parts, castings, copper and similar accessories are short and cause speculation as to future requirements.

CHICAGO

Jobbers in the Middle West report that September business was a little lighter than for August but that it was fair in comparison with last year. A good business is expected in October, since that is the month when activity in general forces sales. There seem to be some factors in the market which have had and are having an unsettling influence, but these have not created much alarm, nor are they apt to as long as the present industrial situation prevails. While there have been flurries since the fixing of prices of copper and steel, prices on the whole are very steady.

PROJECTORS.—Manufacturers are selling all of these units they can make. There were some nice export orders in the week's business.

FARM LIGHTING PLANTS.—One manufacturer reports that his weekly orders from agents have practically doubled since last spring.

HEATING EQUIPMENT.—Heating pads and air heaters are beginning to move sharply as the mornings become colder.

CONDUIT.—Conduit is very difficult to get. No jobbers are well stocked with it, and the prediction in the trade is that there will be no downward trend in prices.

COPPER WIRE.—Distributors expect that the price of copper wire will remain steady at its present level. One manufacturer after the government fixed the price of copper announced a 10 per cent reduction in the price of No. 14 wire. Jobbers who believed he was making a mistake loaded him with orders to an extent which caused him to withdraw his offer and admit his mistake within three days.

WASHING MACHINES.—The Liberty Bond campaign among small investors has slowed up payments on washing machines sold to consumers on the part-payment plan and has also made it correspondingly difficult to sell machines on deferred payments.

FLASHLIGHTS.—The military demand added to the domestic demand is making it difficult for retailers to keep a sufficient stock of flashlights and batteries.

CREDITS AND COLLECTIONS.—There is an interesting situation in the credit man's domain. Through an authentic central source it was learned that manufacturers in Indiana, Wisconsin, Illinois, Ohio, Michigan and other Central Western states during the last week or ten days have been complaining that jobbers who formerly discounted their bills are now giving notes. The complaint in each instance was instigated by the fact that the manufacturer believed himself discriminated against. Such is not the case, however, for the slowing up of payments by jobbers is more or less general. This situation was to be expected, on account of the fact that the jobber's customers have been slower in paying him. Contractors, for instance, whose money became tied up by strikes could not discount bills with their jobbers. Central stations which were making capital expenditures out of income and were finding it impossible to market bonds necessarily took more time in meeting

their bills. Hence the jobber, in addition to carrying a large stock, has been called upon to furnish banking facilities, and he has had to pass part of the burden on to the manufacturer.

ELECTRIC HEATING EQUIPMENT.—Manufacturers in the Chicago territory are making a special drive on electric bake ovens. Quite a number of the large type and very many of the smaller type have already been installed, and the belief exists that the demand would be much greater if central station companies were acquainted with the desirability of this business and the ease with which it can be obtained.

BOSTON

Trade continues brisk in the New England electrical field. Signs of a shortage in incandescent lamps are apparent, and it is noteworthy that within the last two months one moderate-sized jobbing house has sold over 100,000 carbon incandescents with more to come. Collections are reported a little slower and some uncertainty is felt regarding the effect of the price-fixing program on business, though in the main reports are optimistic. Great activity in military and naval circles is now stimulating general business in New England to a marked degree. The service flag is making its appearance over the jobber's door, and the draft has begun to be felt as a real handicap in some quarters. Little is heard as yet about the increased use of women in the electrical trade. Gradual advance of cooler weather is causing a heavy "drive" in the electric radiator field. Popular interest in appliances continues unabated, and an increased volume of business is to be seen in the fixture trade, due in part to a general movement toward renovation of residences of the higher class. Prices are running evenly for the most part, though the largest fixture house in New England reports manufacturers' prices as in an unsatisfactory condition from the standpoint of stability. Deliveries do not change much, though some improvement in odd sizes of small motors is to be seen. It is still too early to see much holiday trade on the horizon, but appliance stocks are accumulating with this in mind.

ELECTRIC IRONS.—These are moving steadily and are universally recognized as a staple article, very little affected by recent price advances.

ELECTRIC RANGES.—Large-unit installations are reported by a prominent New England manufacturer, with a tendency toward dullness in the domestic range demand. Slowness of building construction and an off-season business are influential.

LAMPS.—Reports of an impending shortage close at hand are received. Despite the decline of the carbon incandescent lamp as a product in extensive demand, there is at present a very noticeable revival in its use. Promptness of delivery, even at higher prices than metallized filament lamps bring, is a factor in this business. Jobbing interests have foreseen its opportunities and arranged for stocks to meet the immediate requirements of customers to whom efficiency of illumination is a secondary question.

ELECTRIC RADIATORS.—Business is exceedingly brisk, prices remaining firm and deliveries more difficult to obtain. Stocks are rapidly being exhausted.

FIXTURES.—Business is increasing, but a peculiar feature is the irregularity of demand noted. Dull and rush days often alternate for no apparent reason. Retail prices remain at recent levels.

WIRE AND CABLE.—Smaller sizes are readily obtained, but on the larger sizes deliveries are protracted. Jobbers with contracts at higher rates than are built up on the price-fixing program are trying hard to save themselves from their commitments at former price levels.

ATLANTA

There is no material change in general conditions since last week and business on the whole is holding up well. A few lines show a slight dullness, but sporadic buying in others offsets any tendency toward a market weakness.

The jobbers are not buying quite so heavily at this time

as they did during the last four or five months. The consensus of opinion is that this condition is because the inventory period is but three months off; further, a large percentage of cantonments and training camps are situated in the Southeast, which naturally increased the volume of general supply business considerably above normal requirements during the period of their construction, and there is some question as to how business will be affected after the pressure from this source is relieved.

Building construction in Atlanta seems to be more active than in other Southeastern cities, especially as regards residences. September building permits show a gain of 18 per cent in value over the same month last year. Operations for the first nine months of this year are 49 per cent in value in excess of the same period of 1916.

Contractors have experienced a very trying week in securing adequate labor to carry on the large volume of business already under way, and in a number of instances some jobs could not be started. It was expected that by this time cantonment construction would have advanced to a point where numbers of electrical workers would be available for industrial work, but unavoidable delays and extensions at these camps have advanced the date when relief can be expected from this source.

ELECTRICAL REPAIRS.—Manufacturers and others maintaining repair shops are literally swamped with work of all kinds. Long deliveries on new equipment and wear and tear from constant use under the present industrial pressure has brought to these shops every conceivable type of apparatus from bi-polar machines to a number of foreign makes damaged on German merchant ships prior to their being taken over by the United States.

FLASHLIGHTS.—All sources of information covering this line report business as booming. The already growing demand for flashlights has been stimulated by the soldier trade at the various cantonments. The lamps prove a great convenience to the boys after "Lights out."

HEATING DEVICES.—One jobber reports an excellent business in electric shaving mugs, percolators and toasters to be used in barracks of those camps which permit the use of electricity for this purpose.

GENERAL SUPPLIES.—The trade has enjoyed and continues to enjoy a big business. Information gathered from reliable sources shows an increase of 50 per cent for the first six months of this year over last year, covering five Southeastern states.

TRANSFORMERS.—There seems to be no let-up in the demand for the 2300-volt distributing type up to 50 kva. Manufacturers report an improvement in shipments.

DRY BATTERIES.—Demand apparently exceeds the supply, and jobbers are receiving only from 25 to 40 per cent of their weekly standing orders.

METERS.—A slight improvement is noted on deliveries of the residence type, but no encouragement is given for the polyphase.

SEATTLE

Exceptional results from the "Lighten the labor of the home" campaign characterized the week of business from Oct. 1 to Oct. 8. Heavy sales are reported on household appliances, particularly washing machines, socket device heaters and table appliances. The campaign is eliciting much enthusiasm. The sale of lamps is increasing and a shortage is feared. It is impossible to keep stocks filled. Prices remain firm. Sales of ranges by dealers in carload lots are dropping off noticeably. Small dealers and central stations report no noticeable decrease in sales, however. It is believed that sales on ranges will decrease materially with the coming of winter weather. A decrease is noticed in sales to steel shipyards since the strike started one week ago. Deliveries on sales made previous to the strike in steel shipyards are held up noticeably. An increase in sales to wooden shipyards is expected with resumption of activities following the return to work of strikers on Oct. 8. As wooden shipyard owners filled depleted stocks during the strike, the increase will not be particularly large. Following the placing of heavy orders for the United States Navy Yard at Bremerton by the government for wires, lamps,

motors, etc., noted recently, a decrease in orders from this source is experienced. Buying by the government for Alaska railroad work is very light. Labor conditions are chaotic. A shortage of men is experienced in all lines of industry owing to draft, enlistments and strikes. It is particularly noticeable in the electrical industry because of the inability of dealers to secure and handle shipments of poles and cross-arms. A shortage of these articles is imminent. The freight situation is again coming to the front. Washington dealers are not alarmed, but Oregon dealers report curtailment of water shipping facilities between Portland and San Francisco and the heavy movement of war traffic has accentuated the seriousness of car shortage on the systems which serve western Oregon. Jobbers are ordering for holiday trade. The impression prevails that business will be exceptionally good preceding Christmas because of prosperous times. Dealers are ordering and will feature electrical staples for this holiday trade, specializing in washing and sewing machines, lamps, irons and domestic appliances instead of frivolous electrical novelties as heretofore. Orders for Christmas tree outfits are large.

FLASHLIGHTS.—Stocks are beginning to move and heavy sales are expected, but shortage may result from increasing demands. Shipments are coming through slowly.

FARM LIGHTING OUTFITS.—Inquiries continue pouring in and sales are increasing rapidly.

CONDUIT.—The demand dropped off slightly last week, but is expected to recover. The effect was not noticeable in the total volume of business. Prices remain the same, and stocks are low.

MOTORS.—Both large and small sizes are moving satisfactory. Prices remain firm. Shipments are slow.

WIRING DEVICES.—There is only a slow movement, due to lack of building. Stocks are ample and prices remain the same.

SAN FRANCISCO

Pacific Coast jobbers work on a margin of three to four months, so that orders for Christmas stock have been placed for some time and in many cases shipments have already been received. Deliveries are good in most lines, and with demand brisk there is a general satisfaction with trade conditions. A few contractors are busy on buildings and some have work laid out for six months, but in the main very little new building construction is being started. Industrial plant extension continues active and is keeping the demand on construction materials up to or above normal. The cantonment business is falling off as the work nears completion. The decrease in trade caused by the closing down of plants due to labor troubles in the vicinity of San Francisco has disappeared with the adjustment of difficulties, and jobbing houses report that the increased demands since then will probably bring the average up to normal. The recent renouncement of the I. W. W. by local labor unions is regarded as a most favorable sign for San Francisco, where construction work has always been influenced to a large extent by labor conditions. The general success of farming operations this season in California is expected to put money in circulation which will benefit the electrical trade, and a profitable holiday season is expected.

WIRE.—A base of 35 cents has been in effect since the 7-cent drop occurred about a month ago, and the demand is brisk. The volume of business has not been affected by the government's fixing of the price of copper, although at first there was some delay in ordering to see if the price might drop further.

SOCKET APPLIANCES.—There is brisk demand for socket appliances, although the minimum price on percolators, for example, is now about \$9. There has been no complaint from the purchasers, and a canvass of several San Francisco dealers showed the average percolator sale this season to be \$12 to \$14.

SMALL MOTORS.—The cost of extensions and heavy demand for power elsewhere have discouraged an energetic canvass of the agricultural field for small motors, so demand from that direction has fallen off. Industrial demands, however, are very brisk. Stocks on direct-current, single phase and polyphase motors up to 10 hp. are now good.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List, per 1000 Ft.
No. 14 solid	\$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE PER 1000 FT.—NEW YORK

Single-Conductor

Less than coil	\$61.00 to \$71.00
Coil to 1000 ft.	59.17 to 68.87

Twin-Conductor

Less than coil	\$105.00 to \$135.00
Coil to 1000 ft.	70.00 to 130.95

DISCOUNT—CHICAGO

Single-Conductor

Less than coil	+10%
Coil to 1000 ft.	—10%

Twin-Conductor

Less than coil	+10%
Coil to 1000 ft.	—10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250

DISCOUNT—NEW YORK

Less than 1 1/2 std. pkg.	+10% to 12%
1 1/2 to std. pkg.	10% to 20%
Std. pkg.	34% to 44%

DISCOUNT—CHICAGO

Less than 1 1/2 std. pkg.	+20% to 12%
1 1/2 to std. pkg.	List to 20%
Std. pkg.	30% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28	.29

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 30	.35	.35
50 to barrel	.31 to .3175	.32 to .3275
Barrel lots	.28 to .2875	.29 to .2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. Per Coil	List, Per 100 Ft.
5/16	250	\$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25-50	35.00
2	25-50	45.00
2 1/2	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip	\$75.00 \$69.75
3/8-in. double strip	75.00 72.00
1/2-in. single strip	100.00 93.00
1/2-in. double strip	100.00 96.00

NET PER 1000 FT.—CHICAGO

Less Than Coil	Coil to 100 Ft.
3/8-in. single strip	\$75.00 \$63.75
3/8-in. double strip	78.75 71.25
1/2-in. single strip	100.00 85.00
1/2-in. double strip	105.00 85.00-95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32	\$0.05 1/2	1	\$0.25
1/4	.06	1 1/4	.33
3/8	.09	1 1/2	.40
1/2	.12	1 3/4	.47
5/8	.15	2	.55
3/4	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$55.00	\$24.50
1/4-in.—	60.00	27.00
		23.50

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$36.67-\$55.00	\$27.50
1/4-in.—	\$40.00-\$60.00	\$23.10-\$24.75
		\$30.00
		\$25.20-\$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4	\$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37
2 1/2	.58 1/2
3	.76 1/2

Couplings, List Elbows, List

1/4	\$0.05	\$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.60
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	6% 8%
2500 to 5000 lb.	9% 11%
(For galvanized deduct six points from above discounts.)	

DISCOUNT—CHICAGO

1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	3.8% 5.8%
2500-5000 lb.	6.8% 8.8%
(For galvanized deduct six points from above discounts.)	

FLAT IRONS

NEW YORK

List price	\$5.00
Discount	30%

CHICAGO

List	\$5.00 to \$6.00
Discount	25%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	\$0.25
35-amp. to 60-amp.	50	.35
65-amp. to 100-amp.	100	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	\$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.75
1/5 to std. pkg.	4.50
Standard package, 500. List, each,	\$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500. List, each,	\$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt-B	100	\$0.27
60-watt-B	100	.36
100-watt-B	24	.65
75-watt-C	50	.65
100-watt-C	24	1.00
200-watt-C	24	2.00
300-watt-C	24	3.00
Round bulbs, 3 1/2 in., frosted:		
15-watt-G	25	.50
25-watt-G	25	.50
40-watt-G	25	.50
Round bulbs, 3 3/4 in., frosted:		
60-watt-G	30	.72
Round bulbs, 4 1/4 in., frosted:		
100-watt-G	35	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$34.88
Coil to 1000 ft.	26.52

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$36.56 to \$36.88
Coil to 1000 ft.	27.42 to 27.66

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	\$20.00 to \$29.00
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CHICAGO

Net per 100	\$14.58 to \$38.35
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OUTLET BOXES

Nos.	List, per 100.
101—A, A1 1/2, 4 S.C., 6200, 320.	\$30.00
102—B.A., 6200 S.E., 300, A.X., 1 1/2, 4 S.	30.00
103—C.A., 9, 4R, B 1 1/2	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list.	List	List
\$10.00 to \$50.00 list.	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list.	40%	35%
\$10.00 to \$50.00 list.	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$20.00
1/5 to std. pkg.	15.00
Standard package, 2200. List per 1000,	\$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80 to \$20.54
1/5 to std. pkg.	13.00 to 19.24
Standard package, 2200. List per 1000,	\$20.

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net	Std. Pkg.	3500 Std. Pkg.	4000
5 1/2 N.C.—Solid Nail-it—N.C.				
Less than 1/5 std. pkg.	\$24.30			
1/5 to std. pkg.	12.15			

CHICAGO

	Per 1000 Net	Std. Pkg.	3500 Std. Pkg.	4000
5 1/2 N.C.—Solid Nail-it—N.C.				
Less than 1/5 std. pkg.	\$11.85 to \$18.00	\$20.75 to \$30.75		
1/5 to std. pkg.	9.00 to 11.10	16.30 to 24.20		

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/2-in. cap key and push sockets	500	\$0.33
1/2-in. cap keyless socket	500	.30
1/2-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No. Fuse

High Grade:	List
30-amp. S. P. S. T.	\$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

Less than \$10 list.	Plus 5% to 5%
\$10 to \$25 list.	11% to 16%
\$25 to \$50 list.	14% to 24%

DISCOUNT—CHICAGO

Less than \$10 list.	+5% to 5%
\$10 to \$25 list.	11% to 16%
\$25 to \$50 list.	14% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp., three-point	100	.54
10-amp., three-point	50	.76
10-amp., 250-volt. D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.76

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to net
1/5 to std. pkg.	Net to 15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

	Union and Similar	List, Each
No. 155		\$0.34
No. 160		.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list.	List	
\$2.00 to \$10.00 list.	20%	
\$10.00 to \$50.00 list.	30%	

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list.	25% to 50%	15% to 40%
\$2.00 to \$10.00 list.	25% to 50%	20% to 40%
\$10.00 to \$50.00 list.	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	\$6.00
Discount	30%

CHICAGO

List price	\$4.50 to \$5.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

No. 18, less than full spools.	\$0.49
No. 18, full spools.	0.45

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	\$0.65 to \$0.6585
No. 18, full spools.	0.55 to 0.5585

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No. 14	\$18.00	\$14.00	\$11.25
12	27.51	23.58	19.85
10	38.43	32.94	27.45
8	54.39	46.62	38.85
6	86.10	73.80	61.50

CHICAGO

	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No. 14	\$18.00	\$16.00	\$14.00
12	27.79-28.63	23.82-24.54	19.85-22.50
10	34.44-38.78	30.47-31.57	27.70-28.70
8	48.84	43.13-44.77	39.20-40.70
6	68.25-70.80	62.05-64.00	55.85-57.60

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$37.25
25 to 50 lb.	36.25
50 to 100 lb.	35.25

CHICAGO

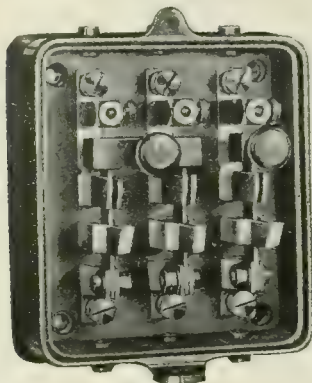
	Per 100 Lb. Net
Less than 25 lb.	\$40.35 to \$42.00
25 to 50 lb.	39.35 to 41.00
50 to 100 lb.	28.35 to 40.00

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Instrument Cut-Out Switch

Cut-out switches designed to provide a positive and safe means for testing wattmeters, ammeters, watt-hour meters, time-limit relays or any similar apparatus which may be connected to the secondaries of current transformers have been developed by the Electrical Development & Machine Company of



MOUNTED ON FIBER BASE AND INCLOSED IN METAL CASE

Philadelphia. In its operation this device insures a closed secondary transformer cut-out circuit in all positions, it is claimed. The apparatus consists of a double-throw switch, with either two, three or four poles as required, so arranged that the knife blades engage the opposite contact clips, which provide means for maintaining a closed secondary circuit, before entirely leaving the other set. The switch is mounted on a fiber base and the whole is inclosed in a metal case provided with suitable sealing lugs. The construction of the case is such as to make it impossible for the meter tester to leave the meter installation disconnected from the current transformer secondaries after his tests have been completed.

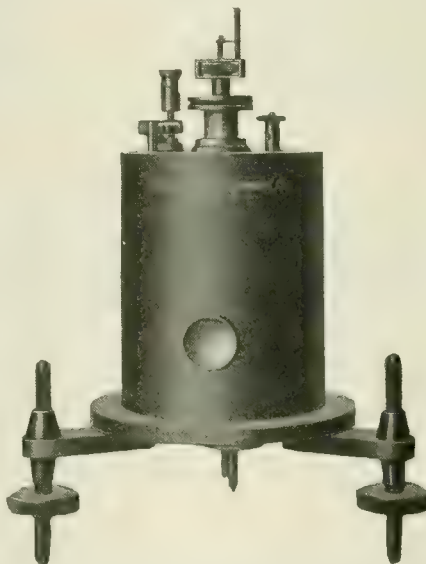
Pressure Filter

The Detroit Steam Appliance Company, 500 Union Trust Building, Detroit, Mich., is manufacturing a pressure filter which it is claimed eliminates undesirable products in the feed water and provides a supply of pure soft water. A correct chemical solution, prepared under the supervision of chemical engineers to suit particular needs, is fed into the heater where scale-making salts are precipitated. The filter is installed between the heater and the boiler. Partly purified water is then pumped through the pressure filter, which removes the rest of the impurities

in the form of suspended matter. On all prospective installations samples of water are taken and analyzed and a scientific method of treatment is decided upon. A filter of special design is installed, and the results of the treatment are carefully followed up.

Quadrant Electrometer

For measurements of very small currents or of electrostatic potentials the Pyroelectric Instrument Company of Trenton, N. J., has placed on the market the Compton quadrant electrometer. The needle and plane mirror comprise one unit and the quartz-fiber suspension another. The needle is of aluminum leaf and is slightly unsymmetrical in relation to the quadrants. The degree of dissymmetry can be



METER FOR MEASURING SMALL CURRENTS

changed from the outside of the case to suit various conditions. One of the small brass quadrants is detachable and can be pushed aside or entirely removed. The two insulated quadrants are mounted on a single ambroid insulator. Leveling screws are provided for the proper placing of the needle and mirror. The dust cover can be twisted so that the small glass window may face in any direction. The total range of the instrument is approximately 0-50,000 mm. per volt, and the easy working range is 0-20,000 mm. per volt.

The period increases with the sensitivity, and varies from approximately two seconds at very low sensitivities up to approximately ten seconds at 20,000 mm. per volt. It is pointed out that the instrument is practically dead-beat.

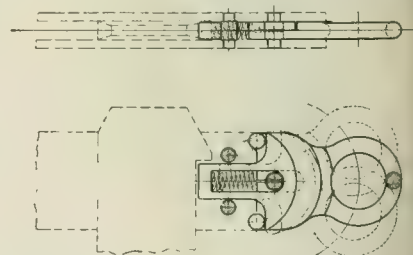
Electric Forge Blower

The Buffalo Forge Company, Buffalo, N. Y., is marketing a variable-speed electric blower known as "No. 2E." This type of blower may be used for furnace draft, operating church organs and for blowing forge fires. It is also used to remove scale from power hammers and for disposing of chip in metal and woodworking processes. A large oil chamber is provided and all running parts are self-oiling. Oversize brushes are used to do away with frequent replacements. A speed regulator is furnished with each outfit, together with flexible cord and attachment plug. The motor can be furnished for 110 volts or 220 volts.

Disconnecting Switches

The Lewis & Roth Company of Philadelphia is now manufacturing a double-blade-tongue-clip type of disconnecting switch which, it is said, lends itself readily to adjustments. It is pointed out that the tongue-clip eliminates soldered joints and its rugged construction makes tempering unnecessary. Should the clip be burned or pitted in service it is only necessary to refinish the surface, after which new contact can be secured through a very slight adjustment of the "tension screw" on the blades. It is pointed out that the insulators used are of the best grade of wet-process porcelain thoroughly vitrified.

One of the blades is tapped, making possible very fine adjustments, a lock nut being used to fix this adjustment. Blades are chamfered as an aid in closing the switch. The clips are milled and the contact surfaces ground and equipped with a shoulder stop regulating the throw of the blades. The lock

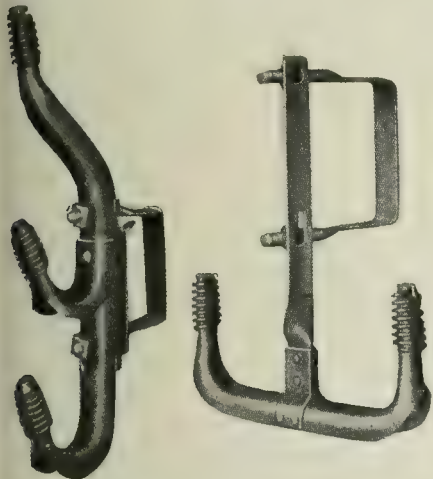


DETAILS OF LOCK OF DOUBLE-BLADE-TONGUE-CLIP TYPE OF SWITCH

used for these switches is a simple door-bolt arrangement provided with an eye for the switch hook. This lock is suitable for either single-throw or double-throw switches, indoor or outdoor service.

Heavy Spreaders and Break Arms

Hubbard & Company of Pittsburgh, Pa., have developed a line of heavy spreaders and break arms that are pressed from No. 9 gage steel and the cross-section of their main body is 1 in.

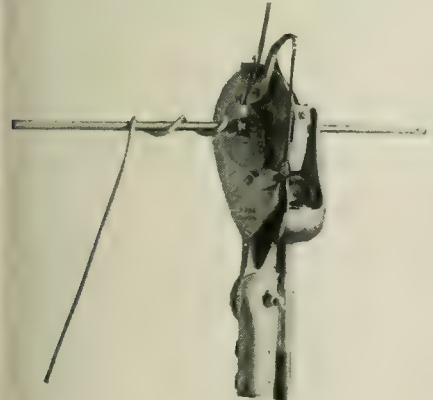


SPREADER AND BREAK ARM

by 1½ in. (2.54 cm. by 3.81 cm.). It is said that the spreader brackets will not break, bend or pull off cross-arms and that they can be installed in a minute. These arms are designed so that the top cross wire clears the line wire. Referring to the accompanying illustration, the device shown on the left is a cross-arm spreader bracket and the one on the right a break arm. This equipment is made in five types.

Tapping Machine for Live Circuits

A tapping machine which wraps the tap wire around a live main line wire just as a lineman would do if the line were dead has been developed by H. B. Bush of Redlands, Cal. A piece of ordinary No. 6 or No. 8 B. & S. gage bare annealed copper wire of approximately the right length is selected to make the tap. One end of tap wire is



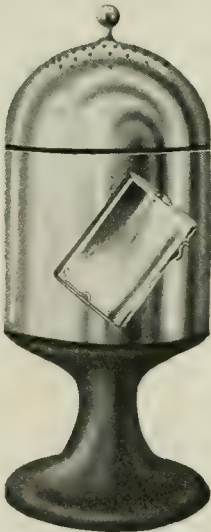
TAPPING MACHINE

wrapped upon the end of the dead branch line by hand, and the machine is then set on the tap wire at a point that will leave 3 in. or 4 in. (7.6 cm. or 10 cm.) of slack. The excess length of tap wire is then cut off, leaving

6 in. or 8 in. (15.1 cm. or 20.3 cm.) sticking out through the machine. The machine is then shoved up and on to the main live line wire and the crank is turned to the right. This rotary motion is transferred to the winding head through a set of bevel and spur gears. The winding head rotates around the main line wire as an axis, and this motion wraps the tap wire around the main line wire and also pulls all slack out of the tap wire. On the end of the wrap a close pigtail is wound. After all the tap wire has been pulled through the winding head, the direction of the crank is reversed, the machine unlocks itself from the main line and the tap is made.

Electrical Display Device

The Herberts Engineering Company, Inc., 10 East Forty-third Street, New York City, has developed an electrical advertising medium that displays announcements, cards, booklets, photos, pictures, cartoons and actual goods of various kinds. The device consists of electrically driven apparatus inclosed in a plated metal jacket and dome, upon



DEVICE IS EASILY INSTALLED

which the goods are made to revolve without any visible means of suspension while the external part of the apparatus is quite stationary. No hooks or wires of any sort are employed. The approximate dimensions of the "Self-fast," as the device is called, are 24 in. high and 12 in. in diameter. Articles of unusual shape take peculiar lines of travel about the smooth metal cylinder, rolling over and over as they go.

Keyless Receptacle for Signs

The demand for a mogul-base porcelain receptacle for conduit box and large sign work is met by the General Electric Company, Schenectady, N. Y., with a new receptacle having a rating of 1500 watts, 250 volts. This receptacle takes a 23/16-in. (5.6-cm.) hole in the sign front, and the socket is adapted for mogul-base lamps.

Electric Water Supply System

Compactness, the makers claim, has been secured in their water-supply system by mounting all apparatus on a substantial iron base. The pump is of the horizontal piston type, belt-driven, with single-speed reduction from a Westinghouse motor specially designed to secure high starting effort. Water is pumped from a depth of 22 ft. (6.7 m.) or less into a tank against an air pressure of 35 lb. to 50 lb. per square inch (2.45 kg. to 3.5 kg. per sq. cm.). To replace that small proportion of air which is absorbed in the water means are provided for automatically introducing air into the tank.

The equipment is entirely automatic and requires little or no attention after installing. A pressure-actuated switch controls the motor so that the pressure in the system is maintained at all times at any value from 35 lb. to 50 lb. (15.8 kg. to 22.6 kg.). Where the water level is more than 22 ft. (6.7 m.) below the pump, a deep-well outfit of the same make should be used. This outfit is made by the Vailes-Kimes Company of Dayton, Ohio.

Dust-Proof Lighting Fixture

Lighting fixtures that are said to be dust-proof and bug-proof have been developed by L. Plaut & Company, 432 East Twenty-third Street, New York City. It is said that these fixtures produce excellent illumination for offices, restaurants or other places where physical conditions make indirect lighting impracticable. The upper part, or holder, is of stamped steel, finished in white enamel and surmounted by a small cap to which the chain is fastened. The holder, which is amply ventilated, is at once a container for the socket and support for both reflector and bowl. The feature of this fixture is the bowl, of which the lower half is porcelain-enamelled and the upper part of clear glass. A great part of the light from the bulb passes, it is



LOWER PART OF BOWL IS PORCELAIN-ENAMELED, UPPER PART CLEAR GLASS

claimed, without loss directly under the clear part of the globe and is redirected by the reflector. The reflector is of white translucent glass, which allows a small percentage of the light to pass through to illumine the ceiling.

New Incorporations

THE ELECTRIC ZINC PRODUCTS COMPANY of Brooklyn, N. Y., has been chartered with a capital stock of \$4,000 to manufacture zinc products. The incorporators are: Herman Kaitz, Morris Goldstein and Louis Silverman.

THE FORTIER ELECTRIC MANUFACTURING COMPANY of Tulsa, Okla., has been chartered with a capital stock of \$30,000 to manufacture electrical fixtures, etc. The incorporators are: U. D. Fortier, George M. Schiek and M. P. Latimer of Tulsa, Okla.

THE ELECTRICAL BROKERAGE COMPANY of Detroit, Mich., has been chartered with a capital stock of \$1,000 to deal in electrical supplies. The incorporators are: John E. McKenzie, Charles L. Martin and T. C. O'Brien, Safety Building, Detroit, Mich.

THE HENRY J. RUEFF COMPANY of Louisville, Ky., has been incorporated by Henry J. Rueff, N. C. Hall and L. A. Hickman. The company is capitalized at \$10,000 and proposes to engage in a retail and wholesale business in electrical supplies and fixtures.

THE LUMINOUS SIGN COMPANY of Jamestown, N. Y., has been incorporated by A. J. West, M. E. Paddock and A. Davis, of Jamestown, N. Y. The company is capitalized at \$100,000, and proposes to manufacture signs, displays, markers, etc., and advertising devices.

THE EXCEL-O-LYTE COMPANY of Des Moines, Iowa, has been incorporated with a capital stock of \$20,000 to manufacture and sell automobile lighting plants. C. W. Lyon is president and treasurer, and E. C. Peters is secretary and general manager of the company.

THE CAR LOCATER LIGHT COMPANY of New York, N. Y., has been chartered with a capital stock of \$10,000 to manufacture electric lamps, locaters and electric devices. The incorporators are: R. M. and P. Loewenthal and C. H. Low, 30 East Forty-second Street, New York.

F. P. MANSBENDEL & COMPANY of New York, N. Y., have been incorporated by F. P. Mansbendel, E. W. F. Mammen and J. S. Leach, 576 Twenty-sixth Street, Brooklyn, N. Y. The company is capitalized at \$5,000 and proposes to do a general electrical and mechanical engineering business.

THE M. V. ALLWEATHER TRAIN CONTROLLER COMPANY has been incorporated by C. L. Rimlinger, F. A. Armstrong and C. M. Egner of Wilmington, Del. The company is capitalized at \$2,000,000 and proposes to manufacture and deal in and with electric and pneumatic signals for train control.

THE McLOUGHLIN MANUFACTURING COMPANY of Camden, N. J., has been incorporated by William J. Strandwitz, William J. McLoughlin, James Scott and Lee E. Griscom. The company is capitalized at \$50,000 and proposes to do a general electrical engineering business and to manufacture electrical goods and apparatus.

THE MAYO ENGINEERING COMPANY of New York, N. Y., has been incorporated by J. S. Bernstein, 233 Broadway, New York, N. Y.; G. F. Kerr, 11 Pryor Lane, Larchmont, and V. J. Mayo, 546 Fourth Street, Brooklyn, N. Y. The company is capitalized at \$200,000 and proposes to do a general electrical and mechanical engineering business.

THE AMALGAMATED OIL CORPORATION of New York, N. Y., has been chartered with a capital stock of \$600,000 by A. E. Moore, 37 Wall Street, New York, N. Y.; A. F. McCabe, 19 Tompkins Place; S. C. T. Dodd, 1918 Avenue H, Brooklyn, N. Y. The company proposes to manufacture engines, motors, storage batteries, gas-making machinery, coke ovens, etc.

THE BLAW-KNOX COMPANY announces that, owing to conditions created by the war which have called to the service many of the salesmen and engineers of the company, it has been decided to close the Boston office for the duration of the war. All inquiries and all work in the Boston territory will be handled through the New York office, at 165 Broadway.

THE CURTISS ENGINEERING CORPORATION of Garden City, N. Y., has been incorporated by interests connected with the Curtiss Aeroplane Company of Buffalo, N. Y. The new corporation will provide facilities for experiment and research work for which a laboratory and plant to employ 300 men will be erected. The officers are: Glenn H. Curtiss, president; K. B. Mac-

Donald, vice-president, and J. P. Tarbox, secretary.

THE BRIDGEPORT ELECTRIC PRODUCTS COMPANY of Bridgeport, Conn., has been incorporated with a capital stock of \$50,000 by C. E. Bilton, William B. Spencer and C. E. Benedict, all of Bridgeport. The company will take over the business developed by the Standard Manufacturing Company, which has been manufacturing push buttons, telephone appliances and other electrical supplies. Temporary quarters will be located on North Washington Street.

THE NATIONAL ELECTRIC & GAS HEATER COMPANY OF AMERICA has filed articles of incorporation under the laws of the State of Maine with a capital stock of \$200,000. The company proposes to acquire the electric heater and gas heater invented and patented by Joseph Alphonso L'Esperance of Montreal, Que., and the exclusive right to manufacture and sell the same in the United States for a period of 99 years; also to do a general business in heating apparatus. The directors are: Alfred Portier, president; Theodore E. Berland, treasurer, and Alfred Portier, all of Pawtucket, R. I., and Louis P. P. Choquette of Central Falls, R. I.

Trade Publications

WASHING MACHINES.—The Arnold Electric Company of Racine, Wis., is distributing an illustrated folder descriptive of its electric washer and wringer.

TOYS.—The Knapp Electric & Novelty Company, 511 West Fifty-first Street, New York City, has prepared catalog No. 26, descriptive of its 110-volt and battery power and its miniature electrical toys.

FORCED DRAFT APPARATUS.—The B. F. Sturtevant Company, Hyde Park, Boston, Mass., is distributing catalog No. 236, descriptive of its steel-plate fans, multivane fans and turbovane fans.

ELECTRIC LAMPS.—The Wirt Company of Philadelphia is distributing a folder descriptive of six quarter-page advertisements for national publications. Attention is called to the Christmas advertisement for the "Dim-A-Lite" portable lamp.

SECOND-HAND MATERIAL.—The Walter A. Zelnicker Supply Company, St. Louis, is distributing bulletin No. 220, in which it lists second-hand rails, locomotives, equipment, machinery, steel pilings, tanks, cranes and miscellaneous items for sale.

HEATING DEVICES.—The Hotpoint Electric Heating Company of Ontario, Cal., is distributing an illustrated folder announcing its mission art display, which provides eight complete changes for eight different window trims covering an equal number of weeks.

NEW HOUSE ORGAN.—Packard Doings is the name of a new house organ which recently made its appearance and is published by the Packard Electric Company of Warren, Ohio. This is a breezy little magazine, and no doubt all who are on the mailing list will look forward to its receipt every month.

TRANSFORMERS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued leaflet 3562-A, descriptive of its OISC transformers cast-in-tank type. This company has also issued a leaflet descriptive of its No. 903 commutating-pole mine motor for Baldwin Westinghouse mine locomotives.

PANELBOARDS AND CABINETS.—Catalog No. 47,901 has been prepared by the Sprague Electric Works of the General Electric Company, New York City, describing panelboards and cabinets. This catalog has been carefully prepared and arranged so that all devices are easily found. The panelboards listed in this catalog are arranged for National Electric Code inclosed fuses or Edison plug fuses. The boards and cabinets shown in this catalog have been selected after careful study of general requirements.

LOCOMOTIVES.—Locomotives for industrial and contractors' service are illustrated and described in record No. 86, recently published by the Baldwin Locomotive Works of Philadelphia. The engines shown are representative of modern practice, but they do not illustrate all the types built for this kind of work. Information is given regarding the hauling capacity of each locomotive, at slow speeds, on grades up to 6 per cent. A number of the engines illustrated were especially designed for service in and about steel mills, blast furnaces and smelters. This company has also published record No. 87, descriptive of military supplies.

Trade Notes

THE GENERAL ELECTRIC COMPANY, 601 Broadway, Newark, N. J., will build a new four-story addition to its plant to cost about \$14,000. Contract for erection has been awarded.

DAVID D. GOOD of the Public Light & Supply Company, Chattanooga, Tenn., has resigned to become publicity representative of the H. C. Roberts Electric Supply Company, 905 Arch Street, Philadelphia.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY of Texas has moved its Houston offices from the Tel. Electric Company building to the Union National Bank building, corner Main Street and Congress Avenue.

THE ENTERPRISE ELECTRIC NOVELTY COMPANY of New York is opening Pacific Coast headquarters at 706 Sansome Street, San Francisco, Cal. The company manufactures portable flashlights and batteries and has not before had an establishment on the Pacific Coast.

GEORGE L. FOOTE, late of Foote, Pierson & Company, electrical specialty manufacturers, New York City, died at his home in Brooklyn, N. Y., Sept. 24, aged seventy-three years. Mr. Foote retired from business a year ago and had been ill several months prior to his death.

W. J. DRURY has been appointed manager at the Cleveland (Ohio) distributing house of the Western Electric Company. Mr. Drury was formerly sales manager at Dallas, Tex., and is succeeded by W. P. Hess, who was formerly in charge of the sales work at Houston. C. W. Chestnut takes Mr. Hess' place. These changes are effective Oct. 15.

THE EDISON LAMP WORKS of the General Electric Company, Harrison, N. J., are making preparations for the celebration of Edison Day, Oct. 21. Arrangements are being made through the trade and otherwise for the printing of newspaper stories about Edison and his discovery of the commercial incandescent lamp and a large amount of co-operative advertising material has been prepared and is being distributed.

THE HOOVER SUCTION SWEEPER COMPANY, New Berlin, Ohio, had as its guests on Sept. 22 the salesmen of the Erner Electric Company, Cleveland, Ohio. George S. Miller, general sales manager of the Erner company, had charge of the party of twenty-four, and he was assisted by R. E. Flower, head of the household department, in making arrangements for the trip. H. W. Hoover, an official of the Hoover Suction Sweeper Company, acted as host and showed the visitors through the plant.

THE FEDERAL SIGN SYSTEM (ELECTRIC) announces the following changes in its Eastern district offices: J. G. Goldfuss, manager of the Philadelphia office, has been transferred to New York as manager of the New York office. D. R. Webb, Jr., assistant manager of the New York office, has been transferred to Philadelphia as manager of the Philadelphia office. E. S. Grandin, Jr., of the New York office, is appointed manager at Baltimore, succeeding A. Schiller, who is appointed assistant manager of the same office.

THE ELECTRIC MACHINERY COMPANY, Minneapolis, Minn., has started work on a new factory considerably larger than the present one and adjoining the main building. This will double the size of the company's plant and so increase the shop facilities that the output will be nearly tripled. The new factory will be completed and in full operation before Jan. 1, 1918. The plans include a 60-ft. span, 25-ton, four-motor traveling crane, some 16-ft. boring mills, and lathes, milling machines, punch presses, drill presses, etc. The company has established a branch office in New York City, with district offices in Boston, Philadelphia and Buffalo.

THE ROBBINS & MYERS COMPANY, Springfield, Ohio, on Sept. 24 took over the plant of the John O. Heinze Company of that city. The latter does not lose its identity or name in the deal, retaining the same officers and sales force as heretofore. Its production, however, will be handled by the Robbins & Myers Company, Plant No. 3, as it will be known, gives the Robbins & Myers Company nearly 45,000 ft. of floor space in the Heinze factory, which will eventually be utilized for fan work becoming the fan machine, winding and finishing shop. Plants Nos. 1 and 2 will be devoted to the manufacture of Robbins & Myers motors, Delco starters, farm lighters, etc., almost exclusively.

New England States

BENNINGTON, VT.—The Twin State Gas & Electric Company is replacing the penstock at its plant on the Woodford Road. The new penstock will be 6 ft. in diameter and 1200 ft. long.

WRENTHAM, MASS.—The Selectmen have signed a contract with the Union Light & Power Company of Franklin for lighting the streets of the town for a period of three years. The contract calls for 162 electric lamps.

WEST SPRINGFIELD, MASS.—Work will soon begin on the construction of an addition to the power plant of the Gilbert-Barker Manufacturing Company at the corner of Union Street and Cold Spring Avenue in West Springfield. The building will be 40 ft. by 90 ft., and will cost about \$25,000.

Middle Atlantic States

ALBION, N. Y.—Arrangements are being made for installing all telephone and electric-light wires from the streets to the building on the County Square in underground conduits.

BUFFALO, N. Y.—The Buffalo General Electric Company is contemplating the construction of a new transformer station about 40 ft. by 51 ft.

CANAAN, N. Y.—F. W. Munch, owner of the local plant, is erecting a 6600-volt transmission line from Millerton to Pine Plains to furnish electrical service in the latter place. Electricity will be furnished to Briar Cliff Farms Dairy Company and the Thompson Water Works Company.

DUNKIRK, N. Y.—The Board of Water Commissioners is considering the installation of a lighting system in the business district of the city.

HAMBURG, N. Y.—The Town Board of East Hamburg has entered into a contract with the Depew & Lancaster Light, Power & Conduit Company for furnishing electricity for lamps and motors in Hamburg and Orchard. A new street-lighting system, consisting of 60, 80 and 100-cp. lamps will be installed. In the center of the villages several 400-cp. Novalux street arc lamps with Holophane reflectors will be erected.

JORDAN, N. Y.—The Jordan Electric Light & Power Company is extending its transmission lines to furnish electrical service in Hart Lot and Warners. Transformers have already been installed in Hart Lot and are now being installed in Warners. Niagara power will be used.

LOCKPORT, N. Y.—The Board of County Supervisors is considering the installation of an electric-lighting plant in the new County Tuberculosis Hospital.

MEDINA, N. Y.—The Western New York Utilities Company of Medina is contemplating the construction of a large dam and power plant to develop about 2500 hp.

NEW YORK, N. Y.—Plans have been filed by the Fifth Avenue Coach Company, 10 East 102nd Street, New York, for the erection of a new factory, about 400 ft. by 425 ft., five and seven stories, on 132nd Street, near Broadway, to cost about \$1,000,000. The plant will be used to manufacture electric motor buses.

ROCHESTER, N. Y.—The Rochester Railway & Light Company has increased its capital stock by \$750,000, which it is authorized to sell to the Mohawk Valley Company to fund the proposed merger with the Canandaigua (N. Y.) Gas Light Company, the Despatch Heat, Light & Power Company of East Rochester, the Eastern Monroe Electric Light & Power Company and the Ontario Light & Traction Company of Canandaigua.

GLOUCESTER CITY, N. J.—Plans are being prepared by the Pennsylvania Shipbuilding Company for the erection of several one-story shop buildings in connection with its new shipbuilding plant. The cost of the entire plant is estimated at \$1,000,000. George F. Pawling & Company, 1438 South Penn Square, Philadelphia, Pa., are engineers.

JERSEY CITY, N. J.—The City Commission has instructed the city clerk to advertise for bids for the construction of a nurses' home, laundry and power house for the new City Hospital.

JERSEY CITY, N. J.—Contracts for the installation of electric-lighting systems (to replace gas illumination) in Public Schools Nos. 1, 9, 11 and 20, totaling \$15,079, have been awarded by the board of education as follows: For Schools Nos. 1 and 9, to the Jandons Electrical Company; No. 1, \$3,610, and No. 9, \$5,090; Schools No. 11 and No. 20, to Walter J. Coleman, at \$3,196 and \$3,183, respectively.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

NEWARK, N. J.—The board of education is considering the installation of telephones in the near future in the Hillside Avenue and Saybrook schools in Hillside, near Newark. The Hillside Avenue school will be tied in with the Newark circuit and the Saybrook school with the Elizabeth circuit.

POINT PLEASANT, N. J.—The Point Pleasant Traction Company is contemplating the purchase of a 100-hp. motor-generating set in the near future.

RED BANK, N. J.—Bids will be received by the board of education, Red Bank, N. J., until Oct. 19 for electrical work in the proposed new high school building. Plans and specifications may be obtained from Ernest A. Arend, architect, 105 West Fortieth Street, New York, N. Y., or Asbury Park, N. J. Charles A. Minton is secretary.

SOUTH RIVER, N. J.—The Borough Council is considering the question of increasing the efficiency of the municipal electric-lighting system. Additional energy may be secured from the Sayreville Electric Light & Power Company.

ANNVILLE, PA.—The Calcite Quarry Company is contemplating replacing the steam-driven equipment at its quarries in Myerstown with electrically-operated machinery.

BRISTOL, PA.—Plans are being considered by the East Pennsylvania Gas & Electric Company for extending both its electric and gas service to North Bristol where a large real estate development is under way.

BRISTOL, PA.—The Merchant Shipbuilding Corporation, it is reported, will soon purchase power-plant equipment for its Bristol plant, including air compressors, generators, converters, coal conveyors, turbines, etc.

CHESTER, PA.—The Chester Shipbuilding Company, it is understood, is contemplating the purchase of new power-plant equipment, consisting of air compressors, generators, turbines, coal conveyors, converters, etc.

CHESTER, PA.—Contract has been awarded by the Philadelphia (Pa.) Electric Company to the Stone & Webster Engineering Corporation, 147 Milk Street, Boston, Mass., for the construction of a new power plant, 400 ft. by 400 ft., at Beach and Palmer Streets. The cost of the plant complete with equipment is estimated at about \$8,000,000.

HAZLETON, PA.—Preparations are being made by the Harwood Electric Company to begin work on the erection of an electric transmission line to Conyngham. It is expected to have the line completed before the first of the year.

PHILADELPHIA, PA.—The Atlantic Refining Company is planning to erect an addition to power house on Passyunk Avenue and Twenty-eighth Street, 82 ft. by 84 ft., to cost about \$50,000.

PHILADELPHIA, PA.—The American International Corporation, which is building a ship-assembling plant on Hog Island, Philadelphia, for the Emergency Fleet Corporation, it is understood, will soon purchase power-plant equipment, riveting tools, punch shop machines, etc. The company has opened executive offices and purchasing department in the Bellevue-Stratford Hotel and will later be located at 142 North Broad Street.

READING, PA.—The Metropolitan Edison Electric Company is planning to install new soot blowers in its boilers, at a cost of about \$8,000. The plant has a battery of 19 boilers.

WILMINGTON, DEL.—The Street and Sewer Department has granted the Diamond State Telephone Company permission to install underground conduits on King, Front, Thirty-first, Thirty-third and Thirty-sixth Streets and Market, Maryland and Washington Avenues.

BALTIMORE, MD.—Contract has been awarded by the Hess Steel Corporation, Loneys Lane and Pennsylvania Railroad, to the Crowell-Lundorff-Little Company of Cleveland, Ohio, for construction of an addition to the electric furnace plant, 19,000 sq. ft. floor space, and an office building, 80 ft. by 42 ft. Additional electric melting furnaces, cranes, power equipment, etc., will be installed.

SPARROWS POINT, MD.—Extensive improvements are contemplated by the Beth-

lehem Steel Company at its local substation.

BLUEFIELD, W. VA.—The Appalachian Power Company has awarded a contract for the construction of a new electric generating station on the New River to C. W. Hancock & Son, Lynchburg, to cost about \$900,000. The proposed plant will be steam-driven and will have an output of 100,000 kw.

SPRINGWOOD, VA.—Plans are being prepared by C. A. Mess of Charlotte, N. C., engineer, for developing a water power project at Springwood. Jasper Miller of Charlotte, N. C., is interested in the project.

WASHINGTON, D. C.—The Bureau of Steam Engineering, Navy Department, Washington, D. C., desires to purchase for installation on shipboard, delivery East Coast within two months, two turbo-generating sets, 200 kw., steam 150 lb. (vacuum 25" available) direct current adjustable from 125 to 160 volts, or one 400-kw. set, same steam conditions, direct current 250 to 320 volts. Must be in good condition, but not necessarily new or exactly to above specifications. Commercial sets wound for 115/125 volts will generally operate over voltage range noted above, or at least near enough to meet battery charging requirements.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 5, for furnishing and installing the piping, pumps, boilers, heaters, buildings and reservoirs for three fuel-oil storage stations, one at Puget Sound, Wash., one at Mare Island, Cal., and one at San Diego, Cal.; also pumps, boilers, heaters and buildings at Pearl Harbor, Hawaii. Drawings and specifications (No. 2562) may be obtained on application to the above bureau or to the commandants of the navy yards, Mare Island, Cal.; Puget Sound, Wash.; Pearl Harbor, Hawaii, or to the custodian, naval coal depot, San Diego, Cal.

North Central States

GRAND RAPIDS, MICH.—Plans are being considered by the Board of Public Work for the construction of the street-lighting system. There is now \$30,000 available in the budget with which to start the work.

ST. JOSEPH, MICH.—Bids will be received at the office of the city clerk, St. Joseph, until Oct. 25 (readvertisement) for construction of sewer and sewage pumping station, as follows: (1) For construction of sewer and sewage pumping station, including all material and appliances except pumping station machinery, electric equipment and accessories thereto; (2) for all electrical work and mechanical devices, piping and equipment to the pumping station, including installation of same. Clarence J. McMullen is city clerk.

CARDINGTON, OHIO.—The capital stock of the Cardington Electric Light, Heat & Power Company has been increased from \$15,000 to \$20,000.

CINCINNATI, OHIO.—The building of the Post-Glover Electric Company at 314 West Fourth Street was recently destroyed by fire, causing a loss of about \$400,000.

CINCINNATI, OHIO.—The Superior Electric Manufacturing Company of Cincinnati, recently organized, has purchased the electric motor and repair business of the Reno-Kaetker Electric Company, at 610-616 Baymiller Street. The latter company has opened offices at 41 Main Street and will continue the manufacture of motor-driven saws.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, Room 305 City Hall, Cleveland, until Oct. 19, for furnishing and installing a freight elevator and safety gates at the easterly sewage treatment works. Copies of plans and specifications and proposal blank may be obtained at the office of the commissioner of engineering, Room 618, City Hall, upon deposit of \$5.

DAYTON, OHIO.—The S. H. Thomson Manufacturing Company of Dayton has increased its capital stock from \$15,000 to \$25,000 to provide funds for the manufacture of a new electrolytic oxy-hydrogen gas generator. The plant is located in the Beaver Power Building.

ELYRIA, OHIO.—The Elyria Telephone Company is contemplating establishing a new automatic telephone system and will erect a business building on Second Street.

HAMILTON, OHIO.—The Ohio Gas & Electric Company has purchased a tract of land near the city for the purpose, it is understood, of erecting a large substation to serve Hamilton and vicinity.

IRONTON, OHIO.—The City Council has authorized the director of safety to advertise for bids for lighting the N. & W. tracks and D., T. & I. tracks.

LEIPSI, OHIO.—Work has begun on the construction of a new electric-light plant in Leipsic for the Northwestern Ohio Light Company near the old water-works plant. Contract for construction of the building, 75 ft. by 90 ft., has been awarded to T. L. Myers and S. A. Dudley, at \$13,000. The equipment will consist of two complete units, one of 200 kw. and the other of 400 kw., the latter being entirely new.

SALEM, OHIO.—The Salem Lighting Company, owned by the purchasers of the Youngstown & Suburban Railway Company, has petitioned the County Commissioners for permission to erect a high-tension transmission line from its plant in Salem to Leetonia, to supply energy to operate the inter-urban system. The railway company now serves Columbiana and North Lima, en route to Youngstown, and connects at Leetonia with the Youngstown & Ohio River line from Salem to East Liverpool, while a spur, it is reported, is to be built next spring to East Palestine, a distance of 20 miles, over a route already surveyed.

CARLISLE, IND.—The Indiana Power & Water Company of Bloomfield is contemplating extending its service to Carlisle. The company is reported to have purchased the property of the Carlisle Gas Company and will operate the plant until the electric-lighting system is installed.

PIERCETON, IND.—The town of Pierceton is negotiating with the Winona Electric Light & Power Company of Warsaw to furnish electricity to operate the municipal electric-light plant. It is proposed to close down the municipal plant. Warsaw is 9 miles from Pierceton.

LYONS, ILL.—The Inter-Ocean Refining Company, 322 Michigan Avenue, Chicago, Ill., which recently purchased a large tract of land near Lyons, is contemplating the construction of a plant. The plans provide for an ultimate expenditure of \$325,000, and will include a power house, stills, filter house, pump house and other buildings.

ASHLAND, WIS.—The Ashland Light, Power & Street Railway Company has begun work on the construction of a hydro-electric power plant at the mouth of the Montreal River on the boundary line between Michigan and Wisconsin, to develop about 1200 hp. at a cost of about \$100,000. An electric transmission line will be erected to connect the plant with the company's lines between Ashland, Mellen and Ironwood. A line will be constructed directly from Montreal River to Ashland, across the Bad River Indian Reservation, at a cost of between \$40,000 and \$50,000 additional.

DE PERE, WIS.—The De Pere Electric Light & Power Company has begun work on extending its electric transmission lines along the De Pere-Green Bay concrete driveway as far as the Country Club. Electricity will be distributed along the route.

EAU CLAIRE, WIS.—The United States Switch Company, a Delaware corporation capitalized at \$1,750,000, which has been granted a Wisconsin charter, contemplates establishing a plant in Eau Claire to manufacture automatic railroad and electric railway switches and other equipment, appliances and safety devices. The company has purchased the former plant of the Eau Claire Manufacturing Company and five acres of ground and, it is understood, will award contracts at once for construction of several buildings. James W. Hubbard of Eau Claire is president.

KENOSHA, WIS.—The capital stock of the Wisconsin Gas & Electric Company has been increased from \$2,750,000 to \$3,350,000, to provide funds for extensions of its power generating and transmission systems at Racine and throughout southern Wisconsin.

MILWAUKEE, WIS.—The merchants and property owners on the east side are considering improvements to the street-lighting system in that section of the city.

OSHKOSH, WIS.—The Oshkosh Gas Light Company has engaged William Baehr, 127 South Michigan Avenue, Chicago, Ill., to prepare plans for an addition, 90 ft. by 100 ft., to its electric-light plant.

WAUPUN, WIS.—The installation of an electric-lighting system in the Wisconsin State Prison, to cost about \$4,000, is under consideration.

CHISHOLM, MINN.—Work has been begun on the construction of the new power plant of the Minnesota Utilities Company. The power house will be 70 ft. by 90 ft., and the equipment will include a 2000-kw. turbo-generator set, an auxiliary engine and a 1000-hp. boiler, equipped with auto stokers.

DULUTH, MINN.—Two machine shops, a carpenter shop, power house, office build-

ing and storage warehouses are being erected in connection with the shipbuilding plant of the Douglass-Duluth Shipbuilding Company at Spirit Lake, Duluth.

MINNEAPOLIS, MINN.—The Electric Machinery Company of Minneapolis is planning to build an addition to its plant, 64 ft. by 122 ft., which will double the output of its plant. The company has a contract for furnishing electric generators to the Rock Island (Ill.) Arsenal.

RICE, MINN.—The Sterling Electric Company, 33 South Fifth Street, Minneapolis, has been awarded a contract for the erection of an electric transmission line and distribution system in the village of Rice, at a cost of \$7,995. Earle D. Jackson, Capital Bank Building, St. Paul, is consulting engineer.

WADENA, MINN.—Improvements to the street-lighting system and erection of a distributing system for domestic service in the village is under consideration by the Village Council.

BLOOMFIELD, IOWA.—The first unit of the new municipal electric-light plant, consisting of a new boiler room and coal house and smokestack, is complete. Two new boilers of 150-hp. each have been installed.

BURLINGTON, IOWA.—The People's Gas & Electric Company has been granted a 25-year franchise by the Board of State Railroad Commissioners to erect and operate an electric transmission line on certain roads and highways in Des Moines County. The company was also granted a franchise to erect a transmission line between West Burlington and the farms of Anna Deems.

CEDAR RAPIDS, IOWA.—The Board of State Railroad Commissioners has granted the Iowa Falls Electric Company a 25-year franchise to erect and operate an electric transmission line on certain roads and highways in Wright County.

CEDAR RAPIDS, IOWA.—The Board of State Railroad Commissioners has granted the Iowa Railway & Light Company a franchise to construct and operate electric transmission lines on certain roads and highways in Muscatine County for a period of 25 years.

DAVENPORT, IOWA.—Work has been started on the installation of new equipment in the substation of the People's Light Company at Third and Rock Island Streets, which will include transformers, switching equipment, lightning arresters and the necessary machinery to change the voltage from 4800 volts to 13,200 volts. The cost of this improvement is estimated at \$25,000.

DES MOINES, IOWA.—The state officials have asked the City Council to install a special design of electroliners on the city streets within the capital extension project.

DUBUQUE, IOWA.—The Board of Supervisors of Dubuque County has granted the Eastern Iowa Electric Company of Dubuque a franchise to erect and maintain electric transmission lines over the roads and highways in Dubuque County for a period of 20 years.

DUNBAR, IOWA.—At an election held recently the proposal to issue \$7,000 in bonds for the installation of an electric-lighting system was carried.

INDIANOLA, IOWA.—The contract for the erection of an electric transmission line from McCook to Indianola has been awarded to Nathan L. Jones of Norwich, Kan.

STRAWBERRY POINT, IOWA.—At an election held Sept. 19 the voters defeated the proposal to sell the municipal electric-light plant and grant the purchaser a 25-year franchise.

KANSAS CITY MO.—The Kansas City Railways Company is planning to erect a substation, to cost about \$16,000.

SPRINGFIELD, MO.—Work will soon be started on the extension of the ornamental lighting system on West Walnut Street to Market Street.

WARRENSBURG, MO.—Work has been started on the construction of a new boiler house at the Missouri State Normal School, to cost approximately \$15,000.

MICHIGAN, N. D.—Contract has been awarded by the City Council for the construction of an electric-light plant and fire hall to J. A. Dinnie & Company of Grand Forks.

LINCOLN, NEB.—The State Board of Control is planning to build a new boiler house (day work) at the State Penitentiary, to cost about \$15,000.

BARNES, KAN.—An election will soon be held to vote on the proposal to issue \$10,000 in bonds for the erection of an electric transmission line.

CALDWELL, KAN.—Bids will be received at the office of the city clerk, Caldwell, until Oct. 17 for improvements to water and lighting system. Separate bids to be submitted as follows: (1) For fur-

nishing material and construction of brick power station, together with concrete reservoir and spray pond, etc.; (2) for furnishing f.o.b. Caldwell two 500 gal. per minute, motor-driven centrifugal pumps; (3) for furnishing and installing all steam and water piping inside building, and installing spray pond equipment; (4) for laying approximately ½ mile of cast-iron pipe and specials and setting one hydrant. Specifications, bidding blanks, etc., may be obtained at the office of Burns & McDonnell, engineers, Interstate Building, Kansas City, Mo., upon deposit of \$5, of which \$3 will be refunded upon return of plans.

CANTON, KAN.—Plans are being considered to abandon the municipal electric-light plant and secure electrical service from the municipal electric-light plant at McPherson.

GALVA, KAN.—The city officials are negotiating with the Water and Light Department at McPherson with a view of securing electrical service from the McPherson plant.

LEAVENWORTH, KAN.—Bids will be received at the office of superintendent of prisons, Department of Justice, Washington, D. C., until Oct. 25 for furnishing material required for addition to main switchboard and electric feeders for lamps and motors to the west main cell wing. Further information may be obtained upon application.

MCCRACKEN, KAN.—At an election to be held on Oct. 23 the proposal to issue \$12,000 in bonds for improvements to the electric-light and water plant will be submitted to the voters. W. B. Rollins & Company, 206 Railway Exchange, Kansas City, Mo., are engineers.

MCPHERSON, KAN.—The McPherson Water and Light Department is considering extending the municipal electric-lighting service to the towns of Galva and Canton.

NORWAY, KAN.—The Concordia (Kan.) Electric Light Company has submitted a proposal to the Town Council to furnish electricity for lighting the town of Norway.

SHARON SPRINGS, KAN.—The City Council is considering calling an election to vote on the proposal of issuing \$15,000 in bonds for enlarging the electric plant. The plans provide for the installation of two 100-hp. engines to replace the two 25-hp. engines now in use, placing the overhead wires on Main Street in underground conduits and other improvements.

Southern States

ATLANTA, GA.—The board of consulting engineers has adopted the report recommending improvements to the water-works system as follows: One 10,000,000-gal. electrically-driven pump for river station; two water tube boilers of 300 hp. each; a 15,000,000-gal. pump for Hemphill Avenue station, triple expansion engine, vertical-drive type; a main 42 in. in diameter to reinforce 30 and 36-in. mains which now supply water to reservoirs from Chattahoochee River; dam on the Chattahoochee River from Cobb County shore to island near water-works intake to force water toward the Fulton County side, etc. W. Z. Smith is superintendent.

BOSTON, GA.—Work has begun on improvements to the municipal electric-light plant. Orders have been placed for the equipment.

DUBLIN, GA.—Plans are being considered by the City Council to enlarge the municipal electric-light and power plant to provide for the increasing demands for electrical service.

SAVANNAH, GA.—Plans are being prepared by the City Council to advertise for bids for lighting the streets of the city and for furnishing electricity for lamps and motors for the various departments of the city government. The contract with the Savannah Electric Company will soon expire.

SOPERTON, GA.—At an election to be held on Oct. 24 the proposal to issue \$10,000 for the construction of a municipal electric-light plant will be submitted to the voters.

AUBURNDAL, FLA.—The City Council is considering the question of letting an electric-light and water franchise. Elmer E. Cline is reported interested in the project.

ALAMO, TENN.—Bonds to the amount of \$10,000, it is reported, have been voted for the installation of a municipal electric-light plant.

PORTLAND, TENN.—The Portland Electric Company, recently incorporated with a capital stock of \$10,000, is planning

to construct and operate an electric-light plant in Portland. R. D. Moore, and W. C. Austin are among the incorporators.

BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company is contemplating building an extension of the Tidewater Railway to reach a new plant of the Tennessee Coal, Iron & Railroad Company, west of Fairfield.

JASPER, ALA.—The Public Service Commission has granted the petition of the Jasper Light & Water Power Company to sell its plant and holdings to the Alabama Power Company of Birmingham.

TROY, ALA.—The City Council is considering the installation of an ornamental lighting-system. Ornamental standards will be used.

ASHDOWN, ARK.—The property of the Ashdown Ice, Light & Power Company has been purchased by M. B. Morgan of Little Rock at \$35,000. The electric-light plant and ice factory, it is understood, will be enlarged.

STUTTGART, ARK.—Application has been made to the City Council by S. R. Morgan of Little Rock for a franchise to supply electricity for lamps and motors in Stuttgart. A committee has been appointed by Mayor Hammans to investigate the feasibility of granting the proposed franchise.

WOODWARD, OKLA.—At an election held recently the proposal to issue \$32,000 in bonds for the installation of a municipal electric-light plant was defeated.

ABILENE, TEX.—The City Commission is considering the installation of a large pumping plant in connection with the municipal water supply system.

HEREFORD, TEX.—The question of taking over the local electric-light plant, to be owned and operated by the municipality, is now being agitated by some of the citizens.

WIERTOWN, TEX.—A modern industrial town, equipped with an electric-light plant, ice factory, waterworks and sewerage systems, is being established by the Wier Longleaf Lumber Company. A railroad, 26 miles long, from Wiergate to Bleakwood and Newton is being built by the Gulf & Northern Railway Company. R. W. Wier is president of the lumber company. Wiertown has not a post office.

pany a franchise to operate in Glendora. The company will begin work at once to extend its line from San Dimas to Glendora and make connection with the trunk line connecting Los Angeles and San Bernardino.

LOS ANGELES, CAL.—A permit has been granted to the Bureau of Power and Light for the election of a power house, to cost about \$13,000, at the corner of Diaz Avenue and Ventura Boulevard, San Fernando Annex.

LOS ANGELES, CAL.—Plans have been announced by the Southern California Edison Company for the construction of two large hydroelectric plants on Big Creek below its present plants. These plants are in addition to the construction work already planned and announced. To carry out this plan to double the output of its plants on Big Creek, the dams are now being raised 31 ft., giving them a maximum height of 160 ft. The proposed project will add \$2,000,000 to the cost of the Edison undertaking at Huntington Lake, making the total cost about \$17,000,000. In addition to the erection of the two plants, a 9-mile tunnel is to be built to divert the San Joaquin River into Big Creek, just below power house No. 2, where a concrete dam will be built. The water from the river and that from the tail-race of power house No. 2 will be confined by a dam and turned through a tunnel 4½ miles long to the third power house. It will then pass on through a tunnel 4 miles long to power house No. 4 and be used again. It is estimated that the entire project will increase the power development at Big Creek to 700,000 hp.

OROVILLE, CAL.—J. Sank of Oroville has filed an application with the State Water Commission for permission to use 28 cu. ft. per second of water in French Creek in Butte County to generate electricity for mining, manufacturing and other uses. The proposed project is to consist of a dam, timber crib, 15 ft. in height, and a ditch, flume and pipe line, 2½ miles long. The plans provide for a development of 2545 hp. The cost of the work is estimated at \$136,000.

PASADENA, CAL.—The city of Pasadena is considering the purchase of the local distribution of the Southern California Edison Company at \$500,000, and incorporating it into the municipal lighting system. Electrical energy would be purchased from the company at wholesale rates under a 30-year contract and distributed over wires controlled by the municipality. It is estimated that 6000 poles would be eliminated from the city streets by doing away with the duplication of distribution systems.

REDLANDS, CAL.—The Pacific Electric Railway Company has selected a route for its proposed line from Redlands to the Yucaipa Valley.

SAN FRANCISCO, CAL.—Application has been filed with the State Water Commission by E. E. Lindsay of San Francisco for 30 cu. ft. per second of water in Bucks Creek, tributary to the North Fork of the Feather River, in Plumas County, for generating electricity to operate an electro-chemical manufacturing plant. The plans provide for a development of 4470 hp. at a cost of \$194,000.

SAN FRANCISCO, CAL.—Application has been filed by Richard M. Dale of San Francisco with the State Water Commission for 750 cu. ft. per second of waters of the Middle Fork of the Feather River in Butte County, to generate electricity for manufacturing purposes. The proposed works will consist of a concrete dam, 60 ft. high, to cost about \$200,000 and power plant \$100,000. It is estimated that 4260 hp. can be developed.

SAN MATEO, CAL.—The Board of Trustees has authorized the city electrician to submit plans and estimates of cost for extensions to the street-lighting system on Main Street and Broadway.

AMERICAN FALLS, IDAHO.—Contract has been awarded by the Idaho Power Company for construction of a new 5000-hp. generating station and closing breach in dam to Sam Porter at \$50,000.

AJO, ARIZ.—The Southern Sierras Power Company of Denver, Col., is contemplating the erection of an electric transmission line from Yuma to the mines of the New Cornelia Copper Company at Ajo, a distance of 160 miles. The contracts call for 2000 kw. of electrical energy. The Southern Sierras Power Company has recently completed the erection of a transmission line from El Centro, Cal., to Yuma.

MALTA, MONT.—The Town Council has awarded the contract for the installation of an electric-lighting system to George W. Kemper of Minot, at \$39,000.

POPLAR, MONT.—M. A. Erickson of La Moore, it is reported, is planning to install

an electric-lighting plant in Poplar. The proposed plant will be driven by a 100-hp. steam engine.

BESSEMER, COL.—Steps have been taken by the Bessemer Improvement Association to raise money for the installation of an ornamental lighting system on North-ern Avenue.

SANTA FE, N. M.—Arrangements, it is reported, have been completed for the financing of a large hydroelectric development on the Rio Grande River at the mouth of White Rock Canyon. The plant will be built and operated by the Rio Grande Light, Heat & Power Company. The plans provide for the construction of a plant with an output of 25,000 hp. and the erection of 150 miles of transmission lines to cities and towns in the State, including Albuquerque, Santa Fe, Las Vegas and Belen. The company will also supply electricity to the Atchison, Topeka & Santa Fe Railway Company's shops at Albuquerque and Belen. The University of New Mexico has already placed contracts for service for the purpose of placing under irrigation upward of 60,000 acres of land adjacent to Albuquerque. The company will also supply electricity to the Senorita Mine and the Sandoval Consolidated mines in the Cochiti copper district and the Santa Fe Dredging Company and the El Oro Dredging Company in the San Pedro gold district. The equipment will consist of five 5000-hp. turbines directly connected to a generator. Electricity will be transmitted at 66,000 volts.

Canada

CLARESHOLM, ALTA.—The Claresholm recently chartered with a capital stock of \$100,000, has been granted a franchise to supply electricity in Claresholm. The headquarters of the company will be located in Calgary.

LETHBRIDGE, ALTA.—The installation of a steam turbo-generating unit, in the municipal electric-light plant is under consideration. The cost is estimated at about \$50,000.

PRINCE RUPERT, B. C.—Investigations are being made of available water power at Falls River and Thulme River. The Falls River site, where it is estimated that 12,000 continuous hp. could be developed at a cost of \$1,500,000, is favored.

TRAIL, B. C.—A new power plant will be installed in the Silver Standard Mine, consisting of a gasoline engine, dynamo, compressor, boiler plant and shop equipment. The erection of a concentrator is also under consideration.

FORT WILLIAM, ONT.—The ratepayers have approved a by-law to enter into an agreement with the Hydro-Electric Power Commission of Ontario for hydro-electric power.

TORONTO, ONT.—The Toronto Hydro-Electric Shop, 226 Yonge Street, was damaged by fire recently, causing a loss of about \$250,000.

GRANBY, QUE.—The Southern Canada Power Company of Drummondville, recently granted a franchise in Granby, will erect a substation and office here.

THREE RIVERS, QUE.—New equipment, consisting of three motor-driven centrifugal pumps, it is understood, will be installed at the waterworks pumping station. The plans also provide for one or two gasoline engine-driven pumps. R. S. & W. S. Lea of Montreal are engineers.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until Oct. 17 for furnishing one 300-kva., single-phase, 2200/60,000-volt testing transformer, with induction regulator and switchboard complete, electric fans, searchlights, reflectors, hood reflectors, brascelite fixtures, one electric range, two portable pumps, 7000 condenser tubes, etc. Blanks and further information relating to this circular (No. 1173) may be obtained at the above office.

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until Oct. 27 for furnishing sheet copper, electric wire and cable, electric motor, motor-generators, automatic starting compensator, electric fixtures and fittings, storage batteries, fire pump, etc. Blanks and further information relating to this circular (No. 1174) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York City; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

Pacific and Mountain States

SEATTLE, WASH.—For the purpose of making a preliminary survey of the Sauk-Suiattle Rivers, in the Washington National Forest, the American Nitrogen Products Company, Securities Building, Seattle, recently purchased a 30-month priority right for the power rights on the two rivers, for the sum of \$25,000. The government has granted the permit with the understanding that a specified amount of development be carried on at the property, the expenditure along that line to be applied as a part of the \$25,000. It is expected that the two streams will be capable of the development of 105,000 hp., for which the company will eventually pay the government \$1 a hp. unit on a permanent lease. The first unit of the plant the company expects to erect near Derrington, at a cost of about \$6,500,000. The project when completed will consist of three such units. The American Nitrogen Products Company has been organized for the purpose of extracting nitrogen from the air by the method which has been adopted and proven successful in Norway.

SPOKANE, WASH.—The Washington Water Power Company of Spokane, it is reported, contemplates the erection of electric transmission lines into the Coeur d'Alene mining district, at a cost of about \$200,000. The proposed line will extend from the Post Falls plant of the company to Cataldo via the Fourth of July Canyon, a distance of 45 miles. Work will be started on the project early next spring.

VANCOUVER, WASH.—Eight additional stalls will be added to the local roundhouse of the Spokane, Portland & Seattle Railway Company. One section of the roundhouse will be used as a boiler shop and equipped with modern machinery.

GOLD HILL, ORE.—The City Council is considering the installation of a power plant to operate the municipal water-works system, to cost about \$25,000.

EXETER, CAL.—The installation of an ornamental lighting system in the business section is under consideration by the City Trustees. The present plans provide for the erection of about 20 electroliers mounted with 600-cp. lamps, maintained by underground wires.

GLENDORA, CAL.—The Board of Trustees has granted the Pacific Electric Com-

11,370 (reissue). DYNAMO-ELECTRIC MACHINE; Joseph Le C. Davis (deceased), Pittsburgh, Pa. App. filed May 4, 1915. Special reference to the ventilation of motors of the railway type and similar machines which are liable to become overheated in service.

1,241,496. THERMOCOUPLE; Lewis W. Chubb, Edgewood Park, Pa. App. filed June 20, 1914. Surface type.

1,241,499. POLYPHASE ELECTRIC FURNACE; Joseph L. Dixon, Detroit, Mich. App. filed June 26, 1917. Provision of new and improved means for effecting the regulation of the furnace.

1,241,500. LOCOMOTIVE; George M. Eaton, Pittsburgh, Pa. App. filed May 11, 1914. For electric railway.

1,241,501. MIXING AND MEASURING MACHINE; Henry R. Edgcomb, Wilkinsburg, Pa. App. filed Dec. 4, 1914. Adapted to weigh out successive definite portions of mixed pulverulent or pasty material.

1,241,503. DYNAMO-ELECTRIC MACHINE; Allan B. Field, Pittsburgh, Pa. App. filed Aug. 22, 1913. Provided with annular ventilating spaces in the magnetizable core members thereof, and it has for its object to provide means for reducing the circulation of eddy currents in the laminations caused by fringing of the magnetic lines of force in the said annular ventilating spaces.

1,241,505. MULTIPHASE RECTIFYING SYSTEM; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed March 30, 1914. Enables the placing of symmetric conductors in each of several containers without the necessity of providing separate maintenance for each of said containers.

1,241,507. CONTROL SYSTEM; Arthur J. Hall, Wilkinsburg, Pa. App. filed Sept. 8, 1914. Controls the operation of electric locomotives or other railway vehicles that are propelled through the agency of polyphase induction motors governed by means of liquid rheostats.

1,241,510. CONTROLLER; Edward A. Hanff, Wilkinsburg, Pa. App. filed Sept. 10, 1914. Provides a controller in which contact members that are biased to a closed position are opened by a cam or other moving element which is connected to the movable member of a mechanically operated switch.

1,241,512. ADJUSTING INCANDESCENT LAMPS; Clinton O. Harrington, Edgewood Borough, Pa. App. filed March 13, 1914. Filament will always occupy a given position with relation to the lamp base.

1,241,515. ARC LAMP; Alfred Huttar, Pittsburgh, Pa. App. filed July 24, 1911. Regenerative type having inclosed flaming arcs.

1,241,523. CONTROL SYSTEM; Benjamin G. Lamme, Pittsburgh, Pa. App. filed Feb. 25, 1914. To control the operation of electric locomotives.

1,241,528. INSULATOR; Paul M. Lincoln, Pittsburgh, Pa. App. filed July 13, 1914. High-voltage insulators which are adapted for outdoor installation, in which service they may be exposed to severe mechanical and electrical service conditions.

1,241,533. CIRCUIT INTERRUPTER; John B. MacNeill, Wilkinsburg, Pa. App. filed Aug. 10, 1916. Provides two levers having cam surfaces near their outer ends, a latch for latching them together and a spring-restrained pin or cam member that is adapted to become so wedged between the cam surfaces as to hold the levers in their closed positions until one of the levers is released by automatic or manual means.

1,241,534. CIRCUIT INTERRUPTER; Joseph N. Mahoney, Wilkinsburg, Pa. App. filed Oct. 15, 1914. Does not require a complicated operating mechanism since the movable contact members of the same are operated simultaneously.

1,241,549. LIMITING REACTANCE COIL; John F. Peters, Pittsburgh, Pa. App. filed Feb. 5, 1914. Coils are inserted in power circuits as protective means for the generating equipment of a power station.

1,241,554. ELECTROMAGNETIC DEVICE; Karl C. Randall, Edgewood Park, Pa. App. filed March 23, 1914. Substantially noiseless operation is secured.

1,241,556. ELECTRICAL CONNECTOR; Edward E. Rose, Swissvale, and Ora A. Colby, Wilkinsburg, Pa. App. filed Nov. 5, 1913. Special reference to detachable plug connectors for use in curling-irons and the like.

1,241,559. COMMUTATOR; Harold M. Scheibe, Somerville, Mass. App. filed Dec. 31, 1913. Radial type.

1,241,565. METHOD OF AND APPARATUS FOR, RADIO SIGNALING; Harry Shoemaker, Jersey City, N. J. App. filed Oct. 4, 1913.

Record of Electrical Patents

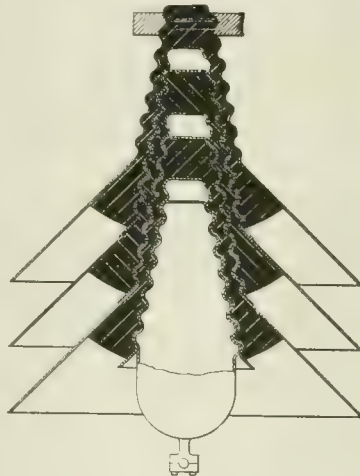
Notes on United States Patents issued on October 2, 1917

Relates to method of, and apparatus for, transmitting and receiving either damped or undamped oscillations and particularly to methods and systems in which telephones are employed for receiving signals.

1,241,566. CONTROL SYSTEM; Karl A. Simon and Arthur J. Hall, Wilkinsburg, Pa. App. filed April 6, 1914. Adapted to govern the operation of polyphase induction motors through the agency of regulatable liquid rheostats.

1,241,567. CONTROL SYSTEM; Karl A. Simon and Arthur J. Hall, Wilkinsburg, Pa. App. filed April 6, 1914. Adapted to govern the operation of polyphase induction motors through the agency of liquid rheostats.

1,241,569. CONTROL SYSTEM; Karl A. Simon, Edgewood Park, and Joseph D. Birrell, Wilkinsburg, Pa. App. filed Nov. 29,



1,241,528—Insulator.

1915. For electric vehicles provided with fluid-operated brakes.

1,241,571. ELECTRICAL PROTECTIVE DEVICE; Benjamin H. Smith, Turtle Creek, Pa. App. filed Aug. 6, 1915. Provides watt or reverse-energy relays for polyphase electric circuits that will operate without vibration when relatively large overloads traverse the circuits.

1,241,574. REGULATING APPARATUS FOR ELECTRIC FURNACES; Wilfred Sykes, Pittsburgh, Pa. App. filed April 12, 1912. Means for automatically effecting and maintaining the most advantageous position for the movable electrode of a furnace of the character above specified during the entire life of the electrode.

1,241,576. HOLDER FOR CANDLES AND THE LIKE; Horace B. S. Teague, Melrose Highlands, Mass. App. filed Dec. 22, 1916. Improvements.

1,241,578. ELECTRIC HEATING APPARATUS; Frank Thornton, Jr., Pittsburgh, Pa. App. filed April 12, 1915. Radiant type.

1,241,580. AUTOMATIC CUT-OUT FOR SWITCHES; Alfred R. Trillitsch, Chicago, Ill. App. filed Jan. 29, 1916. Releases a pivoted switch pole and permits it to move to a circuit-breaking position and will then automatically reset itself.

1,241,592. SWITCH FOR ELECTRIC CIRCUITS; Ragnar Wikander, Pittsburgh, Pa. App. filed March 23, 1911. Provided with two opposed magnet coils.

1,241,608. CROSSING SIGNAL FOR RAILROADS; Kyser B. Coleman, Scottsburg, Va. Improvements.

1,241,627. TERMINAL FOR ELECTRICAL APPLIANCES; Frederick J. Hadfield, Oulton, near Lowestoft, England. App. filed March 1, 1917. Comprises a perforated pillar wherein the conductors to be connected are clamped.

1,241,655. ELECTRIC-ARC FURNACE; Olaf J. Stoud-Platou, Christiania, Norway. App. filed June 2, 1916. Metal shell is constituted by the magnetic material of the furnace in such a manner that the part of the magnet construction uniting the magnet poles of each side of the furnace takes the shape of a bell or hemisphere.

1,241,737. CONNECTOR FOR BATTERIES; Clarence B. Johnson, Norfolk, Va. App. filed Oct. 7, 1914. Improvements.

1,241,756. WIRE COILING AND CLAMPING DEVICE; Julian J. Nielsen, Chicago, Ill. App. filed Dec. 18, 1915. Adaptable for use with standard screws without modification or change of any kind in the character of the screw.

1,241,777. CHANDELIER; Reginald C. Steele, Spokane, Wash. App. filed April 8, 1916. Comprising generally a suspended bowl arranged to inclose the electric lamp or source of light and a reflector of greater diameter than the bowl arranged over the same, the bowl being formed of translucent, light-diffusing material and the reflector being preferably of the same or similar material.

1,241,782. WARMER FOR MOTOR CARS; James G. Tharp, Indianola, Iowa. App. filed March 7, 1916. Mounted on or in the steering wheel of a motor vehicle.

1,241,800. PROCESS FOR ELECTRIC WELDING; Percy A. E. Armstrong, New York, N. Y. App. filed March 24, 1915. Improvement.

1,241,809. CABLE SPlice; Edwin W. Beardsley, San Francisco, and Philip W. Ham, Oakland, Cal. App. filed Jan. 5, 1916. Adapted for use in connection with armored submarine cables.

1,241,851. ELECTRIC-LAMP-SOCKET SHELL; William Ile, Toronto, Ontario, Canada. App. filed Feb. 19, 1917. Laterally arranged tongues are formed on one of the shell members and are adapted to interlock with projections formed on the other member.

1,241,888. ALARM SYSTEM; John H. Safford, Brooklyn, N. Y. App. filed Oct. 15, 1915. For embodiment in safety chests, to give warning in event of the container being disturbed.

1,241,898. GROUND CLAMP; Herbert B. Andrews, William H. Hart and Howard B. Sherman, Battle Creek, Mich. App. filed May 31, 1916. Clamp can be readily applied to an object such as a rod or pipe.

1,241,929. INSULATOR; William A. Dade and Richard E. Morgan, Orlando, Fla. App. filed Jan. 5, 1917. Body of the insulator formed with a downwardly inclined groove adapted to receive the current-carrying wire and equipped with a pivoted finger arranged across the groove to prevent accidental disconnection of the wire from the insulator.

1,241,963. ELECTRICAL MEANS FOR LOCATING CONCEALED PIPES; Edward H. Grove, Washington, D. C. App. filed Aug. 21, 1912. Improvements.

1,241,967. ELECTROLYTIC APPARATUS; Herbert R. Hanley, Winthrop, Cal. App. filed June 5, 1916. Electrolysis of zinc from aqueous solutions.

1,241,990. ENGINE-STARTING DEVICE; C. F. Kettering and William A. Chryst, Dayton, Ohio. App. filed July 14, 1913. Improvements.

1,241,993. ELECTRIC REVOLUTION METER FOR INTERNAL-COMBUSTION ENGINES; John Kirby, N. Y. App. filed Jan. 26, 1917. For indicating the revolutions per minute of an internal-combustion engine, the meter being designed for use in connection with automobiles.

1,242,013. LOCK SWITCH; Frank E. Matteson, Los Angeles, Cal. App. filed July 3, 1916. The idea of a series of disks or plates (made of material that is a non-conductor of electricity and pierced in places with conductors) working one upon the other by the manipulation of the knob, in order to bring the conductors into alignment, is an important feature of this invention.

1,242,014. LIGHTNING ARRESTER; David T. May, New York, N. Y. App. filed June 5, 1916. Vacuum type.

1,242,038. VIBRATING SELF-INTERRUPTER FOR ELECTRIC BELLS, etc.; William E. R. Rademaker, Hoboken, N. J. App. filed Feb. 15, 1916. Eliminates the contact screw.

1,242,048. SUPPORT FOR SUSPENDED CONDUCTORS; Herman Schaefer, Astoria, N. Y. App. filed March 25, 1916. Means for supporting trolley wires or conductors of like character.

1,242,115. SWITCH FOR DENTAL INSTRUMENTS; Percy Russell, Brooklyn, N. Y. App. filed Aug. 15, 1914. Novel form of sleeve-operated movable contact, together with a novel form of inclosing casing.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN

Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, OCTOBER 20, 1917

No. 16

Unnecessary Waste of Energy

THERE is a loud demand for more power than many central stations can furnish. Geared for war, the nation will forge ahead at ever-accelerating speed. It will require power, more power, still more power for the essential industries which are a part of the highly developed war machine. If more power cannot be provided by the electric utilities, only one alternative will be open and no one will hesitate about resorting to it. The alternative is to give less power to industries and other consumers unconnected with the war. Surplus power gained in this way will be diverted to lessen the deficit in war industries. The paramount thing is to win the war.

The ELECTRICAL WORLD believes that, barring unexpected change in the war situation, the distribution of energy will have to be determined by a system of virtual priority. Whether this will be done by active co-operation in which the authorities make the controlling decisions or whether the central station company itself shall rule on these points, the method adopted is less important than the recognition of the principle that we are at war and that the national interest is the only matter than really counts. It may be against franchise stipulations, it may be rankest discrimination under public utility laws, but these obstacles will become as dust if the national need is acute. What we are concerned with is to look ahead so as to meet the exigency, when and if it comes, as readily and effectively as any purely internal operating problem. If action by municipal or state authorities is required in order to make the steps legal, it is dollars to doughnuts that this action will be forthcoming; opposition would lead merely to seizure of the plant by the military authorities, as illustrated recently in a cantonment case.

Taking for granted, therefore, that the essential industries will by some means have all the power they require, the detail ways by which sufficient surplus will be created will have careful attention. The shameless-situation in coal supply will certainly be cleared for war companies. Then it will be up to the companies to please their restricted customers and undoubtedly they will find many disgruntled kickers. They may even find the man who is for the war and enthusiastically for all of its benefits but who wants none of its hardships to boot.

In view of the present outlook for restriction of power to unessential consumers and of the uncertainties in the war outlook the companies face the possibility of further changes in commercial practice. Many have anticipated these to some extent by curtailing sales departments. Others talk of discouraging the use of en-

ergy in signs that they regard as involving unnecessary consumption of power. It is not that signs involve much energy or coal, for they do not; the truth as to the relatively small amounts they take dispels most criticism. But if every ounce of coal is needed to win the war, the ounces that are consumed in unnecessary white ways, in heedless private and public lighting, could be saved. The strongest argument against lighting that is not absolutely vital to comfort and safety, however, is the moral or psychological one; people imagine that the waste is a thousand times more than it is. If we are called on to cut to the bone, let us do it willingly and show the public that we are ready to do our part.

You Can Do Your Bit—Buy a Bond

The Rating of Lighting Systems

IT IS a fact only too familiar that artificial lighting systems are generally not in good condition. In industrial plants particularly, where there is seldom available expert attention to the lighting as such, the various units used are very commonly found to be in bad shape. Lamps blackened, burned out or dirty, shades grimy with the accumulations of weeks, ill-fitting and battered, bear witness to the neglect that is all too common. We have over and over again published data regarding these evils from a practical standpoint, and therefore welcome the brief paper by Davis H. Tuck on a somewhat conventional way of judging the present state of any lighting equipment. The scheme is a comparatively simple one, consisting of grading the efficiency of maintenance with respect to the various untoward happenings which put the lighting equipment in bad shape. The condition of lamps and shades, of circuits and accessories, is rated on a basis of 100 per cent efficiency of maintenance for equipment in thoroughly good condition. Then, even in a somewhat cursory inspection, a fair estimate can be made of the importance of the destructive factors in the case of any lamp or group of lamps. For instance, a dirty lamp is counted at 80 per cent and a dirty reflector also at 80 per cent. If the lamp is both dirty and has a dirty reflector, the efficiency is reckoned at 64 per cent, and so on, and if a hundred lamps are in this unfortunate condition, that hundred has to be scored at this relatively low percentage of merit.

Going through a whole lighting equipment in a similar manner and attributing to each lamp its observable defects, an average efficiency of maintenance for the whole group can be quickly computed. In one typical example figured by Mr. Tuck a particular equipment

thus rated footed up to 55.2 per cent, and by correcting the faults of maintenance the average illumination as measured by an illuminometer was doubled. This shows the practical value of what seems at the first glance a somewhat empirical method of procedure, which has the advantages, however, of being quick and effective. A rating scheme of this kind is altogether commendable as giving a concrete idea of general conditions. As might be expected, Mr. Tuck finds these much worse on the average with local lighting than with the general illumination in which larger units are used. It is a common experience that even with well-planned and liberal general lighting a considerable factor of safety has to be allowed for the equipment being out of condition. With local lighting, especially in an industrial establishment, the average conditions are likely to be much worse, owing, first, to the greater exposure of the lighting units and, second, to the fact that faults in a large unit obtrude themselves on the attention, while those in the numerous smaller units may escape notice. The practical value of this sort of well-ordered inspection ought to be very obvious. If the proprietor of an industrial establishment found that some one had passed off on him incandescent lamps of only half the efficiency of the standard, a howl would go up that would din into the ears of the state commission. Let him be as careful of his own private affairs as he justifiably expects the public service company to be, and there will be far fewer complaints of improper lighting.

It Is Good Patriotism—Buy a Bond

The Fine Art of Firing

THE paper by Victor B. Phillips on boiler control deals with a vital point in steam-producing economy. A furnace or a boiler, like every other apparatus, has a point of maximum efficiency, and in combining furnace and boiler it is imperative to know just what union of these two factors gives the highest final efficiency of steam production. An overloaded or an underloaded boiler or furnace performs somewhat badly, and since both overloading and underloading are necessary conditions in the operation of the average plant, a close knowledge of the variation of the efficiency with the load has a direct bearing on costs of operation. Difference in handling may very well make a change of 25 per cent in the furnace efficiency. To meet the requirements of pushing boilers to the utmost output it is necessary to have a good deal of flexibility in the operation of the furnace part of the plant, so that the combustion may be accurately regulated. It must work well at all loads, and the wider the range over which it works the better. Mr. Phillips' experiments give a very instructive view of the situation and not only show the conditions of good working but also indicate the limitations impressed on these by the stoking mechanism. It is not by any means true that the mechanical stoker clears up all the difficulties with regard to firing. Generally speaking, it does much its best work at a particular rat-

ing and with a particular fuel, and the lesson to be learned in these days is how best to extend the favorable range of operation over a wider area.

A very striking part of Mr. Phillips' article is the showing made of the evil effects of too thick fire. It is, of course, a familiar fact that a thin and even fire gives the highest attainable furnace efficiency, yet the curves shown impress that fact with startling force. To find for the same standard high output a difference of 30 per cent in the fuel consumed as between a thin fire and a thick one ought to make the station operator sit up and take notice of the problems of capacity. Of course, this relation is intimately connected with the possible air supply which can be made available. Only a very free opportunity to vary the air supply to the point of maximum efficiency will give a furnace which operates satisfactorily over a wide range of output. Another factor of great importance practically is the relation of furnace design to the character of the fuel used. More and more importance is being attached to the heating of the boiler surfaces by radiation rather than by convection. The ratio of these two heating factors turns in the main on the character of the fuel. In a rough general way the smaller the volatile contents of the fuel the larger the relative importance of radiation. The furnace design, therefore, has to cover a wide variety of possibilities and really involves many fine points in engineering. The larger the range of output which must be covered and the more varied the fuel which may have to be used the more difficult it is to obtain high heating efficiency. Inasmuch as the efficiency of the turbo-generator is already in a highly satisfactory state, the boiler and furnace together constitute the largest outstanding variable factor in efficiency and consequently deserve the same attention and care that have been bestowed upon engine and dynamo design.

It Is the People's Loan—Help It

Specific Preparation for War Service

EVERY electrical manufacturer and every ranking staff employee of a plant-producing equipment of direct importance from the standpoint of the government's present needs owes it to his country and to the industry to be prepared to state at a moment's notice precisely what he is doing that has a bearing upon the successful conduct of the war. Many thousands of trained electrical men are needed with the colors, and all will honor those who go, no matter whether they go ahead of the formal selection of the country or in response to it. In time of war, however, it becomes necessary to make an almost infinite number of adjustments of personal services, compared with peace conditions. It is a delicate question just where a man belongs. The government at Washington is now in possession of a vast amount of useful information about American technical men, thanks to the census work done by the engineering societies, and yet it behooves every man to study the question of how he can

be of maximum usefulness and then to endeavor so far as is consistent with his sense of patriotic duty to attain unto it. Others may have to decide where he is to go or stay, but in times like these a quiet understanding of one's personal equation in industry is worth gaining. The higher the executive in electrical manufacturing, the more essential it becomes that indiscriminating changes of service be avoided.

Don't Be a Slacker—Buy a Bond

Reorganizing the Electrical Trade

BY THE adoption of a new constitution and the reorganization that it makes possible the National Contractors' Association of the United States, as explained elsewhere, has taken a long step forward. As the creator of business in the industry the contractor and contractor-dealer group is an essential part of its structure and growth. In taking the initiative to stabilize the resale and installation trade the association has set a mark which in many ways establishes it as a leader in the industry.

Systems of distributing commodities in this country are now under the rigid scrutiny of thinking business men. The electrical manufacturer, central station, consulting engineer, industrial jobber and contractor-dealer together make up the distributing chain in the electrical industry. The trade relations between these groups to-day are complicated and in many instances wasteful. We have called attention to this condition in many earlier editorials, pointing out particularly that because the men of the electrical industry have developed design and production on a scientific basis they should be the first to recognize the practicability of analyzing and correcting trade abuses from the same scientific viewpoint.

Various organizations, associations and individuals have helped to remedy conditions. We have passed in common with other industries through the stage of special arrangements and agreements into the stage of organized activity to get at fundamentals and build around those. The most comprehensive plan which has been proposed, and one which its author frankly states is a composite of many men's ideas, is the so-called Goodwin movement. Boiled to its fundamentals, the Goodwin plan comprises first the classification of the industry into buying groups, the organization of those groups where not already organized into purposeful associations, the intelligent classification of the com-

modities and supplies sold to those groups by the manufacturer, and the pricing and adjusting of trade prices by the individual manufacturer so that the discounts along the chain of distribution will give a margin of profit in each group that will provide an incentive to go after business.

The contractors have recorded themselves in favor of this general plan. As far back as 1902 the National Electrical Contractors' Association had a vision of its function. To-day the opportunity exists to carry out its purpose. Much must be done. The rank and file of contractors must be awakened to their business opportunity. With trade margins adjusted, however, the contractor and the contractor-dealer can make a profit under fair and just competitive conditions and become bigger business men.

Have You Enlisted Your Money?

Formulas for Traction Electromagnets

LIFTING electromagnets for both direct and alternating currents are employed for so many purposes that it is important to standardize their designs in conformity with experience. The fundamental principles of their action are well established, but in the application of those principles to practical design there is much room for empiricism and experimental trial. It is desirable to set reasonable limits to the range of these experimental variations.

Having given a device which has to exert an assigned pull over a given distance or length of stroke, the intensity of the magnetic field required and the area of the magnetic polar surfaces become fairly well defined. The size and cost of the electromagnet are, however, much less easy to establish. They depend upon the amount of electric power which must be dissipated in the winding or windings in order to obtain the correct excitation.

The article by George L. Hedges this week is directed toward the determination of the most satisfactory and most economical designs for an electromagnet of given duty. The formula to be selected depends on whether the service is to be continuous or intermittent; also on whether the work calls for a solenoid or for a plunger electromagnet.

Assuming that the formulas and charts have been satisfactorily checked and tested by practical trials, the data should be of much service to electromagnet designers.

ONE of the principal articles which will be printed in the next issue of the ELECTRICAL WORLD will dwell on methods which have been adopted by central station companies to increase the efficiency and economy of their commercial departments as a result of war-time conditions. These methods have been analyzed with the view of bringing out the best practice of companies which have given this subject serious consideration. Another ar-

The Coming Issues

ticle will emphasize the advantages to be gained by the use of electric furnaces in various metallurgical processes involving non-ferrous metals. Data will be presented on the performance of various furnaces in different commercial installations under different conditions. In addition, information will be presented on subjects of interest to industrial plant and other electrical engineers, and the various departments will appear as usual.

Design of Solenoids and Plunger Magnets

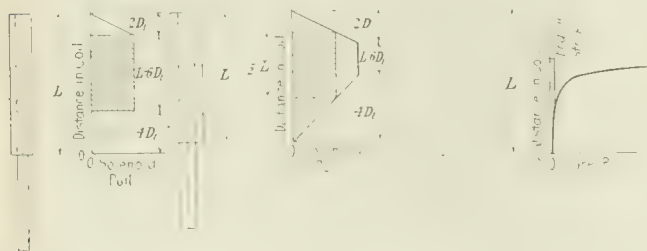
Formulas for Computing Diameters of Plungers for Cheapest, Lightest and Smallest Designs—
Charts to Facilitate Calculations Which Refer to Cylindrical
Direct-Current Types Only

BY GEORGE L. HEDGES

Engineer, Kelman Electric & Manufacturing Company, Los Angeles, Cal.

THE usual method of design of a magnet is to assume a diameter of plunger and calculate the ampere turns necessary to give the required pull, then calculate the winding necessary for the ampere turns. By making a number of calculations starting with different plunger diameters the most efficient magnet is approximated. It is easily realized that this method of design involves considerable laborious calculation and has the objectionable features inherent in cut-and-try calculations. By the use of the formulas deduced in this paper the plunger diameter for the most economical magnet—cheapest, lightest or smallest—may be found directly. The paper will consider only cylindrical magnets for use on direct-current circuits.

To simplify calculation the bobbin thickness, the thickness of the bobbin insulation and the clearance between plunger and bobbin have been neglected; that is, the inside diameter of the winding has been considered the same as the plunger diameter. This ap-



FIGS. 1(a), 1(b) AND 2—OUTLINES AND APPROXIMATE PULL CURVES OF LONG AND SHORT SOLENOIDS AND PLUNGER ELECTROMAGNETS

proximation will not cause sufficient error to affect the commercial accuracy of the results.

Pull and Work of an Electromagnet.—The pull of a solenoid is due entirely to the attraction between the winding and the plunger, the maximum existing at the center of the winding and being equal to

$$F_s = \frac{q}{4} \frac{AN^2 L}{L^2} = \frac{\pi q D_i^2}{4} \frac{NI^2}{L} \quad (1)$$

Typical solenoids with approximate pull curves are shown in Fig. 1: (a) for a solenoid of length equal to or greater than twelve plunger diameters ($L =$ or $> 12D_i$), and (b) for a solenoid of length less than or equal to twelve plunger diameters ($L =$ or $< 12D_i$).

The total work exerted by a solenoid is equal to the total area inclosed under the pull curve. The maximum useful work, W_s (uniform pull times stroke), available from a solenoid is equal to the effective pull \times stroke. It is evident from the pull curves in Fig. 1 that for maximum useful work, other conditions being equal, the longer of two solenoids is the most economical to use. For a solenoid of given proportions such that $L = qD_i$, the conditions for maximum useful work (Fig. 1) are: (a) for a long solenoid $l = L = 6D_i = (q - 6)D_i$, and pull F_s , hence $W_s = F_s(q - 6)D_i$; (b) for a short solenoid

$$l = L/2 = qD_i/2, \quad (2)$$

$$\text{and pull} = L/12D_i \times F_s = qF_s/12.$$

$$\text{Hence } W_s = q^2 F_s D_i / 24.$$

In general, therefore, the condition for maximum useful work with a long or a short solenoid is $W_s =$

USE LEFT HAND SCALES FOR SOLENOID AND RIGHT HAND FOR PLUNGER ELECTROMAGNET

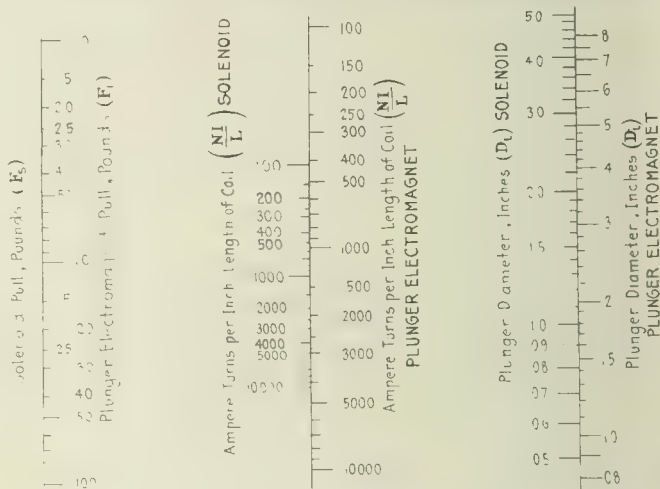


FIG. 3—AMPERE TURNS REQUIRED PER INCH FOR A GIVEN PULL WITH SOLENOIDS AND PLUNGER ELECTROMAGNETS

$F_s p D_i$, where $p = q - 6 = L/D_i - 6$ for long solenoids, and $p = q^2/24 = L^2/24D_i^2$ for short solenoids. A good average value of q is 12, whence $L = 12D_i$, and both (a) and (b) above give $l = pD_i = 6D_i$; pull $= F_s$;

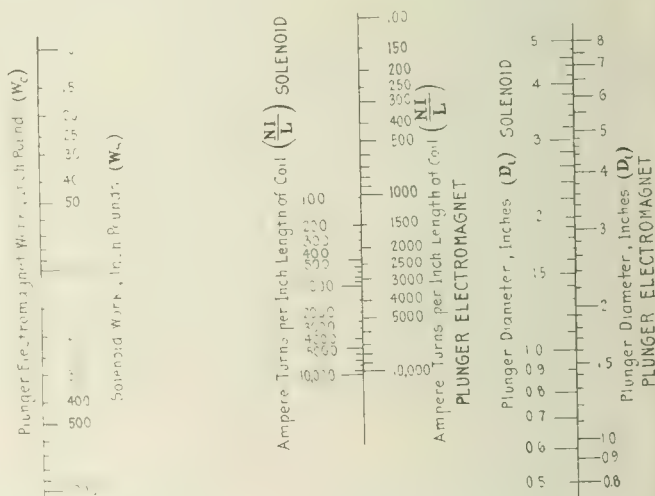


FIG. 4—AMPERE TURNS REQUIRED PER INCH ON SOLENOIDS AND PLUNGER MAGNETS TO SECURE A GIVEN AMOUNT OF WORK

$W_s = F_s l = 6D_i F_s$, and $p = 6$. Such relations give the shortest solenoid for which the height of the work rectangle (Fig. 1) is equal to the maximum solenoid pull.

The pull of a plunger electromagnet is made up of

two components—the solenoid pull, or pull between the winding and the plunger, and the core pull, or the attraction between the core and the plunger. The core-pull component is the predominant component for plunger electromagnets with the comparatively short

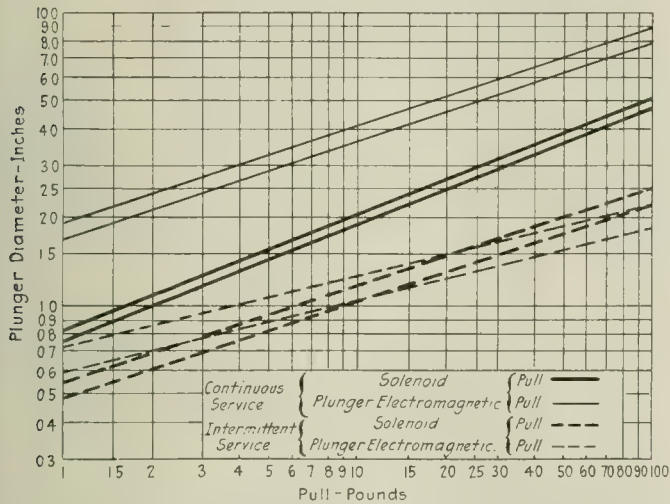


FIG. 5—PLUNGER DIAMETER* OF SMALLEST SOLENOID OR PLUNGER MAGNET FOR A GIVEN PULL

strokes usually used, and in these calculations for plunger electromagnets the core pull will be considered, while the total pull and the solenoid pull will be neglected. The core pull is:

$$F_c = A \left[\frac{NI}{2660hL} \right]^2 = \frac{\pi D_i^2}{4} \left[\frac{NI}{2660hL} \right]^2 \quad (3)$$

The maximum useful core work for a given stroke (shown in Fig. 2 by the shaded area) is $W_c = \text{pull} \times \text{stroke}$. For an electromagnet of given proportions such that $L = qD_i$, $l = hL = hqD_i$; hence $W_c = F_c hqD_i = F_c pD_i$, and $F_c = W_c / pD_i$.

Thickness of an Electromagnet Winding.†—The

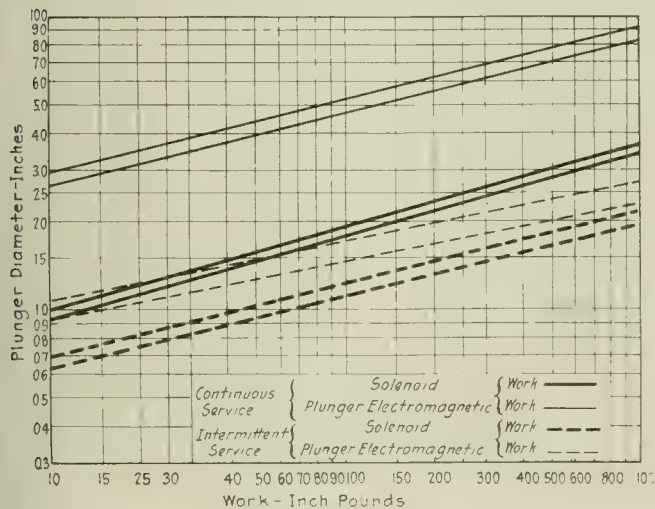


FIG. 6—PLUNGER DIAMETER* OF SMALLEST SOLENOID OR PLUNGER MAGNET FOR A GIVEN AMOUNT OF WORK

thickness of winding for an electromagnet used on continuous service, with a radiation of P_s watt per square inch of radiating surface, is:

*The upper line of each set is for a winding of No. 20 D. C. C. wire, while the lower line is for No. 0 D. C. C. wire.

†From "Solenoid and Electromagnet Windings," *Proceedings A. I. E. E.*, November, 1915.

$$t = a \left[\frac{NI}{L} \right]^2 \quad (4)$$

For intermittent service the thickness of winding for an electromagnet with a rate of temperature rise of θ_s deg. C. per second is:

$$t = b NI/L. \quad (5)$$

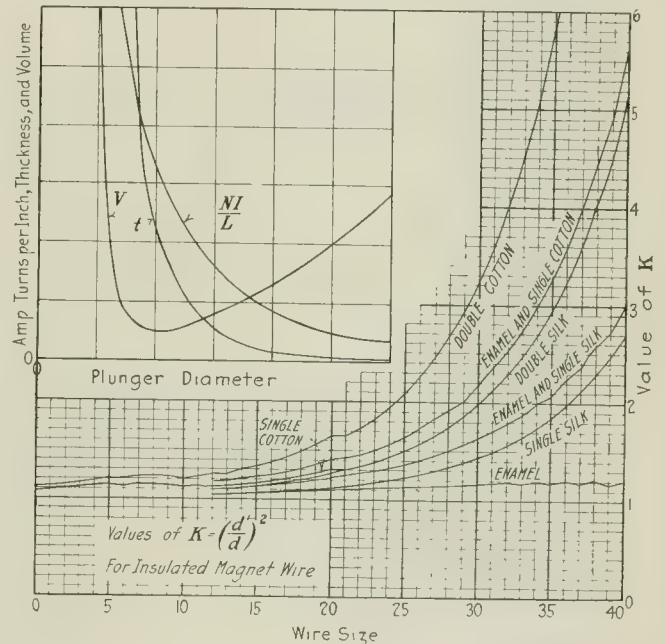
Volume, Weight or Cost of an Electromagnet.—For a given type of design the volume, weight or cost of the magnetic circuit of an electromagnet will, for different sizes of magnets, be proportional to the internal volume of the winding, or, from our notation, be equal to the internal volume of the winding multiplied by m .

The total volume, weight or cost of an electromagnet is:

$$V = V_c + V_w \quad (6)$$

where $V_c = m_i \pi D_i^2 L$ and $V_w = n \pi D t L = n \pi L (D_i t + t^2)$.

Procedure in Making Calculations.—If F , l or W is given, the value of inside diameter of winding, or diameter of plunger, may be computed, from which it is possible to calculate the ampere turns and thickness of



FIGS. 7 AND 8—RELATIVE PLUNGER CHARACTERISTICS FOR DIFFERENT PLUNGER DIAMETERS; AND CONSTANT K FOR DIFFERENT SIZE WIRES AND VARIOUS INSULATIONS

winding for the smallest, lightest or cheapest magnet.

If F and l are given, $NI/L = f(D_i, F)$, according to (2) or (3). From (4) or (5) the thickness of winding is $t = f(NI/L)$. From (6) $V = f(D_i, t, L)$; hence $V = f(D_i, F, L)$. For V to be a minimum $dV/dD_i = f'(D_i, F, L) = 0$. This expression solved for D_i will give an expression of the form $D_i = f(F)$. Similarly, if W is given, $D_i = f(W)$, and one or the other of these values gives the value of D_i to be used to calculate the smallest, lightest or cheapest electromagnet. The application of this theory will give general formulas for the design of solenoids and plunger magnets.

Summary of Working Formulas.—The working formulas tabulated herewith were obtained by using the following values in the general formulas:

For continuous service: Heat radiation, $P_s = 0.4$ watt per square inch.

For intermittent service: Rate of temperature rise, $\theta_s = 0.67$ deg. C. per second.

For solenoid work: $q = 12$, whence $L = 12D_i$; and $p = 6$, whence $l = 6D_i$.

SYMBOLS USED IN FORMULAS

- $a = (0.5255 P_s)k \times 10^9$.
 $b = K \frac{0.01948}{\theta_s} \times 10^3$.
 d = diameter of bare wire in winding (in.).
 d' = diameter of insulated wire in winding (in.).
 D = mean diameter of winding (in.).
 D_i = inside diameter of winding (in.); also diameter of plunger.
 F = total pull of magnet (lb.).
 F_s = solenoid pull (lb.).
 F_c = core pull (lb.).
 g = lb. pull per square inch of plunger section (average value 0.009).
 $h = l_{max}/L$, a constant for magnets of the same proportions.
 $K = \left[\frac{d'}{d} \right]^2$, practically a constant for adjacent wire sizes.
 l = stroke (in.).
 L = length of coil (in.).
 m = volume (cu. in.), weight (lb.) or cost (dollars) of the magnetic circuit per cubic inch of internal volume of winding.
 n = volume (cu. in.), weight (lb.) or cost (dollars) per cubic inch of winding. (For volume, of course, $n = 1$.)
 NI = ampere turns.
 $p = l/D_i$ = ratio between stroke and diameter of plunger.
 $q = L/D_i$ = ratio between length of coil and diameter of plunger.
 P_s = watts radiations per square inch of radiating surface of winding (considering both the exterior and interior cylindrical surfaces).
 t = thickness of winding (in.).
 θ_s = rate of temperature rise in winding in deg. C. per second.
 V = volume (cu. in.), weight (lb.) or cost (dollars) of magnet.
 V_c = volume (cu. in.), weight (lb.) or cost (dollars) of magnetic circuit.
 V_w = volume (cu. in.), weight (lb.) or cost (dollars) of winding.
 $W = F \times l$ = total useful work from magnet (in.-lb.).
 $W_s = F_s \times l$ = solenoid useful work (in.-lb.).
 $W_c = F_c \times l$ = core useful work (in.-lb.).

For plunger electromagnet work: $p = 0.8$, whence $l = 0.8D_i$; and $h = 0.3$, whence $L = l/0.3$.

Selection of Formulas.—An electromagnet may be required to exert a given pull through a given stroke or perform a given amount of work. Examination of the pull characteristic of solenoid and plunger electromagnets, as shown in Figs. 1 and 2, indicates the following selection:

For a long uniform pull use a solenoid.

For a short strong pull use a plunger electromagnet.

For the performance of a given amount of work where the pull exerted should be uniform throughout the stroke use a solenoid.

For the performance of a given amount of work where increased pull toward the end of the stroke is an advantage use a plunger electromagnet.

Use of Formulas and Charts.—1. Make an assumption of what the wire size will be in the winding, and find the value of D_i for this wire size and for the given pull or work, from Fig. 1 or Fig. 2.

2. Find the other required quantities in the order given in the summary of working formulas.

3. Design the winding.

4. If necessary, repeat the above steps, using as trial wire size the value found in the design of the winding.

To use the NI/L charts draw a straight line between the given value of pull or work on the left-hand axis and the given value of plunger diameter on the right-hand axis. The intersection of this line with the center axis gives the required value of NI/L .

GENERAL REMARKS

The factor K which appears in all of the formulas for D_i is a quantity depending on the size of the magnet wire in the winding (which depends on the voltage on which the magnet is to be operated), and is equal to $(d'/d)^2$. The value of K for various kinds of insulation and sizes of wire is given in Fig. 8. It is not economical to use any of the kinds of insulation at points above the knee of the curve, as the proportion of insulation to copper is too great. At points below the knee of the curve the value of K is practically constant for adjacent sizes of wire. In the formula for D_i , K is governed by a fractional exponent, hence there may be a considerable error in the initial assumption of trial wire size without materially affecting the accuracy of the results. This is shown graphically in the D_i charts (Fig. 5 and Fig. 6) by the fact that the pair of lines for No. 1/0 and No. 20 wire for each case are close together; that is, there is only a small difference in plunger diameter for a given pull or work with a difference in the size of wire in the winding from No. 1/0 to No. 20.

The relation between the different variables in electromagnet design for a solenoid or plunger electromagnet for a given pull or work is shown in Fig. 7. These particular curves are plotted from formulas (1), (4) and (6), for solenoid pull and continuous service, but similar curves are obtained for the other cases. It will be noted that the curves for ampere turns per inch and for thickness show very large values for small plunger diameters and very small values for large plunger diameters, but the V curve shows a pronounced minimum value. It is the plunger diameter for this minimum value of V which is given by the formulas and charts in this paper.

It must not be inferred that the formulas given in this paper or the reference formulas for solenoid and core pull and work from which they are derived will give absolute results. The accuracy of the results obtained from the use of the derived formulas depends on the accuracy of the reference formula for the particular example, and this is affected by several factors, such as magnetic leakage, which cannot be easily evaluated. With proportions of magnets approximately as given, and with sufficient ampere turns per inch to saturate the plunger, the results will be amply close for practical use, especially as a factor of safety should be used to allow for the weight of plunger and for friction of plunger and mechanism. For a solenoid it is usually sufficient to use a value of F_s or W_s about 50 per cent greater than the required pull or work, and for a

WORKING FORMULAS FOR DESIGNING SOLENOIDS AND PLUNGER MAGNETS

Service		CONTINUOUS		INTERMITTENT	
SOLENOID	Data given	Pull, F_s and length, $L = l + 6D_i = \text{or } > 12D_i$	Work W_s , length $L = 12D_i$, $l = 6D_i$ and $F_s = W_s/l$	Pull F_s and length $L = l + 6D_i = \text{or } > 12D_i$	Work W_s , length $L = 12D_i$, $l = 6D_i$ and $F_s = W_s/l$
	Internal diameter (in.) D_i	$(0.210KF_s^2)^{1/5}$ or Fig. 5	$(0.00536KW_s^2)^{1/7}$ or Fig. 6	$(0.0967KF_s)^{1/3}$ or Fig. 5	$(0.01344KW_s)^{1/4}$ or Fig. 6
	Ampere turns per in. length NI/L	$141.5F_s \div D_i^2$ or Fig. 3	$141.5F_s \div D_i^2 = 23.6W_s \div D_i^3$ or Fig. 4	$141.5F_s \div D_i^2$ or Fig. 3	$141.5F_s \div D_i^2 = 23.6W_s \div D_i^3$ or Fig. 4
PLUNGER ELECTROMAGNET	Data given	Pull F_c , length $L = l/0.3$	Work W_c , $l = 0.8D_i$, $L = l/0.3 = 2.67D_i$, $F_c = W_c/l$	Pull F_c , length $L = l/0.3$	Work W_c , $l = 0.8D_i$, $L = l/0.3 = 2.67D_i$, $F_c = W_c/l$
	Internal diameter (in.) D_i	$(4.26kF_c)^{1/3}$ or Fig. 5	$4.44KW_c^{1/4}$ or Fig. 6	$(0.0948K^2F_c)^{1/4}$ or Fig. 5	$(0.0527K^2W_c)^{1/5}$ or Fig. 6
	Ampere turns per in. length NI/L	$900\sqrt{F_c} \div D_i$ or Fig. 3	$900\sqrt{F_c} \div D_i = 1007\sqrt{W_c} \div \sqrt{D_i^3}$ or Fig. 4	$900\sqrt{F_c} \div D_i$ or Fig. 3	$900\sqrt{F_c} \div D_i = 1007\sqrt{W_c} \div \sqrt{D_i^3}$ or Fig. 4

plunger electromagnet to use a value of F_c or W_c about 25 per cent greater than the required pull or work. The solenoid pull of the plunger electromagnet, which was neglected in the plunger electromagnet calculations, gives an additional margin of pull for the plunger electromagnet.

Rating Artificial Lighting Systems

A Study of Conditions Affecting Efficiency of Illumination and Factors for Use in Calculating the Percentage of Normal Illumination That May Be Obtained

BY DAVIS H. TUCK
Illuminating Engineer, United States Public Health Service

WHEN making lighting surveys in industrial plants the equipment is found in various stages of deterioration. Lamps may be dirty and bulbs black; lamps may be used in reflectors that are too large or too small for the given size of lamp; lamps may be missing, broken or have their filaments "shorted." Reflectors may be dirty; reflectors may be loose, resting upon the bulb for support; the fixture may be defective owing to worn insulation; the reflector may be broken or missing. All of these items decrease the illumination to some degree, and it is important to gain an idea of the percentage decrease in illumination which may be ascribed to the combined effect of these factors. Obviously it would not be practicable to measure the loss of light due to each item for each lighting unit, as this would be an enormous task in even a small shop. Therefore an approximate system of rating becomes desirable. Such a system, which the writer has used in making lighting surveys in the industrial plants of Wisconsin, will be presented, together with comments on the results secured with it.

The term "efficiency of maintenance" was decided upon as a term which could be represented by a percentage figure and which would represent both the degree of maintenance that an artificial lighting system had received and the percentage of the available light that was being received on the working planes.

In formulating the discounts for various defects in

maintenance it was decided to make the discounts conservative, so that a resulting efficiency of maintenance of 100 per cent would represent an installation which had received good care but which would not necessarily be in perfect condition. Thus a lamp may have been in use for 800 hours, and, while not a new lamp, it would not be blackened and would be rated at 100 per cent.

Carbon, metallized and tungsten-filament, mercury-vapor, arc, open-flame and mantle lamps become inefficient owing to the following causes: (1) Continued use; (2) dirt and dust accumulations on lamps and reflectors; (3) burn-outs and breaks; (4) reflectors becoming cracked, broken, loosened or missing, and (5) mechanical injury to connections. Various other items of deterioration take place so gradually that in many cases they are given no special attention in the practical economy of the shop.

Continued Use.—The life of a lamp is not, as is generally supposed, the elapsed time between its entering into service and its burning out. The life of a lamp is given by its manufacturers and is its economic life. Thus when a lamp burns a certain number of hours it may be shown that its energy consumption per light unit has increased to such a degree that it is economy to replace it with a new one.

Dirt and Dust Accumulations on Lamps and Reflectors.—It has been shown by actual measurements that

the loss of light due to absorption by dust and dirt for average conditions is about 50 per cent for equipment that has not been cleaned for four months; also that a small quantity of dust, so small as hardly to be noticeable, will cut down the light by 20 per cent.

Burn-outs and Breaks.—It is evident that a burn-out or break may cut down the light by 100 per cent. Often, however, a burn-out or break may be of such a nature that the light source does not fail entirely but that the light is greatly diminished.

Cracked, Broken, Loosened or Missing Reflectors.—The addition of a suitable reflector to a lamp generally adds about 50 per cent to the light delivered in useful directions. When a reflector is cracked or broken the light from the unit is diminished according to the nature of the damage to the reflector. When a reflector is loosened from the fixture or bent out of shape the distribution is altered and the efficiency of the reflector is lowered. It is evident that when a reflector is missing the light that would be gained by its use is totally lost.

Mechanical Injury to Connections.—The loss of light due to mechanical injury to connections will vary with the nature of the injury. Often the injury is of such a nature as to cause a flickering or intermittent light. It may cause a total failure of the light together with all other lights on the same circuit.

Lighting installations are designed to give desirable initial intensities at the work, and it is assumed that the equipment will be maintained so as to produce this intensity. From cost considerations the initial intensity is made as low as possible for work to be done efficiently and to insure prevention of eye strain and accidents. It is readily seen that when deterioration of the lighting equipment sets in the intensity of illumination falls off and that if this deterioration is not arrested serious efficiency losses follow. Often lighting systems are allowed to deteriorate to an extreme point, and nothing is done unless complaints come in from employees after the lighting facilities throughout the shop have become so poor that work has to be temporarily discontinued. The production losses from such circumstances when added up throughout the year greatly exceed the expense of systematic maintenance in advance.

Even when systematic maintenance is carried out the deterioration between inspections is marked, and for this reason it is desirable to allow a factor of safety when planning lighting installations, as is the general practice in other engineering problems. The author has frequently found general overhead direct and indirect lighting systems which after a trial of six months or more have been condemned by the factory management as unsatisfactory. In the majority of these cases the trouble lay in that the maintenance had been neglected, and in the minority it was due to faulty engineering. The stronghold that local lighting has in many factories to-day is due to the fact that the initial intensity is many times that required for the work at hand, and although deterioration is much more rapid for local light units than for overhead general units, the factor of safety has been made so large that only in extreme cases will the illumination fall below requirements. When local lights deteriorate to such an extent that they become unsatisfactory the individual workman usually makes repairs himself.

Thus the trouble is not brought to the attention of the management. With overhead general lighting, however, the individual workman has no control over the units, and when the intensity fails, because of lack of maintenance, the job has assumed such proportions that the attention of the management is called to the matter.

In making illumination surveys of shops it was found desirable to note how well the lighting equipment was maintained and to arrive at an approximate figure by inspection that would denote the degree of maintenance. The term "efficiency of maintenance" is used to designate the percentage of the initial intensity that a lighting equipment will give, the loss in intensity being due to the lack of proper maintenance.

EXAMPLE OF APPLYING METHOD

The following table shows the method adopted for rating artificial lighting equipment. The efficiency of maintenance in each case represents approximately the percentage of light given by the equipment after the loss of light due to the corresponding condition is deducted:

Condition	Efficiency of Maintenance, Per Cent
Lamp dirty	80
Lamp very dirty.....	70
Lamp blackened, due to aging.....	80
Lamp too large or too small for reflector.....	80
Lamp missing, broken or having filament "shorted".....	50
Reflector dirty	80
Reflector very dirty.....	70
Reflector, cracked or bent.....	80
Reflector broken or missing.....	50
Connections loose, fuse out or drop cord bare.....	80

There follows an example taken from one department of a shop recently inspected and referring to general overhead units in a tool room: twelve units, lamps dirty, reflectors dirty; three units, lamps dirty, reflectors missing; two units, lamps dirty, reflectors very dirty; nine units, lamps very dirty, reflectors very dirty; one unit, lamps very dirty, reflectors missing; one unit, lamps dirty, reflectors clean; two units, lamps dirty and blackened, reflectors dirty.

To arrive at the efficiency of maintenance for the tool room referred to it is necessary to multiply the number of units having the given condition by the values of the efficiency of maintenance for those conditions, expressed as a decimal, and to take the weighted mean:

12 × 0.80 × 0.80.....	7.68
3 × 0.80 × 0.50.....	1.20
2 × 0.80 × 0.70.....	1.12
9 × 0.70 × 0.70.....	4.40
1 × 0.70 × 0.50.....	0.35
1 × 0.80.....	0.80
2 × 0.80 × 0.80 × 0.80.....	1.02

30 16.57
(16.57 × 100) ÷ 30 = 55.2 per cent efficiency of maintenance.

By measurement with an illuminometer the average illumination was increased in the ratio of one to two by bringing the efficiency of maintenance up to 100 per cent. By making such measurements in a large number of shops, it has been observed that the efficiency of maintenance of local units is approximately one-half that of the overhead general units.

A department of maintenance of artificial lighting equipment should be inaugurated in every factory and

workshop. This maintenance work should be made a part of the electrical department, which is in the best position to make periodic inspections of lighting equipment. Reports of inspections, using a system similar to the one outlined above, should be made to the factory manager and efficiencies of maintenance of 100 per cent maintained. The ratings given above are

liberal, and efficiencies of maintenance of 100 per cent are not unreasonable.

By adopting such a practice a large economic waste caused by consumption of energy without adequate return in light production, losses due to decreased production, inferior products, accidents and defective eye-sight could be avoided.

Work of Remodeling Old Hydroelectric Plant

The Prevalent Shortage of Coal Has Led One of the Pioneer Water-Power Plants of the New England States to Substitute Direct-Connected Equipment for Old Belt-Driven Machines

ALTHOUGH most of the United Electric Light Company's yearly output is derived from its steam-turbine station at Springfield, Mass., the maximum utilization of water at the Indian Orchard hydroelectric station, about 7 miles (11.8 km.) distant, is of special importance lately because of the present shortage of coal. For this reason and because it is fundamentally advisable to utilize water power most efficiently, the company has remodeled the hydroelectric plant.

The station, which was one of the pioneer water-power plants of New England, was equipped with belt-driven units, including four Stanley inductor-type alternators, a General Electric direct-current generator, two pairs of Brush arc machines and three McCormick waterwheels. The arrangement of these units is indicated in Figs. 1 and 3. Two of the alternators, rated at 330 kw. each, were connected with two adjacent waterwheels, which in turn were connected with a countershaft as shown in Fig. 3. Owing to the losses in belting and shafting, it was impossible to develop more than 530 kw. with both units operating. The countershaft drove a direct-current generator furnishing railway energy.

The other two alternators, also 330-kw. units, were

about 25 ft. (7.6 m.) apart on centers and were driven from pulleys at opposite ends of a third waterwheel. Each waterwheel consisted of two 36-in. (9.1-cm.) wheels mounted in a single casing with a central draft

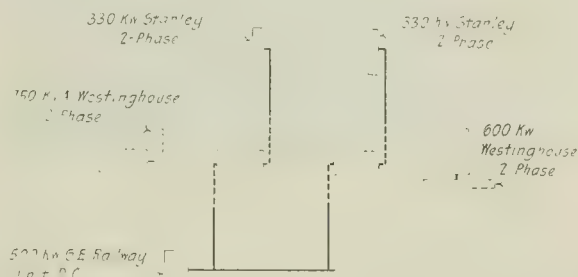
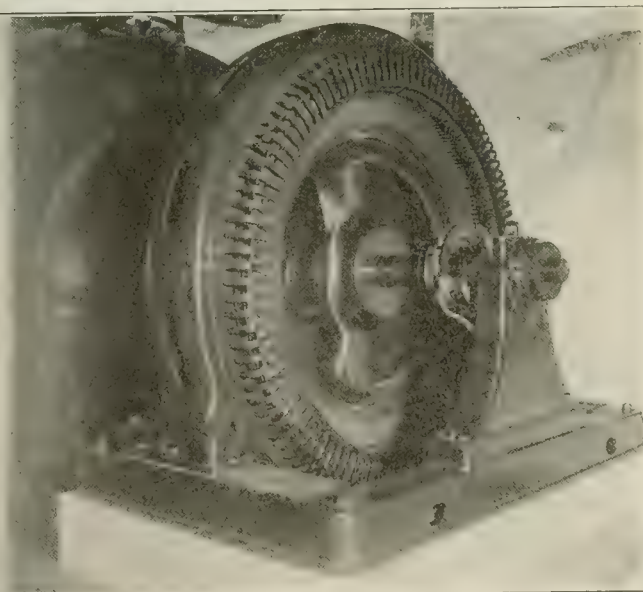
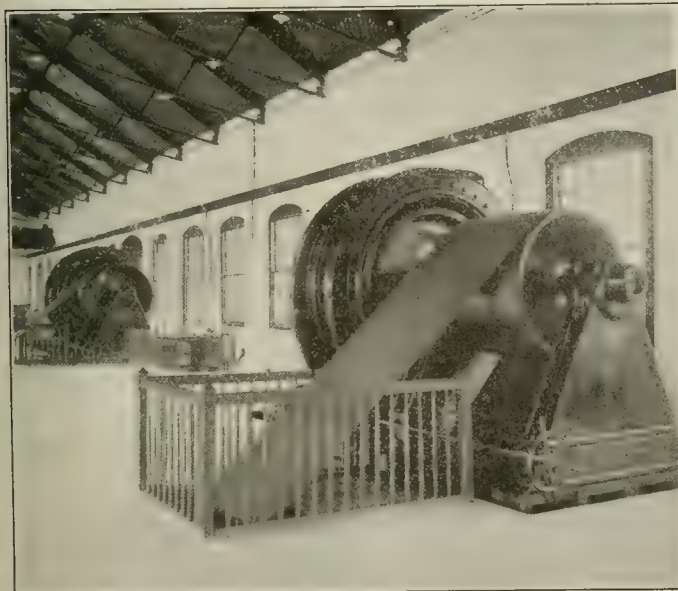


FIG. 3—LAYOUT OF EQUIPMENT IN PARTLY REMODELED PLANT

tube and were designed for 212 r.p.m. under a 35-ft. (10.6-m.) head.

In remodeling the station the last-mentioned alternators were replaced by one 750-kw. direct-connected Westinghouse alternator, the waterwheel connected with the old alternators being used to drive the new machine. This is shown in Fig. 2. The exciter for this unit has been installed in the belt recess of one of the old Stanley alternators which have been replaced (Fig.



FIGS. 1 AND 2—TYPE OF GENERATORS AND DRIVE USED IN OLD PLANT, AND ONE OF THE NEW DIRECT-CONNECTED GENERATORS DRIVEN BY OLD WATERWHEEL

5). While the 500-kw. direct-current generator attached to the countershaft is still being used, it will be replaced eventually by a 500-kw. Westinghouse rotary converter. The countershaft will be removed and two more 750-kva. Westinghouse generators will be substituted for the remaining inductor-type alternators, making a complete direct-current installation throughout.

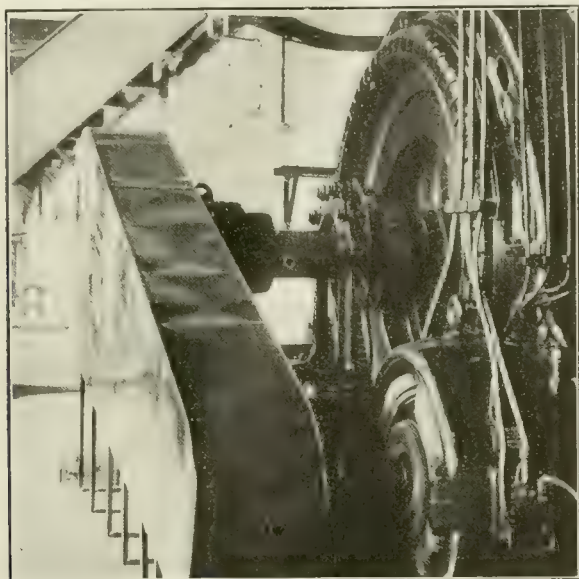


FIG. 4—DIRECT-CONNECTED ALTERNATOR WITH EXCITER AT ONE SIDE

Meanwhile, the waterwheels driving the inductor alternators and direct-current generator are assisted under low-water conditions by operating one of the alternators as a synchronous motor. While this arrangement does not permit very efficient operation, it serves as a makeshift pending the other changes contemplated.

The fifth generator indicated in Fig. 3 is a 600-kw. direct-current Westinghouse alternator which was installed several years ago in connection with a waterwheel placed at right angles to the other prime movers in a well below the operating room. This machine is equipped with a belt-driver exciter, the belt being inclosed in a guard, as shown in Fig. 4.

The major portion of the Springfield street-lighting service was originally supplied from Indian Orchard by brush-arc machines belted to countershafts, but this load has gradually been transferred to the State Street plants in the interests of economy.

Local lighting and power are supplied at Indian Orchard by a loop system connecting with the State Street and Bircham Bend plants of the United Electric Light Company.

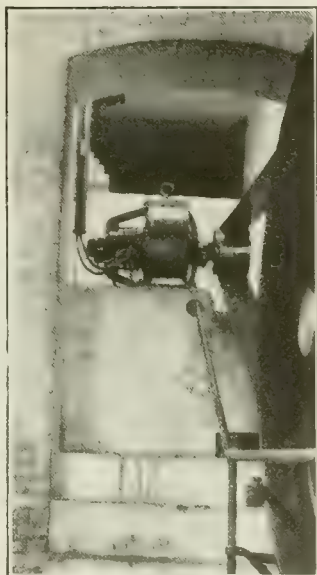


FIG. 5—OLD BELT-WAY AC-COMMODATES EXCITER FOR ALTERNATOR

Filament Lamps for Optical Projection

Emerson L. Clark of Lakewood, Ohio, suggests, in patent No. 1,221,418, a means of effectively utilizing all the light rays of a filament lamp for projecting purposes. A light intensification of nine times is claimed over the ordinary methods of lighting. The light globe consists of two hemispherical parts inclosed in water-jackets. These hemispherical parts have their interior surface highly polished and silvered or coated with any other highly reflecting material. The incandescent support is cemented or otherwise fastened, and the terminals are sealed in order to prevent a short circuit. The disk which serves as the window is placed in the hemispherical part, and the two parts are securely fastened together to make an airtight joint. The fluid cooling of the metallic hemispherical part prevents the temperature of the entire inclosure from increasing to any considerable extent. Since the temperature of the glass, which has the lower coefficient of expansion, will be greater than the temperature of the fluid-cooled metal, the difference in the coefficients of expansion of the glass and the metallic part will thus be compensated. By keeping the polished surface cool no loss in reflective power is experienced.

Cathode-Ray Oscillograph Measures Power

In patent No. 1,219,961, recently issued to Irving Langmuir of Schenectady, N. Y., not only are the irregularities of the original vacuum tube overcome but an exceedingly effective screen is proposed which does away with all difficulties inherent in the usual fluorescent screen.

Contrary to the idea of employing a small amount of ionizable gas in the Braun tube to conduct the electric discharge current, the Coolidge idea is embodied. In this an incandescent cathode is employed emitting negative electrons in an "atmosphere" as low as one-hundredth of a micron. This high degree of exhaustion is effected by means of the Caede molecular pump.

A perforated plate is arranged to close one end of the tube to serve as the main anode for the source of energy. The greater part of the electrons given off by the cathode will strike the plate, and those traveling in a direction parallel to the axis of the envelope will pass through the aperture in the plate, through the tube, and through a second aperture, closing the other end of the tube. In this way a pencil of rays is produced which is directed upon a reflecting screen.

In the path of the cathode ray, before it reaches the deflecting screen, are arranged two sets of electrostatic deviators which cause the traveling negative electrons to take up two types of lateral deflection compounded at right angles to each other and directly proportional to the voltages and current effects it is desired to outline. In this manner, after reflection, with the rays impinging on a screen having a finely divided deposit of volatilized tungsten or molybdenum, the surface of the screen traces out an incandescent path, showing how the cathode-ray pencil is deviated from its normal central stationary position. The area of the diagram or the area inclosed by the path of the cathode rays on the screen may be measured, and after the instrument has been suitably calibrated the power in the circuit may be computed from this area.

Importance of Flexibility of Boiler Control

Separate and Flexible Air Control a Means Toward Securing Maximum Efficiency Over Wide Range of Loading — More Extensive Utilization of Radiant Energy from Fuel Bed Strongly Advocated

BY VICTOR B. PHILLIPS

The Cleveland (Ohio) Railway Company

SOME engineers do not appreciate the nearly equal importance of rating and efficiency as factors bearing upon the cost of producing steam. For example, in the power plant of a typical street railway about 40 per cent of the cost of producing steam is for fixed charges and labor, while about 50 per cent is for

is primarily to insure entire flexibility of control.

The present barriers to flexibility in the boiler plant are to be found in the furnace and not in the boiler. The ability of a boiler to absorb heat depends upon the temperature and amount of gas passing over the boiler surfaces. Temperature is by far the most important of these two factors, for the reason that it is essential to every mode of heat transfer, be it conduction, convection or radiation. The importance of radiation, which is a mode of transferring heat from the furnace to the water that depends solely upon temperature difference (assuming, of course, a constant condition of boiler surfaces), has been recognized only very recently. For example, in the old-style settings with Dutch ovens very little attention was directed to the efficiency and effectiveness of heat transfer by radiation, whereas in the most modern settings a very large part of the total heating surface is exposed to the radiant heat of the furnace. The growth of such practice makes the factor of gas velocity of secondary importance.

Such being the case, a flexible furnace, in which the conditions governing combustion and therefore temperature may be properly regulated through a wide range, will give uniform boiler efficiency. Hence it follows that the furnace is the problem demanding

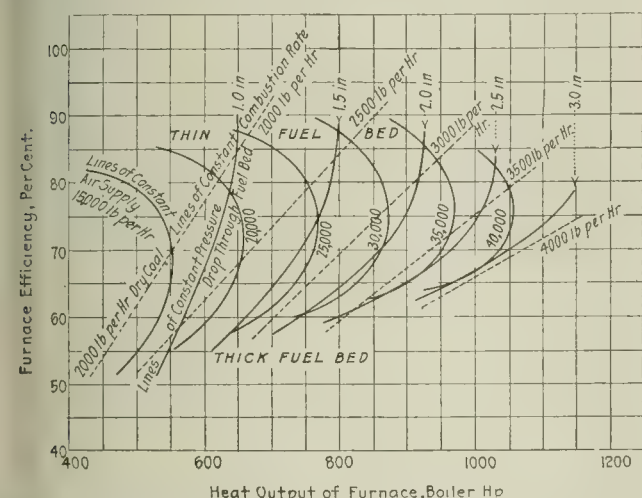


FIG. 1—FURNACE PERFORMANCE AT DIFFERENT OUTPUTS WITH DIFFERENT RATES OF AIR SUPPLY AND THICKNESSES OF FUEL BED

fuel. The relative importance of these items is, of course, a function of the plant load factor; but there are few plants where the load factor is sufficiently high to reduce fixed charges and labor to less than 35 per cent of the total cost of steam production. It is therefore advisable to look to the reduction of these charges as well as to increase in efficiency in improving boiler performance.

In the formulation of a policy for the construction and operation of a boiler plant data of two kinds are essential. First of all it is necessary to know the cost of fuel, especially in relation to the general price level, and to know also the load factor. In the second place, data on the maximum efficiency attainable with the boiler equipment throughout a wide range of loads must be available. The conditions whereby such efficiencies may be obtained must be known. With these data and only with these data may the engineer intelligently decide upon the amount and type of equipment suitable to conditions and upon the proper methods of operation and loading. It is perfectly safe to say that the boiler room of the average power plant offers tremendous opportunities for saving. It is here that systematic study is most worth while. It is also safe to say that much of future development will be in the way of increased flexibility of control. For example, uniformity of performance over a wide range of loads is an important characteristic of the modern turbine. The reason for burning pulverized coal or oil under boilers, in some respects an expensive process,

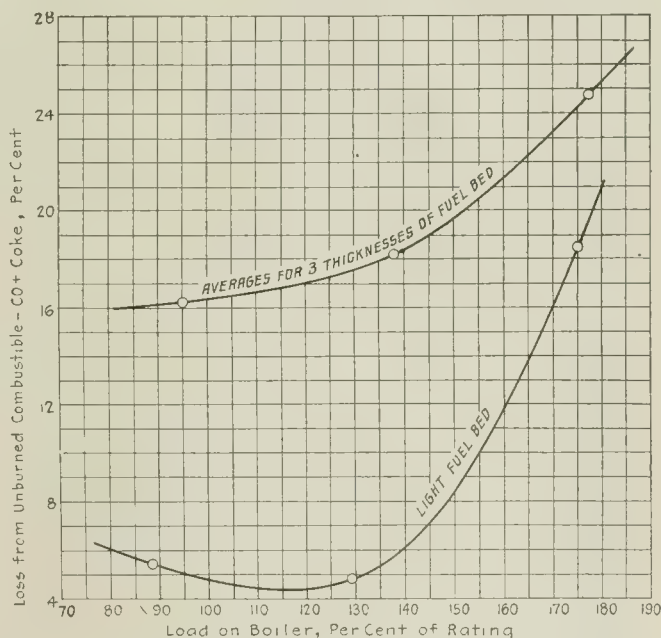


FIG. 2—LOSS FROM UNBURNED COMBUSTIBLE WITH DIFFERENT THICKNESSES OF FUEL BED AT DIFFERENT LOADS

solution. It must be made to operate efficiently not only at the single load for which it is rated, but with very nearly as good performance at, say, 250 per cent of rating.

With a view to discovering operating limitations and the conditions giving maximum efficiency, and also

to improving stoker and boiler setting design, the writer conducted an exhaustive series of tests for the Cleveland Railway Company. The equipment tested consisted of a Taylor six-retort stoker with extension grate* set under a 512-hp. Babcock & Wilcox boiler. Nine main tests were conducted, consisting of a test for each of three different fuel-bed thicknesses with each of three different loadings. The most extreme conditions of operation were studied, with clear-cut and striking results. A description† of procedure and tabulations and graphs of test data have been published elsewhere, together with some discussion of the fundamentals of furnace and boiler operation and the system of testing adopted. Some of the points brought out in that paper will be supplemented and amplified in this article, which will also treat of test results applying to the furnace, or "heat liberator," and the boiler, or "heat absorber."

THE FURNACE

A fundamental factor in the efficient burning of any fuel is the time required for the completion of the combustion process. Regulation of the time element is essential to complete flexibility of control. Inability to regulate it, however, is an inherent characteristic of many automatic stokers because the grate area is usually a fixed quantity. In most stokers the time of transit of coal varies inversely with the stoker speed, so in order to burn the increased supply of coal the total air must be increased and a greater rate of combustion must be realized. The inflexibility in time regulation must be compensated for by great flexibility in the air supply. As the load on a stoker is varied, the amount of air supplied to the several parts of the grate surface must be varied. Furthermore, it is far from true that changes in this supply in these several parts should be in the same relative proportions for all loads.

Consider, for example, the comparatively simple chain-grate stoker. The dimensions of this grate are proportioned to give good performance at rated load with a particular grade of fuel. Increase of load necessitates an increase of speed or of fuel-bed thickness, or of both, as well as increased draft. For a fuel bed of the same thickness and resistance to air flow doubling the amount of air requires four times as much draft. If, as is rarely the case, the increased fuel supply is obtained solely by increase of speed, the greatly increased draft blows holes through the lighter portions of the fuel bed, or at least reacts more than proportionately in those sections where partly consumed coal has less weight. At first the relation between resistance and weight of fuel is the same at the front as at the back of the grate, but this relation is shortly disturbed. The draft, increased four times, concentrates its destructive efforts upon the weaker portions of the bed. The grate proportions become entirely improper, and recourse must be had to a thicker fuel bed.

Suppose now that the refuse on the grates at the bridge wall amounts to 20 per cent of the weight of coal fired. Then doubling the fuel-bed thickness perhaps doubles the weight of refuse at the rear of the grate. But this increase in actual weight is only 20

per cent of the actual increase of weight on the front grates. The large increase in the resistance of green coal to air of combustion makes the rate of combustion relatively slower in the front so that the more anterior portions build up in thickness. Thus difficulty from holes may be reduced, but a great loss in coke to the ash pit results. Once more the grate proportions are improper. From this lengthy citation it is at once

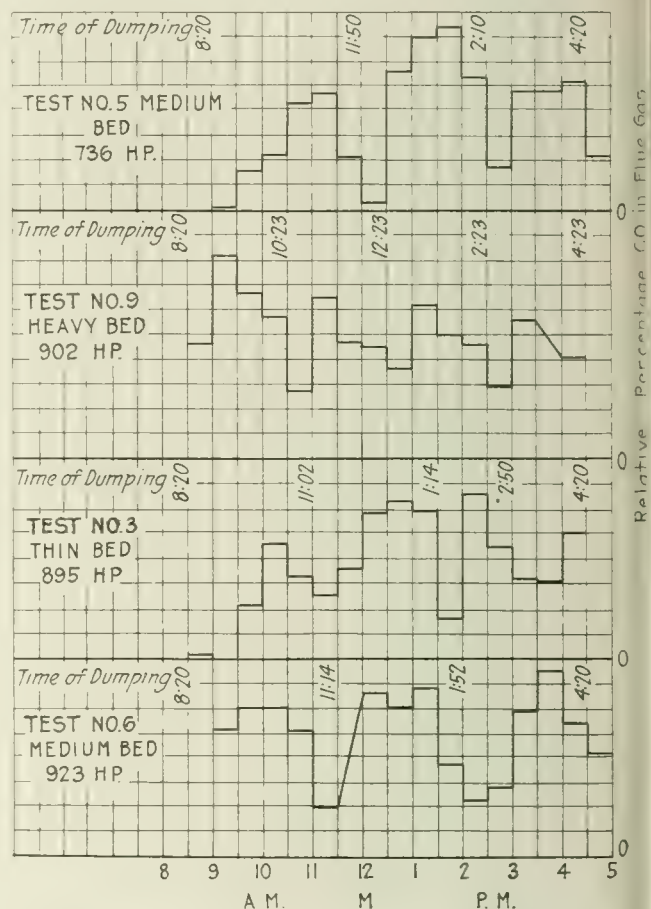


FIG. 3—RELATIVE PERCENTAGES OF CO IN FLUE GAS WITH DIFFERENT OUTPUTS AND FUEL-BED THICKNESSES

evident that much of the above difficulty could be removed by regulation of the air supply independently in the several parts of the furnace.

Similar conditions exist with some underfeed stokers. With these stokers the lower grates, especially the extension and dump grates, have not an adequate and independently controllable supply of air with which to burn the combustible delivered to them at overloads. Such a condition becomes accentuated when the combustible received at a higher rate than burned piles up and still further shuts off the air supply.

Two sets of curves are presented herewith to demonstrate this point further. The first set show the relation of CO to time of cleaning fire or, in other words, to the amount of coke and ash on the lower grates. These curves indicate that the CO comes from the most part from these grates. Obviously the solution of the difficulty is more air, but the air supply to the extension grates comes from the main air boxes and cannot be independently regulated in some cases, so it is increased or decreased along with the air to the rest of the grate surface. The second set of curves show the relation of total loss from incomplete combustion to load. They constitute the most effective kind of argu-

*Installed in 1913-14.

†Journal, Amer. Soc. Mech. Eng'rs, May, 1917

ment on the shortcomings of the automatic stoker, though at the same time the writer does not hesitate to rank the Taylor stoker with the very best. This inflexibility is characteristic of the present status of the stoker operation.

But progress has not been lacking in recent years. Compared with some chain-grate and overfeed stokers favored a few years ago, the present forced-draft underfeed stokers are a great improvement. Not only do they give better efficiency, but, what is in most plants much more important, they are vastly more flexible. It is perfectly possible to follow the load of a railway power station with some of these stokers, or, in other words, trace a boiler load curve to correspond to the station load curve. Such flexibility is essential on some electrified railroads, of which the Norfolk & Western system is an example. In this case the boilers are made to undergo tremendous fluctuations in loading.

While considerable latitude in loading has become possible with the modern stoker, it is still impossible to maintain uniformly high efficiencies or to avoid various difficulties over a wide range of loads. One difficulty is the formation of clinker, the conditions described above being very favorable to clinker formation. As the ash and coke pile up on the lower grates including the dump grates and the air is cut down, high temperatures result. The ash becomes fused across the dump grates and fastens onto the bridge wall. Excessive difficulty in cleaning and destruction to the furnace lining are the consequences.

EFFECTS OF OVERLOADS

In the course of the tests run by the writer another point was developed in connection with sustained overloads. It was found that the best results by far were obtained when a comparatively light fuel bed was used. This was true to a surprising degree even at a heavy overload. With the boiler loaded to nearly 200 per cent of rating (average for eight hours) the thin fuel bed was easier to maintain in good and uniform condition and the resulting efficiency was higher than with either the heavy or medium thicknesses of fuel bed. Such being the case, it seems desirable in carrying sustained overloads to have more stoker engine capacity and to rely less upon the burning down of a heavy fuel bed.

Stokers, such as the Taylor stoker, depend to some extent upon the dump grates for the burning out of coke. The air for this combustion is drawn up by the draft maintained in the combustion chamber. In some tests for the determination of infiltrated air the writer tried operating with a practically balanced draft, i.e., less than 0.10 in. (2.54 mm.) of water draft in the furnace. As a result, flames were driven out through the under sides of the dump grates, which consequently became red hot. While a minimum draft is desirable, many of the grates were burned out. This experience suggested the advisability of sealing the ash pit and by means of a by-pass from the air ducts creating a slight pressure. By this plan a minimum draft may be maintained without serious escape of air through the dump grates.

Nevertheless, a comparatively slight draft in the furnace means a considerable draft back through the setting with the consequent deleterious effects of in-

filtered air. A series of tests which were necessarily inaccurate showed that this infiltrated air for the setting already discussed was 3500 lb. (1587.6 kg.) per hour with a 0.30-in. (7.6-mm.) draft. This setting was new and in excellent condition, and the results take no account of air infiltrated when cleaning doors were open. The value given is interesting as indicating what the infiltrated air must be in a poorly maintained setting where natural draft is employed.

The second installment of this article, which will dwell on the boiler as a heat absorber, will be printed in a later issue of the ELECTRICAL WORLD.

UNUSUAL UNDERGROUND SYSTEM AT CINCINNATI

Large Ducts and Cables, Rugged Construction and Provisions for Watertight Construction and for Admitting Water for Cooling Ducts

Construction work is at present well under way on the underground transmission system which will connect the new power station of the Union Gas & Electric Company of Cincinnati with its substations. Some of the minor details yet remain to be worked out, but a general statement of the problems encountered and the methods to be employed in its solution are given in this article.

The conduit leaves the power house in four runs of ten ducts each. The ducts at this point are arranged in groups two wide and five high. At a distance from

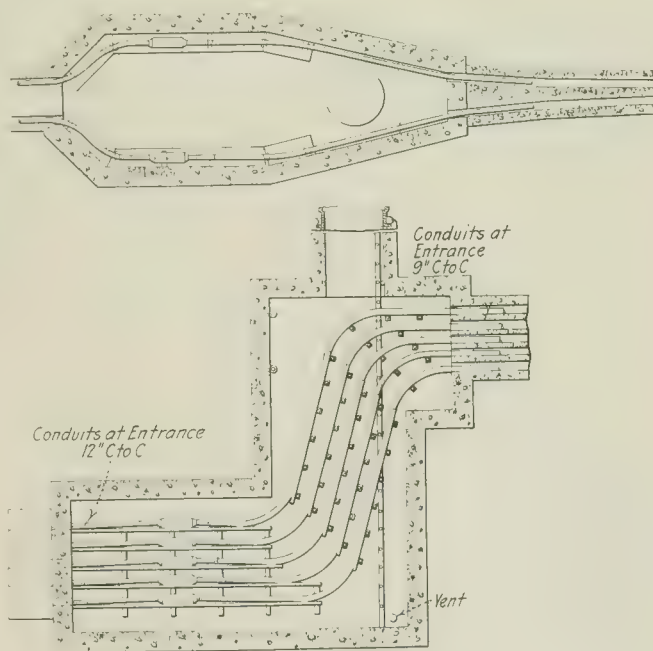


FIG. 1—STRAIGHT-LINE TWO-LEVEL MANHOLES OF LARGE SIZE HAVING REINFORCED-CONCRETE WALLS

the power house, where the number of ducts is reduced, the same width is maintained, the number of layers being less. This arrangement was selected for these reasons: It permits economical construction; it is rigid against vertical loads or stresses; it gives large radiating surface, and it allows the cables in the manholes to be separated and spread to the sides of the manholes without crossing each other. When the system has

been completed it will comprise 674,000 duct feet, apportioned as follows:

20,000 ft. (6,096 m.)	10-duct fiber conduit $\times 10 = 200,000$ duct feet
17,000 ft. (5,181.6 m.)	10-duct tile conduit $\times 10 = 170,000$ duct feet
16,000 ft. (4,876.8 m.)	8-duct fiber conduit $\times 8 = 128,000$ duct feet
6,000 ft. (1,828.8 m.)	6-duct fiber conduit $\times 6 = 36,000$ duct feet
35,000 ft. (10,668 m.)	4-duct fiber conduit $\times 4 = 140,000$ duct feet

In the aggregate this will mean the installation of 94,000 linear feet (28,651.2 m.) of conduit, or 674,000 linear feet (20,543.56 m.) of duct.

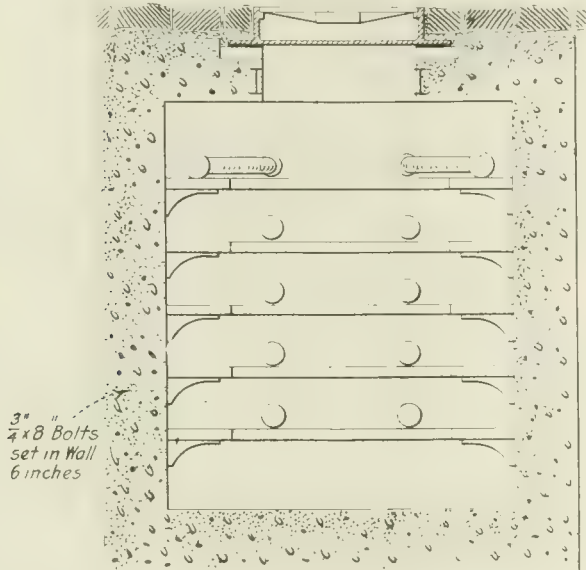


FIG. 2—ORDINARY STRAIGHT-LINE MANHOLES, SHOWING HOW CABLE WILL BE RACKED

Aside from the great length of duct involved, several other factors enter to make the Cincinnati company's underground problems important. The rough character of the territory traversed, for example, adds to the difficulties. Furthermore, part of the system will probably be under water each year. Besides this, the cables themselves are of very large size. In fact, they will be the largest three-phase, 13,200-volt cables yet built. They measure 3.25 in. (81.75 mm.) in outside diameter and contain three 400,000 circ.-mil conductors. In all cases they will be pulled into 4.5-in. (116.3-mm.) duct laid in concrete, with a thickness of 3 in. (76.2 mm.) of concrete between adjacent ducts and 3 in. (76.2 mm.) of concrete between the ducts and the outside of the incasement. The fiber conduit, which is 5/16 in. (7.93 mm.) thick, was especially made for the Cincinnati job. Fiber was selected because of ease and speed of laying, better alignment, ease of cable pulling and removal, non-fusibility and lowest total conduit cost. The tile duct was purchased at a time when it was impossible to get fiber duct large enough for the job.

The problems occasioned by the unusual topography of the city and by the existence of other utility construction in the streets were generally solved by building two-level manholes. Some of these are really mammoth structures. One, for instance, is 20 ft. (6.09 m.) long by 28 ft. (8.53 m.) deep by 7 ft. (2.13 m.) wide, with reinforced-concrete walls 1 ft. (0.3 m.) thick. There are many 14-ft. (4.27-m.) manholes. In sections where changes of level were necessary it proved economical to run the duct into the manholes at one level and out at another. The difference in level in some instances was as much as 12.5 ft. (3.95 m.). In changing levels the cables will be supported on channel-iron

troughs, additional protection to the sheath being provided by the asbestos and cement fireproofing which will be applied in all manholes.

In designing all manholes on the system care was taken that they should be made large enough to take care of future growth. It is the hope of the company's engineers that none will need to be rebuilt at least within the coming decade.

In that section of the city which is flooded each year the entire underground system will be made watertight. This is necessary to prevent the silt carried by the overflowing river from clogging ducts and manholes. Exclusion of water and silt will be accomplished by the use of double manhole covers made in two parts. An inner cover will carry a gasket to keep out water. The outer cover will withstand the traffic strains. To prevent explosions from gas that collects in manholes natural ventilation by means of static-head differences will be normally used, assisted by local forced ventilation when and where necessary.

On account of the large power-carrying capacity of the cables and the consequent high temperature that may be expected in the ducts, two cooling schemes have been worked out. Near the power house where the conduit passes through a cinder fill, arrangements will be made to circulate water down through the cinder and over the outside of the conduits when thermometers indicate dangerous temperature rises. Besides, it will be possible to turn city water into the underground system at several points in the system and permit it to flow by gravity through ducts and manholes toward the power house, where it can be drained into the river. By the installation of thermometers in pipes at various points on the system it is expected that the necessity

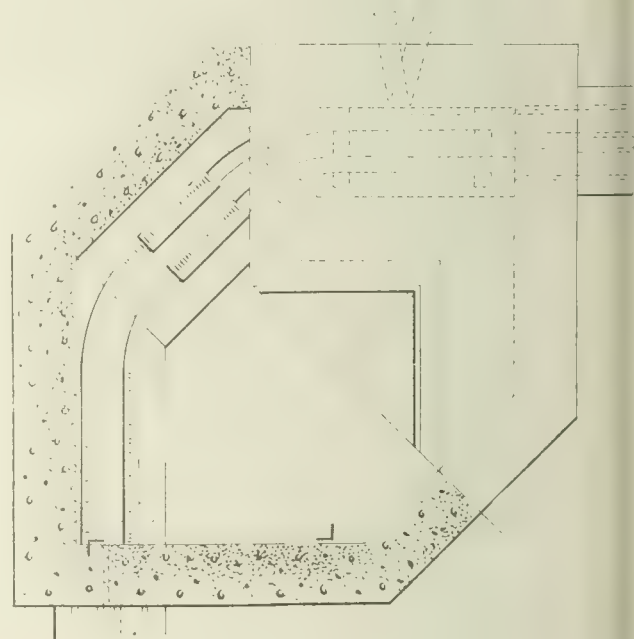


FIG. 3—CORNER MANHOLE CONSTRUCTION

for turning in water can be foretold with certainty. The fact that all ducts drain toward manholes and that very cold weather is not experienced at Cincinnati will permit of this practice, it is thought, even in winter.

The system is being built under the direction of C. R. McKay, consulting engineer for the Union Gas & Electric Company. Sargent & Lundy, Chicago, are constructing engineers.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

OBJECTION TO BONUS SYSTEM IN BOILER ROOM OF PLANT

A Chief Engineer Asserts that This System Promotes Dishonesty—Advises Using Devices for Convenient Operation and Checking Results

E. H. Perry, assistant chief engineer of power plants for Sears, Roebuck & Company, Chicago, believes it is fundamentally wrong to employ a bonus system for encouraging economical operation in a power plant. In his opinion such a system cannot help but induce the men in the plant to resort to dishonest practices in order to earn the bonus. In one instance which came to his attention a locomotive engineer reported a run of several thousand miles on a quart (0.946 l.) of cylinder oil, when in fact he had been oiling his engine with lard oil stolen from lanterns. In another case where a bonus was paid on waste, in order to reduce needless consumption thereof, one man was found to have his locker full of waste which he had accumulated at the expense of his fellow workers. Still another observation indicated that coal scales were ingeniously tampered with to make the coal consumption low enough to earn the bonus.

The better plan, Mr. Perry believes, is to provide the boiler-room force with the best devices for convenient operation and accurate checking of results, and then to hold the force responsible for getting the best results which the plant seems to be able to give. To this end the power plant of Sears, Roebuck & Company has been equipped with automatic coal-weighing scales, flow meters, automatic feed-water regulators and such other devices as have shown themselves worthy of consideration. Conditions have been worked out so well that now one man takes entire care of ten boilers.

MOTOR AIR GAPS AND ALLOWABLE BEARING WEAR

Small Clearance Between Rotor and Stator of Induction Motor Limits Amount of Wear Permissible in Bearings

BY E. C. PARHAM

Failure of operators to appreciate the fact that the air gaps of small induction motors are usually only a few thousandths of an inch often leads directly or indirectly to the trouble most common to these motors—rubbing of the rotor on the stator. Bearing wear equal to only the bearing clearance of direct-current motors will let the rotor down on the stator.

In one instance an inspector was called to look at a repulsion-induction motor on the inside of which sparks like those from an emery wheel occasionally could be seen. Inspection disclosed the fact that a very small area of the rotor which was not perfectly cylindrical

had been striking a few laminations that projected from a part of the stator. Whether there would be contact or not depended on whether the rotor was at one end of its end-play travel or the other. In any event the pinion-end bearing lining had worn almost to the safe limit. If there had not been those few projecting laminations which gave a timely warning, the rotor probably would have been seriously damaged later.

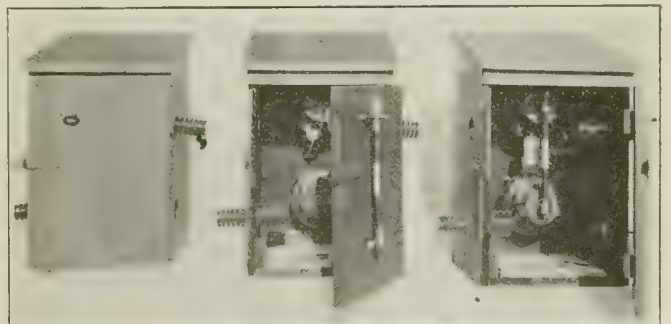
Buy a Bond for Liberty

PROVIDING FOR SAFETY IN HANDLING EXPULSION FUSES

Screw Eye Is Placed on Door of Cut-out Box to Accommodate Fuse Holder and Discourage Laying Fuse in the Box

On the lines of one Western company two linemen were engaged in inspecting 11,000-volt transformer installations. One of the linemen climbed a pole, opened the boxed-in cut-out door and pulled the holder in the usual way with a treated wood hook stick. He then removed the holder from the stick and laid it on the bottom of the open cut-out box. In some manner the end of the cut-out came in contact with the bare terminal clip and the lineman received a very severe shock. He was saved from death by the prompt and efficient resuscitation methods of his companion, but spent many weeks in the hospital recovering from the burns received.

Inquiry developed the fact that many employees were laying fuse holders on the bottom of cut-out boxes after they had been pulled. To prevent a recurrence of this form of accident, this company has placed a screw eye in the front of the door of each cut-out box, as shown



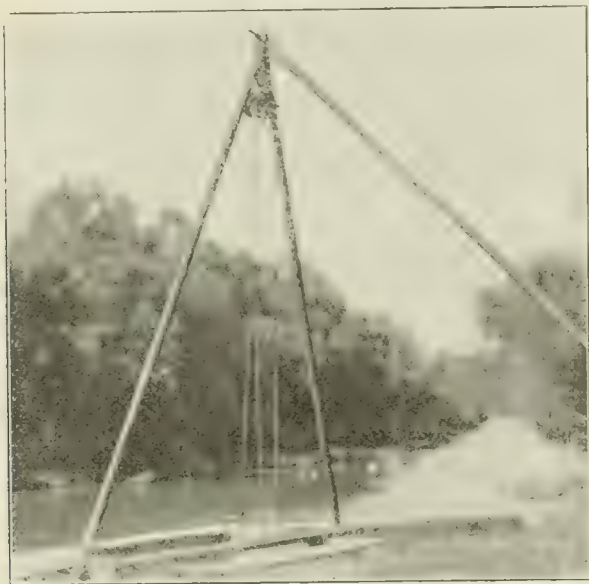
CUT-OUT BOX FITTED WITH SCREW EYE TO HOLD FUSE

in the accompanying illustration. The eye is sufficient in size to accommodate the tube but not the bulb of the holder, which is of the expulsion type. Linemen are instructed upon removing a holder to slip it into the screw eye, where it may be placed in safety. The eye also provides a convenient handle for opening the door.

ARRANGEMENT USED FOR LIFTING INTAKE SCREENS

Old Boiler Tubes and a Chain Hoist a Much Simpler
and Cheaper Method than Usual Permanent
Structure at Intake Mouth

In contrast with the usual permanent intake-screen lifting apparatus used by small stations the tripod and chain hoist illustrated herewith is thought to be a model of simplicity and inexpensiveness by the company using it. It is in service at the intake of the 1000-kw. steam-turbine plant of the Crawfordsville (Ind.) Electric Light & Power Company. The outfit consists of three spliced lengths of old boiler tubing and a 1-ton (0.9-t.) chain hoist. The two legs of the tripod which are adjacent to the stream are of equal length, but the third leg, which rests back from the bank of the river, is longer than the others to give workmen plenty of room to handle outcoming or in-



SIMPLE DEVICE FOR LIFTING INTAKE SCREENS

going screens. F. H. Miller, manager of the Crawfordsville plant, states that the outfit performs its work admirably and was very inexpensive to construct.

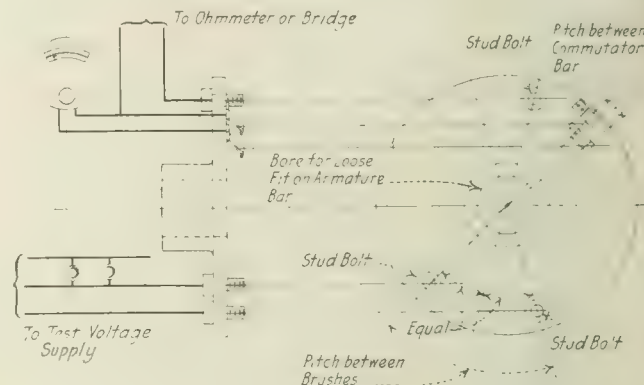
DEVICE THAT FACILITATES TESTING OF ARMATURES

Rotary Terminal Block with Contacts Can Be Slipped
on Armature Shaft and Used to Assist in
Measuring Resistance, Etc.

BY EVERETT E. GEORGE

For testing armatures the writer has made a rotary terminal block which consists of a wooden disk with three stud bolts extending through it. The bolts are equidistant from the center hole, which is bored to fit loosely on the armature shaft. Two of these bolts should be spaced so they will fall at or near the brush joints when the device is slipped on the commutator end of the armature shaft, and the third bolt should be equidistant from them but also on the commutator. When testing, the armature is set on end, with the commutator up and the shaft vertical. The testing voltage is applied across the first two bolts or legs. At a brush

point corresponding to the third leg a spring finger is attached to the disk. Across this finger and the third leg is connected a bridge or ohmmeter for measuring resistance between brush points. One commutator bar distant from this finger is a second finger. Across these two fingers is connected a millivoltmeter. Each finger



ARMATURE-TESTING CONTACT BLOCK THAT SLIPS OVER SHAFT

should be wider preferably than the mica between segments.

By using long flexible leads this terminal block may be revolved once, and if the armature is in good condition, the millivoltmeter will give a constant reading, provided the fingers are properly adjusted. With the block stationary and the testing voltage off, the resistance between brush points may be read. This device may be modified to suit the type of armature most frequently tested. By the use of this rotary terminal block the time for testing armatures can be reduced from several minutes to ten seconds.

To Buy Bonds Is the Easiest Way

INDICATING FUSE UNNEEDED UPON SECONDARY NETWORK

Experience Shows that Prompt Attention to Customers' Complaints Facilitates the Location
of Burnt-out Fuses

Following an article entitled "Parallel Operation of Distribution Transformers" in the Aug. 25, 1917, issue of the ELECTRICAL WORLD, in which S. B. Hood, superintendent of distribution for the Northern States Power Company, Minneapolis, Minn., described a special sheet-copper fuse for the secondary network, some question arose as to whether or not it was possible to tell from the ground whether one of these fuses had blown. In a letter from Mr. Hood he points out why it is not necessary for the fuses to be of an indicating type. Mr. Hood's letter follows:

"It is hardly possible to tell when one of these fuses is blown except by close visual inspection. In most cases the copper fuse link melts over a very small section near the middle. This melted space is generally too narrow to be readily visible from the ground.

"Some years ago I used this device as a visible indicator by bridging a very small copper wire across the fuse link. This indicating wire, being on longer centers than the main fuse, did not blow unless the main link fused first. The indicating wire was so delicate, however, that it readily became broken, and the actual

number of failures of the main fuse was so small that it was finally decided that the indicator was more trouble than it was worth.

"In the operation of interconnected secondary networks the operating department can depend upon the company's customers indicating very promptly when a fuse blows. If the customers' complaints receive immediate attention, defective fuses or transformers can generally be picked up on the first night the fuse is out. On the lines of the Northern States Power Company we try to maintain our secondary lamp voltage at from 114 volts to 117 volts, the latter being received by consumers very close to a transformer. As the load is evenly distributed along the secondary network, it follows that where a transformer fuse fails for any cause, the consumers close to this transformer will get a secondary drop approximately four times normal. In other words, instead of getting 117 volts at their lamps they will get about 105 volts. This sudden drop in voltage will almost surely result in one or more consumers complaining of poor light at the same time.

"It is our practice to have the trouble clerk answering these calls inquire if the light has been getting poor gradually or has been noticed to become poor suddenly. If the customer reports the latter condition, we know almost to a certainty that the fuse at the nearest transformer is out. A troubleman is then sent at once to investigate and correct the defect. We believe that chasing trouble on interconnected secondary network is a very simple problem."

GRAPHIC COMPROMISE FOR CONDUIT CONSTRUCTION

Method of Avoiding Confusion and Inconvenience in Complying with Ruling Applying to Circular Area

By a ruling of the Worcester (Mass.) wire department last July it became necessary for all new housewiring construction within a radius of one mile from the City Hall to be made in iron conduit. In laying out such work the engineers of the Worcester Electric Light Company found that if the geographical mile circle should be taken as the actual limit of iron construction, much confusion and inconvenience would result. On account of the street irregularities, certain houses lie partly within and partly without the mile circle, and next-door neighbors in the same block would in some cases be affected by the ruling and in others not.

To meet this condition and secure a positive definition of a workable character which should limit the iron construction area, the company's engineers held a conference with the officials of the wire department, and it was agreed that a compromise should be made. In other words, an irregular boundary was selected that approximately coincides with the "mile circle" but parallels the street lines so that residences on each side of the streets included will benefit by the ruling. In some cases the iron conduit area is extended beyond the mile circle, and in others it is reduced. Thus certain park land lying within the mile circle is not included in the prescribed area, while in other cases certain populous streets have been included to offset reductions else-

where. A map laid out on this principle was prepared by Messrs. Mandeville and Abbott of the lighting company without leaving their desks.

Encourage the Men—Buy Your Bond

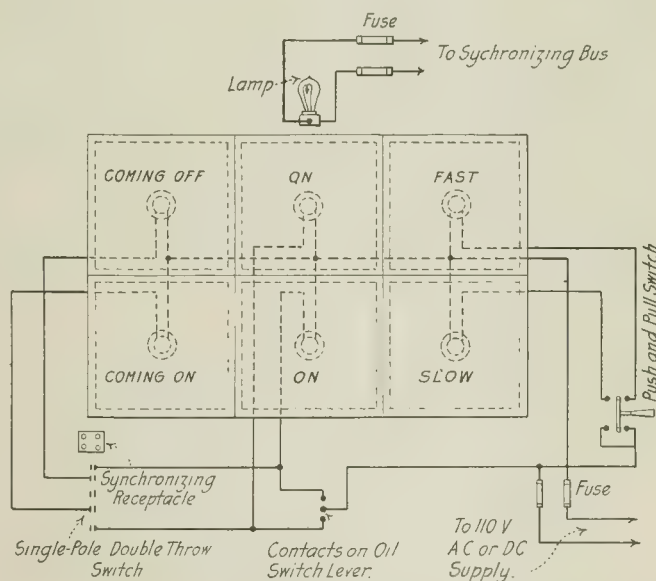
SIGNALING ARRANGEMENT FOR ENGINE-ROOM USE

Box with Six Signal Compartments and Provisions That Compel Switchboard Operator to Signal Engineer Before Synchronizing

BY WILLIAM R. DAVIS

In power plants where the generators are some distance from the switchboard a reliable system of signals between the engineer and the switchboard operator is necessary. The following is a description of a system which the writer has installed in connection with a 1500-kw. unit. A box 18 in. by 10 in. by 6 in. (46 cm. by 25 cm. by 16 cm.), made of transite, was divided into six compartments, in each of which was mounted an 8-cp. lamp. The signals were painted on tracing cloth just large enough to cover the front of the box. This box was mounted on the top of the gage board, where it could be plainly seen by the man at the engine throttle.

Two contacts connected to the signals "On" and "Off" were mounted on the generator oil switch. A pull and push switch, normally open, was mounted on the generator panel and connected to the signals "Slow" and "Fast." Just below the synchronizing plug receptacle was mounted a single-pole, double-throw knife switch, the handle of which in the up position will prevent the plug from being inserted. This switch was connected to the signals "Coming On" and "Coming Off" so that in throwing down the switch the engineer is notified that the operator is ready to synchronize. The switch is



WIRING ARRANGEMENTS FOR ENGINE-ROOM SIGNAL

mounted in such a manner as to compel the switchboard operator to notify the engineer before he synchronizes. A lamp is also mounted on top of the signal box and connected to the synchronizing bus, which permits the engineer to bring the engine to the proper speed by watching the pulsation of the lamp.

CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

PRESENT-DAY PROBLEM OF TAKING NEW BUSINESS

Ohio Commercial Managers Discuss Charges for Line Extension and Rates, Especially with Respect to Depreciation of Plant Cost

With underlying conditions to-day so abnormal, with customers seeking service where formerly their patronage was sought, new problems are presented, problems the solution of which affects the business of the years to come just as vitally as it affects the business of to-day.

At the recent meeting of the commercial men of the Ohio Electric Light Association George E. Miller, sales manager of the Cleveland Electric Illuminating Company, read a paper entitled "What Are You Doing About New Business?"

After showing how business has increased, particularly the power load, the difficulty involved in making extensions on account of labor and long deliveries of material, and the condition of the security market, with the very high cost of construction, Mr. Miller discussed the problem of new business from two angles—first, that relating to the extension of residential business, and second, that relating to the extension of commercial business—saying:

In residential business we should not lose sight of the fact that any new policy, such as an increase of rates, is serious. It is serious because rates on residential business affect so large a number of people. Moreover, there will always be among people those who feel that the central station company is taking advantage of them in their helplessness. Because any change in policy affecting residential business does affect so large a number, it is further dangerous, because it is apt to be taken up by local newspapers which find their sustenance in exploiting views that appeal to great numbers of people. Since any change of policy in residential business does affect so large a number and might react upon the company, is it not then the wiser policy to hold residential rates at their present level and to ask the customers to finance extensions for such service in whole or in part?

The plan which we have adopted in Cleveland to cover this case is as follows: The company will stand \$25 toward the cost of any extension and will ask the customer to advance the balance of the cost of extension. Then as additional residential business comes on the line the company refunds \$25 to the original customer for each additional house added to the extension. While it is realized that this plan is empirical and not ideal, the company is using it.

On the commercial business the situation is somewhat different, and on business requiring additional investment I think there should be two classifications—first, war business, which is primarily a temporary business, and, second, non-war business. I believe these two classes of manufacturers should be treated differently by the central stations, but as yet our company has not reached a solution of the problem. Personally I should like to say to the manufacturers engaged in war business something like this: You have made your deal with one of the foreign governments who financed your manufacturing operations. Why should you not finance the line extension so that we can supply the power? The difficulty comes, however, in finding

POLE AND WIRE LINE EXTENSION AGREEMENT

Agreement made this — day of June, 1917, by and between the —, hereinafter called "company," and —, hereinafter called "consumer."

SECTION 1.

- (a) The company agrees to extend its pole and wire lines from the northwest corner of lot number 10,740 north to a point at the northwest corner of lot number 10,764 and east and west from this point to lots numbers 10,757 and 10,766.
- (b) To do the work at a cost of two hundred dollars and eighteen cents.
- (c) To refund, without interest, to the consumer fifteen dollars for each additional bona fide consumer connected off of said pole and wire line extension within a period of five years.

SECTION 2.

- (a) The consumer agrees to pay the amount specified in Section 1
- (b) And deposit said sum with the company upon the signing of this agreement and before said work is commenced.

SECTION 3.

It is mutually agreed:

- (a) That so much of the sum specified in Section 1 (b) as shall not have been returned to the consumer within a period of five years shall not be subject to refund but shall be retained by the company as part consideration thereof.
- (b) That in no case shall the amount of refund by the company exceed the amount paid by the consumer under this agreement.
- (c) That this agreement covers said extension and that no additional poles are included, and that refund will be made according to Section 1 (c) on customers that are within one hundred feet of said line.
- (d) Customer's deposit shall not at the end of any one year be greater than an amount which is the difference between the gross revenue paid by all consumers within the limits of said line and the original amount of said two hundred dollars and eighteen cents deposit.

The settlements are to be made at the request of the consumer at the end of one year, and final settlement is to be made within the five-year period.

In witness whereof the parties hereto have, by their duly authorized agents, executed this contract in duplicate this — day of June, 1917.

the dividing line between war business and non-war business, since many concerns employed in apparently peaceful pursuits are vitally aiding the Allies. Nevertheless, some solution for this problem should be worked out, and worked out quickly, or otherwise central stations will find themselves in an even more difficult situation.

The public utilities law in Ohio provides that a valuation for rate-making purposes must be made on the basis of reproduction new at the time the rate making is in progress. Under these conditions a company which puts \$6,000,000 into its property during 1917 and 1918 may be in 1919 confronted by some politician stirring up a rate case. Readjustment of prices by that time may have reduced the then value of the property represented by that \$6,000,000 to as little as \$4,000,000, which was its value three years ago. In that case the question arises as to what will become of the extra \$2,000,000 of actual money which was put into the property.

We in Cleveland have not the solution of that problem. One solution might be to increase the commercial rates to take care of increases in capital expenditure—to set aside a fund to take care of this extraordinary depreciation. But the expected decrease in prices may not come. Then the question arises, has the central station any right to charge increased commercial rates and accumulate a fund to write off something which it may never write off? Moreover, this policy, if it is adopted, must have the approval of the public service commission.

I wish to emphasize, however, that some move toward

the solution of this difficulty should be made and made quickly. Quite frequently nowadays the War Department is asking central station companies to make extensions, and these must be made. It is the government's policy not to object to any of the rules and regulations which any operating company may have on file with the commission, so it seems to me that it is the plain duty of every public service company to perfect a plan which will protect its capital investment made under the present conditions.

Following Mr. Miller's address, J. B. Johnson of Elyria stated that his company had been paying \$20 toward each residential extension, and expressed the belief that the average residential customer is not worth a twenty-five-dollar extension investment.

A representative of an Ohio operating company read the agreement on the opposite page, pointing out that the customer might be able to get his money back either through the addition of sufficient new customers to the line or through the use of enough energy to justify the extension. A representative of another company in southeastern Ohio stated that his company was endeavoring to close a contract which would involve an expenditure of \$250,000 and was asking the company to guarantee a 25 per cent load factor. The contract is to run for a term of ten years. He also cited incidents wherein manufacturers were very glad to bear a part of the line-extension expense. Another company is asking its prospective customers to buy its bonds in an amount equal to the extension required to serve them. In one instance this company is furnishing a town with material to build a line to serve itself. The town will pay for the material and at a later date will rebill the company for the material and labor in the line.

Get on the Band Wagon—Buy a Bond

SCHEME TO PROVE STEAM HEATING UNPROFITABLE

Strategic Move by a Lighting Company Which Plans to Rid Itself of a Franchise That Is Proving Burdensome

A central station company in the Middle West which has been operating a combination electric light and power and steam-heating station has recently gone about getting rid of the steam-heating end of the business in a rather interesting manner. Owing to the company's growing load and to some new territory which it had recently connected by transmission lines the location of the old plant became not the most economical one possible on the system. The company accordingly built a new station in the same city, but at another location. Contrary to what would supposedly be best practice, it divided its generating station instead of working toward consolidation. In the new plant there are boilers, engines and equipment for furnishing electric light and power, while in the old station sufficient boilers were left merely for furnishing steam heat.

This division makes it possible for the company to make an exact showing on just what the steam-heating plant is doing. The rates are ridiculously low, and it undoubtedly will show on the company's books as incurring a deficit. The franchise under which this plant is operating expires in about four years. Between this time and the expiration of the franchise the company can conduct a sufficiently effective publicity

campaign to acquaint the steam-heat customers with the fact that the plant is not a paying proposition at the existing rates and cannot be made to pay without entirely rehabilitating the system at an extraordinary expense. At the end of the franchise it will probably be possible to get rid of the plant without creating unfavorable comment.

The Call for Liberty—Buy a Bond

MAKING A PAID SALESMAN OUT OF EVERY EMPLOYEE

St. Louis Company Pays the Members of Its Organization Outside of the Commercial Department a Commission for Successful Leads

For some time past the Union Electric Light & Power Company of St. Louis has been endeavoring to enlist the aid of every employee of the company in securing new customers. At first the plan was to acknowledge the receipt of leads by publishing the names of those who contributed them in the company's magazine, *Wire and Pipe*. The publication of names arranged by departments created friendly rivalry which made the plan quite successful. During the first four months of 1917 the company received 347 leads from its employees, and from these leads it closed 250 contracts.

At that time, however, the plan was changed so that the sales department now pays employees and other departments of the company for their personal efforts on the following basis: 25 cents for each residential lead, 35 cents for each commercial lead and 50 cents for each industrial lead, provided in every case that a contract is obtained.

This commission is not paid if a prior lead has been received, and it is not paid for leads received by office employees during the regular course of business. The sales department furnishes each department head with a supply of the forms shown herewith. Employees are requested to report leads on these forms, filling out the prospective customer's name and address and information regarding an appointment, if a definite appointment has been made. The form is filled out in triplicate, the original and the duplicate being sent to the chief clerk of the sales department as promptly as possible, and the triplicate copy being kept for the record of the person sending in the lead. If it is more convenient, it is possible for an employee to telephone the sales department. Provision has been made for taking care of such tips.

During the second four months of this year, May to August inclusive, F. D. Beardslee, sales manager of the company, states, 810 leads under the new plan were obtained from employees and 533 contracts were sold. These results indicate that the cash incentive increased the number of leads received in the ratio of 1 to 2.4 and increased the ratio of contracts obtained in the ratio of 1 to 2.13. From this it is evident that the offer of money not only broadened interest in the plan but also made non-commercial employees search more diligently for business.

It is interesting to note the excellent type of leads secured. In July, for instance, the leads from employees were 137 in number, of which 91 resulted in contracts, or 66.4 per cent. Fifty-eight employees, representing

sixteen departments in all, sent in these leads. As a rule, of course, the number of leads per employee per month is in the neighborhood of two or three, but in this month of July one man in the collecting department sent in eleven leads, ten of which resulted in contracts, and one man in the installation department reported twelve prospects, with a result of eight contracts ob-

company has received fewer complaints and its customers appear to be better satisfied.

Quite a few of these post cards have been noticed tacked on the wall near the meter, which the company feels is an indication of approval of its plan of furnishing a permanent record of the condition of the meter at a stated time.

SALESMAN'S REPORT

CONTRACT SECURED? { YES WHEN? - - - - - DATE 191
NO

CONTRACT SECURED ON THIS LEAD? YES-NO

CONTRACT SECURED ON PRIOR LEAD? YES-NO

NATURE OF SUCH PRIOR LEAD?

SALESMAN DATE 191

INQUIRY FOR SERVICE

NAME

ADDRESS

CALL AT

TELEPHONE No. BUSINESS

NATURE OF SERVICE WANTED { COMMERCIAL
RESIDENTIAL } CHECKED FOR PRIOR CONTRACT } 1
CHECKED FOR SERVICE }

LEAD FROM

CALL RECEIVED 191 TIME A. M. BY
P. M.

APPOINTMENT MADE FOR (Date) AT (Time) A. M.
P. M.

REFERRED TO

BY DATE 191 TIME A. M. REPORT EXPECTED
P. M.

FRONT AND BACK OF CARD USED BY EMPLOYEES OF ST. LOUIS COMPANY ACTING AS SALESMEN

tained. It is interesting further to observe the interest in the plan that has been taken by the more technical departments of the company.

A PLAN FOR INFORMING CUSTOMERS OF METER TESTS

It Has Been Found in Small Eastern Town to Allay Suspicion and to Reduce Number of Complaints

A simple and inexpensive plan for keeping the customer posted on the test condition of his service meter has been put in practice in Salem, N. Y., a town of 1300 people, by the Salem Light, Heat & Power Company, which has had exceptionally good customer-relations results.

It has been the policy of this company, W. H. Simpson, the superintendent, writes, as soon as a complaint

SALEM LIGHT, HEAT and POWER CO.

Salem, N. Y.,19....

M....:-

We have this day tested Meter No.

through which we serve you.

The Meter registers.....% at.....load.

Kindly place on file for your reference.

S. L. H. & P. Co.,

Sup't.

POST-CARD NOTIFICATION TO CUSTOMERS

is entered just to check up the bill and then to test the meter. Frequently the meter is tested when the bill is known to be correct, so that the customer can know the result.

As soon as the test is completed and the results checked over, a post card such as the one shown is mailed to the customer. Since this plan was started the

Hit the Line Hard—Get That Bond

COMMONWEALTH EDISON OPENS BARGAIN ROOM

Shopworn Goods Formerly Sold at Employees' Sales Are Now Disposed of to Public Also at 33 1/3 per Cent Discount

The Commonwealth Edison Company of Chicago formerly disposed of goods which became shopworn in its electric stores by occasionally conducting an employees' sale. With the increasing stock and the larger volume of merchandising business which the company now does, it seems that there will be enough of this sort of merchandise to keep the sale going at all times. Therefore a new bargain salesroom, adjoining the company's electric shop at 72 West Adams Street, has been opened.

The management of the company is unwilling that any customer of its electric shops should have an opportunity to claim that the goods purchased were not absolutely new. Consequently something must be done with the lamp shade which has acquired a finger mark or a little dust on the trimmings, though this does not really hurt its value except under the most critical inspection. An article having a highly polished nickel or copper finish will become dull and will not look right until it is rubbed up as these things constantly are in the home. A lamp shade which has a scratch or a slight nick inflicted by somebody's umbrella—things like these are taken off the main salesroom floor and become a part of the stock in the new bargain salesroom. This salesroom will be open to the general public as well as to employees. The discount from the retail prices originally asked for the articles will be 33 1/3 per cent for everybody without further discount to employees. This new bargain salesroom, it is believed, will enable a great many people to get really first-class electrical goods in almost perfect condition.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

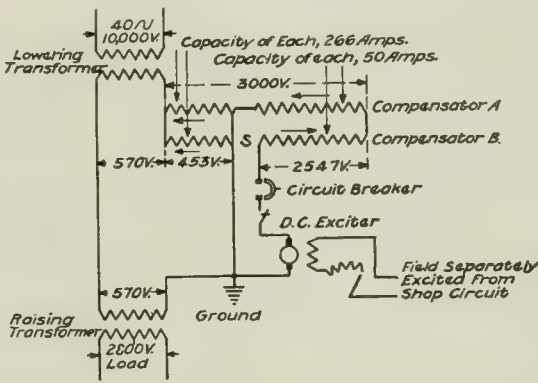
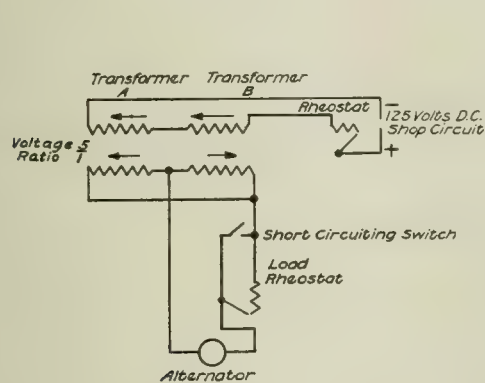
D.-C.-EXCITED TRANSFORMERS
AS CURRENT-LIMITING REACTORS

Two Auto-Transformers Connected with Half of Each Winding in Multiple for A.-C. Circuit, Other Windings in Series for D.-C. Excitation

TO PREVENT frequent interruption of the entire source of energy available in the testing department of the General Electric Company, auto-transformers were connected as shown in Fig. 2 so that half of each winding could be excited by direct current. In this way the iron cores were initially saturated with

transformers connected as shown in Fig. 1. The most convenient source of power at the time was a small 8-kw. alternator, giving 250 volts at 125 cycles, although one test was made at 40 cycles. The data used in plotting the curves in Fig. 5 were obtained with a short-circuited load and with the secondary coils of the two transformers in multiple to act as a reactor connected directly across the alternators while the voltage was held constant.

For the curve in Fig. 3 the alternator voltage and direct-current excitation were held constant, the former at 250 volts and 125 cycles, while the load was varied.

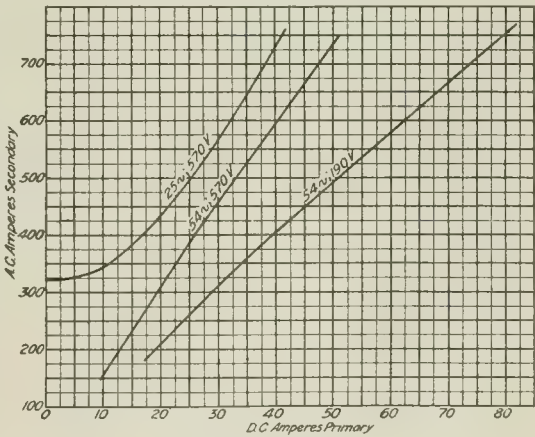
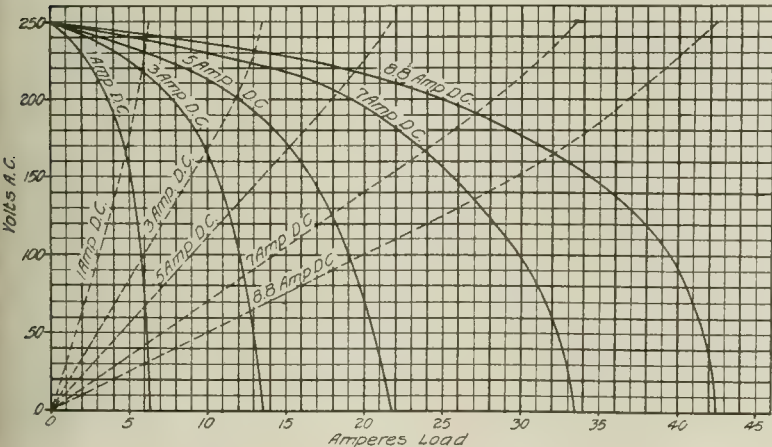


FIGS. 1 AND 2—CIRCUIT EXPERIMENTED WITH, AND METHOD OF PROTECTING CIRCUIT WITH DIRECT-CURRENT-EXCITED TRANSFORMERS

a unidirectionally magnetic flux of opposite polarity in each with respect to the alternating emf. in the secondary coils.

Before setting up the large compensator, which was

Curves were plotted for the voltage across the load as well as across the reactor. These curves are probably not very representative of what might be shown by tests at a lower frequency. The dotted set of curves



FIGS. 3 AND 4—DATA OBTAINED WITH SET-UPS INDICATED IN FIGS. 1 AND 2 RESPECTIVELY

formerly used on single-phase interurban railway cars for reducing the voltage from 3000 to 453, a preliminary test was made with a pair of 10-kw. lighting

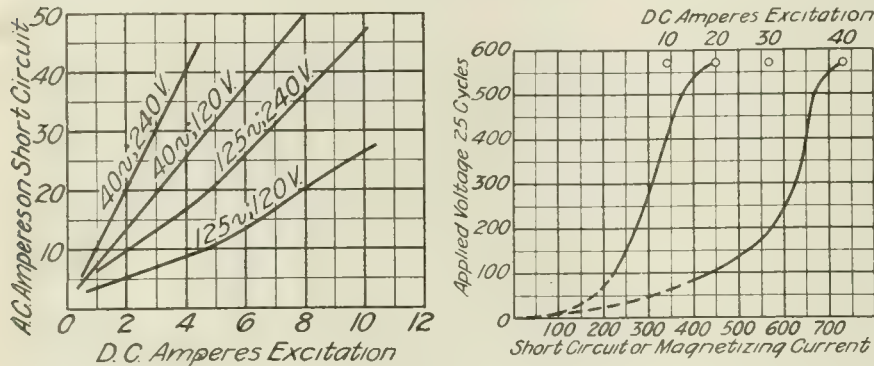
show an upward curvature which would indicate a better regulation of the circuit under normal operations for a given current limit on short circuits than with a coil of uniform reactance at all loads such as an air-core reactor.

Next, the outfit selected to protect the testing service

*This method of connecting transformers for use as current-limiting reactors has been described by John D. Taylor in a paper entitled "Even Harmonics in Alternating-Current Circuits," *Trans. A. I. E. E.*, Vol. XXVIII, Part 1, 1909, page 729.

was tested with current from the load side before being connected with the power line, tests similar to those made with the smaller transformers being conducted on short circuit. The data for these tests are shown in Figs. 4 and 6.

The curves in Fig. 7 afford an opportunity of studying what performance might be anticipated with mag-



FIGS. 5 AND 6—DATA OBTAINED WITH SET-UPS IN FIGS. 1 AND 2 RESPECTIVELY

netically biased transformer cores. The curves indicate a series of unsymmetrical hysteresis loops starting at different flux along the magnetic saturation curve of silicon steel and dropping through an amplitude of 4000 lines per square centimeter in each case, then returning to the starting point. In each the steel is more and more magnetically biased as the centers of successive loops get further away from the intersection of the neutral axes. In the reactor with a direct-current component of ampere turns giving magnetically biased cores the alternating magnetizing will vary over the range of H at a rapidly increasing rate in the case of each of the successive loops when constant alternating voltage is impressed across the winding B and the direct-current excitation H is varied. In other words,

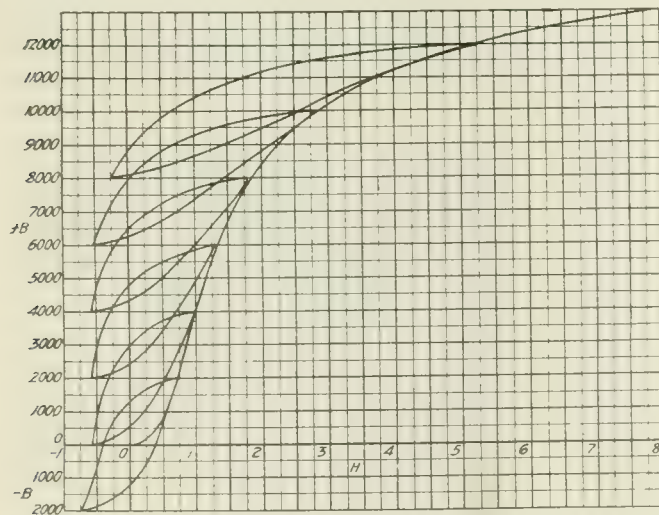


FIG. 7—GROUP OF UNSYMMETRICAL HYSTERESIS CURVES, INDICATING THAT MORE ALTERNATING CURRENT CAN FLOW THE GREATER THE MAGNETIC BIAS OF THE DIRECT-CURRENT-EXCITED TRANSFORMER

as the direct-current ampere-turns are increased, the reactance is reduced, because more alternating current must flow to overpower the direct-current magnetization before it can induce the same counter emf. This information was presented by F. Parkman Coffin in the October, 1917, issue of the *General Electric Review*.

Lamps and Lighting

Relative Sensibility of the Average Eye to Light of Different Colors.—Data on the spectral sensibility of radiation of the average eye, as based upon a group of 130 observers, of which number seven were known to be color-blind. The relative-visibility curves were determined with a flicker photometer and an equality-of-brightness photometer. The data available indicate that 60 per cent of the cases examined fall into three quite evenly divided groups which are either (1) red-sensitive, (2) blue-sensitive, or (3) average; while 30 per cent of the cases examined are quite evenly divided into three groups which fall below the average sensibility in either (1) the red, (2) the blue, or (3) both the red and the blue, thus giving rise to an apparently high sensibility in the green. A mathematical equation is given of the

average visibility curve, which is applied in a separate paper in calculating the luminous energy emitted by a black body at various temperatures; also the luminous efficiency, the Grova wave length, and the mechanical equivalent of light. The value of the latter is about 50 candles per watt of luminous energy of maximum visibility.—*Scientific Paper No. 303, Bureau of Standards.*

Generation, Transmission and Distribution

Electricity Supply Costs.—FRANK H. WHYSALL.—The author discusses factors which must be considered in selecting a site for a station and also the effect of the size of the undertaking on the cost of supply. Special consideration is given to the use of exhaust steam for industrial purposes.—*London Electrician*, July 27, 1917 (abstracted from *Channel*).

Relative Cost of Producing Electric Energy and of Purchasing It.—G. P. ROUX.—An inquiry into the principles that should underlie the decision of industrial consumers as regards generating energy or buying it from the central station. The common method in estimating cost of production is to include exploitation, maintenance and fixed charges, the latter covering interest, insurance, taxes, amortization and depreciation. Other factors are often ignored, as, for example, rent, probable increase of taxes, and the productive capacity of the capital invested in electrical equipment as compared with what it would bring if employed in the regular work of the factory. Besides these there are factors of less importance. The author groups under "cost of production" coal, ash disposal, water treatment, lubricants, wages and accident insurance, professional services, and expense for repairs and upkeep. Under "fixed charges" he lists a number of items that enter into the initial outlay but are usually overlooked when estimating total interest charges. Among these are counsel fees, expense of preliminary studies and experiments, charges for transportation, storage and watchmen, payment for lost time by workmen, insurance and interest on capital during the construction period, and the outlay in the final period of experiment and verification before the equipment is ready for operation. Such items sometimes make up 10 per cent of the cost of installa-

tion. Against amortization charges, on the other hand, there should be set the scrap value of some parts of the equipment, old copper, for instance, being worth 60 per cent of its original price. The cost of reserve generating equipment should never be lost sight of. Continuity of service cannot be assured without it. None the less, the author has never known it to be taken into consideration, as it should be, in estimating the net cost of power. Then there is the loss, already alluded to, of the difference between an arbitrary return of, say, 6 per cent on the capital tied up in the electrical installation and the presumably much higher rate of profit from funds invested in the business proper. The necessity of keeping on hand a considerable amount of ready money to meet current expenses of the plant is a further consideration. Similar calculations to the above should be made by the central station companies themselves in framing their tariffs. This task of computation belongs to the specialist, the engineer, who could often save the consumer of electrical energy important sums.—*Revue Gén. de l'Elec.*, Sept. 1, 1917.

Installations, Systems and Appliances

Electric Resistance Furnace.—FRANK THORNTON.—Description of experiments on an electric resistance furnace with various resistors placed inside the furnace, either on the hearth of the furnace or on a shelf around the walls. The furnace was designed for heating steel commercially to forging temperatures. It was pointed out that such a furnace would have many other applications, such as heat treating, melting, firing ceramics, etc. Many difficulties were encountered in using granular resistor beds, and it was decided to try silica carbide blocks or slabs for the resistance material. The results were satisfactory and the furnace was operated successfully up to 1200 deg. C. for hardening tools and dies and for firing porcelain.—*Met. and Chem. Eng'g*, Oct. 15, 1917, report of meeting of A. E. S.

Electrophysics and Magnetism

Relation Between Tension and Magnetic Permeability.—JAMES THERON ROOD.—Cast iron is unaffected in its magnetic properties by stresses, whereas wrought iron and steel are greatly affected in their magnetic properties by extensional stresses. This effect, however, is not a constant but varies in both sign and magnitude, according to amount of stress and to degree of saturation. Below the knee of the B - H curve permeability of wrought iron and steel is increased by all stresses below a certain maximum, this maximum varying with the material. This increase may be as high as 20 per cent. For stresses beyond this maximum the permeability is decreased up to the elastic limit of the material. This decrease may reach 15 per cent. Above the knee of the B - H curve permeability of wrought iron and steel is decreased by any extensional stress. This decrease may reach a value of 8 per cent or more. Its value diminishes as the degree of saturation increases. With rolled material the effect of tension on magnetic properties increases as the elasticity decreases. Cast iron is an exception. Considered from standpoint of the free and combined carbon present in the material, the results of the tests made fall naturally into the ascending scale of cast iron, steel, wrought iron. The carbon molecules or particles may act as filler or cement, thus preventing the free action of the pure iron

molecules. If it is assumed that the effect of tension is, first, to twist the molecules so as to bring their axes toward parallelism with the direction of the stress; second, to tend to separate the molecules, the reversal effect at low stresses can be accounted for.—From paper read before American Association for the Advancement of Science, Dec. 29, 1916.

Units, Measurements and Instruments

Electric-Current Measuring Instruments with Parabolic Law of Deflection.—J. K. A. WERTHEIM SALOMONSON.—Made by mechanically coupling the moving parts of two instruments, in one of which the deflection is proportional to the current and in the other proportional to the square of the current, so that they oppose each other. A discussion is presented regarding the relative or absolute sensibility of such an instrument and suggestions are given as to its use.—London *Electrician*, Sept. 7, 1917 (abstract of paper in *Proceedings of Koninklijke Akademie van Wetenschappen*).

Miscellaneous

Transfer of Heat Between a Flowing Gas and a Containing Flue.—LAWFORD H. FRY.—The author offers a formula which within a wide range of conditions will represent with all the accuracy needed for practical work the processes of heat transfer between a gas and a metallic flue wall. The formula applies equally well to the loss of heat by a hot gas in a cooler flue and to the gain of heat by a cool gas in a hotter flue, and although it has been established by purely empiric methods, yet the accuracy with which it conforms to the results obtained by various observers using widely differing experimental methods leads to the belief that it represents closely the fundamental law by which heat is transferred under the conditions under consideration. The wide range of the experimental data on which the formula is based may be summarized briefly as follows: The gases experimented with were products of combustion, lighting gas, CO_2 and air, all at atmospheric pressure; also air at pressures ranging from 0.15 lb. to 140 lb. per square inch absolute. The rates of flow ranged from 0.5 lb. to 650 lb. per hour. Flues of annular and circular cross-section were used, with effective diameters ranging from 0.5 in. to 2 in. and of lengths from 0.64 ft. to 20 ft. The inlet gas temperatures ranged from 2340 deg. Fahr. with the products of combustion being cooled to 55 deg. Fahr. with air being warmed. In all of the experiments throughout this wide range of conditions the transfer of heat is satisfactorily represented by the general formula: $\log \log T_1/t - \log \log T_2/t = Mx$, and if the flue temperature be higher than the gas temperature, $\log \log t/T_1 - \log \log t/T_2 = Mx$, where M is a constant in any given case, being dependent only on W , the rate of flow of the gas, and on $d/4$, the hydraulic depth of the flue. In the experiments under consideration there is a critical rate of flow at about 5 lb. of gas per hour. At all rates of flow above this the value of the coefficient M is accurately given by the equations $\log M = A - m \log W$, where $A = 1.558 - 0.185d$, and $m = 0.14 + 0.083d$. Applications of the formula are based on a Babcock & Wilcox experiment in which products of combustion at a high temperature were passed through a water-jacketed flue and the temperature determined at a number of points along the flue.—*Journal of A. S. M. E.*, October, 1917.

Scientific and Industrial Research

A Department Devoted to Interchange of Ideas,
Investigations Contemplated, Research Facilities
Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF

Cornell University, Ithaca, N. Y.

A NATIONAL UNIVERSITY FOR PROMOTING RESEARCH

Bill to Create Such an Institution Was Introduced
in the Last Two Congresses, and Another One
Will Probably Be Presented Soon

A bill to create a national university, one of the purposes of which will be to provide for scientific research, was introduced by Mr. Murray in the last (Sixty-fourth) Congress and was heartily supported by Mr. Fess, of the committee on education, who introduced a similar bill in the Sixty-third Congress. It has been stated on good authority that a similar bill will be introduced as soon as the next regular session convenes in December.

As outlined in the recent bill, the purpose of the national university is fourfold: (1) To provide instruction in foreign trade, diplomatic and consular service and in international law; (2) to promote the advance of pure and applied science and of the liberal and fine arts by original investigation and research; (3) to provide for the higher instruction and training for posts of importance and responsibility in state and federal government; (4) to co-operate with the scientific departments of the federal government and with institutions of higher learning throughout this country and abroad. The university shall confer no academic degrees, but an equivalent of the master's degree from some institution of recognized standing will be required for admission. Supervision of the university shall be in charge of a board of trustees consisting of the Commissioner of Education and twelve members appointed by the President of the United States, the term of one member expiring each year. In addition there shall be an advisory council consisting of one representative from each state. Museums, libraries, bureaus, laboratories and departments of expert research belonging to the federal government shall be as far as possible open to the students. An appropriation of \$500,000 is asked for the first year.

In presenting the unanimous report of the committee on education in favor of such a university, Representative Fess pointed out the resourcefulness of the German scholars and scientists, who, by finding substitutes for the supplies cut off by the war, are doing as much as, if not more than, the German soldiers in the war. Already the city of Washington is a research center, and it has model laboratory and library equipment in the various governmental bureaus. Hundreds of experts are available so that research can be easily cared for. The national university proposed will not interfere with existing colleges and universities, but will supplement them. It will divert the flow of American students to Europe and attract Europeans here.

Summary of Investigations, Available Apparatus and Research Suggestions

INVESTIGATIONS UNDER WAY OR COMPLETED (RESEARCH WORK REPORTED SINCE SEPT. 15.)*

ELECTROLYTIC CORROSION.

Investigation of pipe drainage systems to avoid electrolysis.—*Burton McCollum and K. H. Logan, Bureau of Standards, Washington.*

GALVANOMETERS.

Development of new type of vibration galvanometer which shall be sensitive and portable.—*P. G. Agnew, Bureau of Standards, Washington.*

LAMPS, TUNGSTEN.

Candlepower maintenance of series type C tungsten lamps.—*J. F. Meyer and E. C. Crittenden, Bureau of Standards, Washington.*

MAGNETIC TESTS.

Determination of mechanical properties of steels by magnetic analysis.—*C. W. Burrows and R. L. Sanford, Bureau of Standards, Washington.*

Investigation of effect of repeated stress upon magnetic properties of steel.—*C. W. Burrows and R. L. Sanford, Bureau of Standards, Washington.*

PHOTOMETRY.

Measurements for the establishment of a normal eye for heterochromatic photometry.—*E. C. Crittenden and A. H. Taylor, Bureau of Standards, Washington.*

Investigation of diffusely reflecting white paints for use with sphere photometers.—*A. H. Taylor, Bureau of Standards, Washington.*

RADIOACTIVITY.

Study of radioactive luminous preparations; determination of time-luminosity curves, variation of luminosity with quantity of material, etc.—*N. E. Dorsey, Bureau of Standards, Washington.*

RADIO TRANSMISSION.

Development of radio-frequency current transformer.—*R. D. Duncan, Jr., Bureau of Standards, Washington.*

SIGNALING APPARATUS.

Development of fog-signaling apparatus.—*F. A. Kolster, Bureau of Standards, Washington.*

STANDARD CELLS.

Improvements of Weston normal cell. Preparation of mercurous sulphate with definite, uniform and constant properties.—*E. C. McKelvy and M. P. Shoemaker, Bureau of Standards, Washington.*

TELEPHONE LINES.

Investigation of methods for measuring the transmission efficiency and losses in telephone lines.—*F. A. Wolff, Bureau of Standards, Washington.*

X-RAYS.

Investigation of protective materials for X-ray work.—*W. S. Gorton and P. T. Weeks, Bureau of Standards, Washington.*

SUGGESTIONS FOR RESEARCH

CURRENT TRANSFORMERS.

Experimental investigation of electric by-pass valves, vacuum gaps, sphere gaps and other similar devices as a protection of current transformers against traveling waves and surges with steep front.—*Editorial Suggestion.*

FUSE INDICATOR.

On a branch transmission line protected by a fuse, some arrangement to indicate at a distant place, say in a power plant, when the fuse has blown. Either an extra low-tension pilot wire could be allowed or the telephone wires should be used.—*Editorial Suggestion.*

IRON, ELECTROLYTIC.

The electrolytic production of iron on an industrial scale seems to have a bright future, but it is accompanied by a polarization of electrodes. This is probably the only reason for which all iron has not been produced electrolytically for a long time, like copper which is electrolytically refined. It is of great interest to find out how this polarization varies with the nature of the electrolyte, its temperature, etc.—*H. Le Chatelier, Paris, France.*

PHASE BALANCING.

Large operating companies are at times called upon to furnish large single-phase loads, such as electric furnaces, which badly unbalance their generating and distributing systems. It is desired to develop inexpensive devices or methods of connections that would remedy the situation at least in part. Revolving phase balancers or motor-generator sets are often too expensive and require attention.—*Editorial Suggestion.*

STORAGE BATTERIES.

Determination of the charging current which will flow when a definite constant potential is applied to a storage cell under various conditions of state of charge, temperature, specific gravity of electrolyte, type of plate, age of plate, etc.—*J. Lester Woodbridge, Electric Storage Battery Company, Philadelphia.*

TRANSFORMER OIL MAINTENANCE OF.

We have not found that even the latest type transformers can be relied on to prevent the entrance of moisture unless an unusually high degree of skill is exercised when assembling the transformer cover and bushings. There is no difficulty in drying the oil except that the time and expense of drying transformers which are out some distance from the maintenance headquarters is quite large.—*E. P. Peck, Georgia Railway & Power Company, Atlanta, Ga.*

*The names of individuals given after each institution reporting investigations are those of persons with whom others interested should communicate. All institutions reporting research work should give such names.

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

SAVING MONEY TO BUY THE LIBERTY LOAN BONDS

Allen B. Forbes Says that Economic Losses from Wars Often Do Not Have the After Effects Anticipated

Every effort is being made by the Liberty bond committee in New York to impress upon the people the necessity of saving to buy bonds. So far as is possible the money must come out of present and future earnings of Americans.

"Intensified production and intensified economy" must be the slogan if America is to win the war and end the German menace. This was emphasized in a statement by Allen B. Forbes of Harris, Forbes & Company, chairman of the distribution committee. Mr. Forbes said:

The economic losses resulting from wars, while staggering in their totals, often do not have the serious after effects on the industrial and financial structure of a nation that it would seem natural to anticipate. This is true because of the fact that the law of compensation still continues to exist even in the midst of the most horrible of all human activities—devastating war.

It is perfectly reasonable to anticipate, for instance, that as a result of the destruction of capital caused by the present European war the world will face during the next decade a world-wide rise in interest rates. This expectation appears logically and economically sound. History has amply proved, however, that such a development does not invariably attend the ending of a war.

The period from 1853 and 1864 was one of almost continuous wars. During this period there occurred the Crimean war, the Italian Liberation war, the Austro-Prussian war and our own civil war. Interest rates were high during this period, but the Bank of England records show that immediately after the end of these wars the interest rate declined sharply and for the next twenty years the open discount rate averaged less than 3 per cent, declining at one time to 1 per cent. In other words, after these wars the discount rate averaged less than during the period before the wars began.

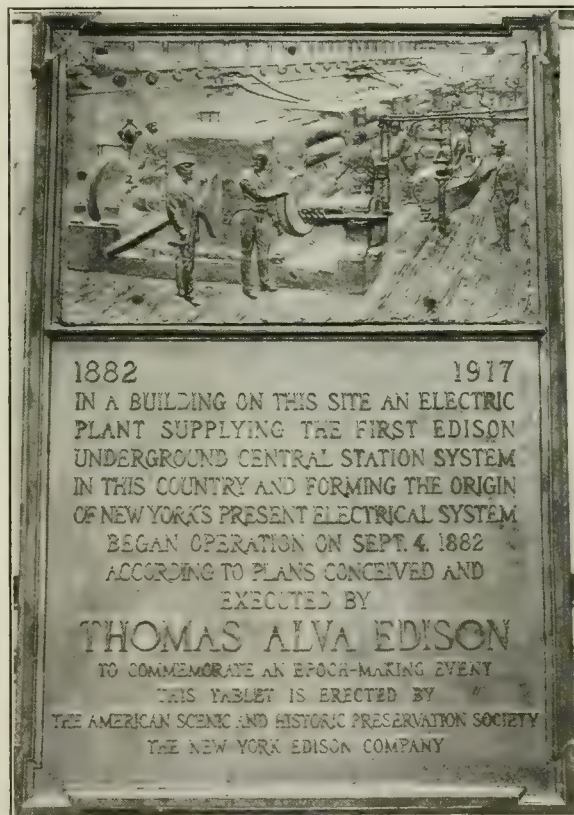
In fact, it appears that the movement of the interest rate of the world during this period was very similar to what occurs during a panic. In the midst of a panic interest rates usually advance, but immediately after the panic there ensues a period of comparatively low interest rates. We all know that the investor who has the foresight and courage to purchase high-grade investment bonds during panic periods not only obtains an investment returning him for many years thereafter an unusually high interest return, but invariably later on has the satisfaction of witnessing a material enhancement in the value of his investment.

Among the compensating advantages resulting from wars which go a long way toward offsetting the economic losses suffered at that time are increased national production and increased national economy. If we are going to carry this war through to a successful conclusion and if we are going to avoid disastrous after effects, we have got to have intensified production and intensified economy. Certainly, no one in this country is exempt from 'doing his bit' in this respect. People who never owned a bond or had a bank account must economize and build up a bank account and become owners of government bonds. This is certainly the least service that our country can ask of any of us.

NEW EDISON TABLET FOR THE PEARL STREET STATION SITE

Exercises Commemorating Thirty-fifth Anniversary of Incandescent Lamp Part of the Electrical Exposition in New York

Exercises commemorating the thirty-fifth anniversary of the introduction of the incandescent lamp in New York and for the dedication of the bronze tablet which is to be placed on the site of the original generating station operated by Edison at 257 Pearl Street, in that city, were held at the Grand Central Palace on Thursday of this week in connection with the annual Electrical Exposition.



BRONZE TABLET WHICH WILL MARK SITE OF FIRST EDISON
ELECTRIC POWER HOUSE IN NEW YORK

Thomas Alva Edison was invited to be present, as were also the men who were with him during the construction of the original station.

Borough President Marks accepted the invitation of the American Scenic and Historic Preservation Society to make an address. Other speakers on the program were Dr. George F. Kunz, the president, and J. W. Lieb, president National Electric Light Association. Arthur Williams, general commercial manager New York Edison Company and president of the Electrical Exposition, presided.

CONTRACTORS ORGANIZE TRADE RELATIONS TO THE INDUSTRY

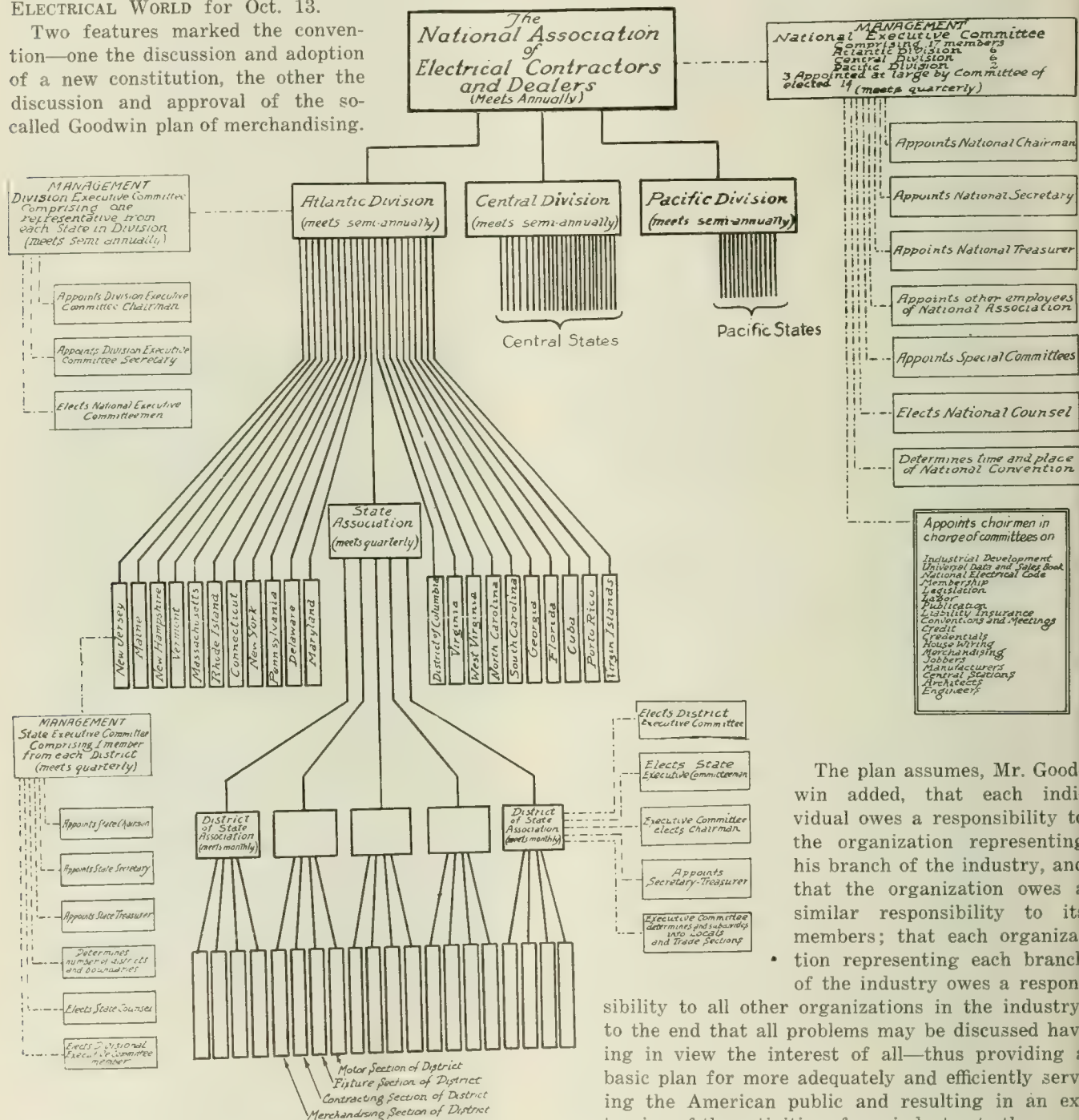
New Constitution Adopted and Constructive Program to Better Trade Relations of Industry Agreed Upon

An epoch-making convention of the National Electrical Contractors' Association was held on Oct. 8 to 13 at New Orleans. The general program and part of the sessions were reported in the ELECTRICAL WORLD for Oct. 13.

Two features marked the convention—one the discussion and adoption of a new constitution, the other the discussion and approval of the so-called Goodwin plan of merchandising.

cipally through trade papers, trade organizations and other channels, to co-ordinate the various interests in the electrical industry.

Or, to put it another way, the plan seeks to bring together in harmonious action the various interests in the industry, so that there may be established the retail distribution of electrical materials, at fair prices to the consumer and with a fair profit to all parties taking part in the transaction.



THE FAR-REACHING PLAN OF ORGANIZATION

William L. Goodwin presented a paper entitled "The Ills of the Industry and Their Remedies Through the Proposed National Association of Electrical Contractors and Dealers." A condensed report of his talk follows:

The Goodwin plan, said Mr. Goodwin, involves a campaign of education, now under way, conducted prin-

The plan assumes, Mr. Goodwin added, that each individual owes a responsibility to the organization representing his branch of the industry, and that the organization owes a similar responsibility to its members; that each organization representing each branch of the industry owes a responsibility to all other organizations in the industry, to the end that all problems may be discussed having in view the interest of all—thus providing a basic plan for more adequately and efficiently serving the American public and resulting in an extension of the activities of our industry to the great undeveloped field before us.

In outlining his plan at length Mr. Goodwin expressed the belief that it will be necessary for the national contractors' organization to develop an income of at least \$250,000 per year to deal properly with the problem before the contractor-dealer. He added:

"In order to do that, for your own self-interest, you must have the financial support of every contractor-

dealer in the industry, so far as it may be possible for you to enlist their support. You need that money to provide the staff, and the staff is necessary to carry out the plan which I have proposed. The present officers of the national association are handicapped from lack of finances to accomplish the results desired."

The chart reproduced here indicates the sweeping changes in the constitution. Local associations form the working units governed by state and national associations and boards by delegates from the locals. The constitution also provides for members such as drug stores, hardware and department stores which are doing a retail electrical business. The constitution was adopted unanimously.

President R. S. Stearnes and the other officers and committees of the association will continue in office until the new executive committee is formed under the new constitution. This executive committee will then appoint its own and the national chairman and other officers for the year.

Meanwhile special state committee chairmen on permanent organization have been appointed as follows, under the three division chairmen—James R. Strong, New York, for the Atlantic Division; Earnest McCleary, Detroit, for the Central Division, and H. C. Reid, San Francisco, for the Pacific Division:

Alabama	J. R. Wilcox	Minnesota.....	W. I. Gray
Arkansas	C. G. Rush	Missouri.....	Fred Adam
California ...	W. D. Kahlwey	Nebraska.....	James Corr
Connecticut..	G. M. Chapman	New Jersey..	Paul H. Jaehnig
Georgia	T. H. McKinney	New York.....	J. J. O'Leary
Illinois	J. N. Pierce	Ohio.....	F. C. Werk
Indiana	A. L. Swanson	Oregon.....	J. R. Tomlinson
Iowa	J. E. Sweeney	Pennsylvania..	Albert Gentel
Kansas	R. M. Sutton	Tennessee.....	J. A. Fowler
Kentucky	C. C. Childers	Texas.....	W. M. Clower
Louisiana ...	C. Sam Barnes	Virginia.....	E. G. Andrews
Massachusetts	A. J. Hixon	Wisconsin...	George F. Rohn
Michigan	J. J. Thorne	Washington.....	J. NePaige

Do It Cheerfully—Lend for Liberty

BUSINESS CONDITIONS WITH THE LAMP MANUFACTURERS

Independent Incandescent Lamp Manufacturers Fear Another Serious Shortage of Supply During the Coming Winter

A dinner was given on the evening of Oct. 4 at the Hotel McAlpin, New York, by A. W. Wiest, president of the American Appliance Company of Indianapolis, to commemorate the purchase of the Metalyte Company of New York, manufacturer of incandescent lamps. Twenty-five representatives of independent manufacturers of incandescent lamps attended the dinner, and the outlook for the manufacture and sale of lamps during the coming winter was discussed at length.

The opinion was expressed that the shortage of lamps in the coming months would be as great as, or greater than, it was during the last winter. Demand is still running far ahead of production. Many of the manufacturers said that they are unable to provide for new customers, so heavy is the demand from old customers. They do not feel alarmed at present in regard to the supply of raw material, but the scarcity of labor is being felt by lamp manufacturers as well as in other branches of the industry.

WAR NEEDS OF THE PUBLIC AND THE PUBLIC UTILITIES

At Convention of State Commissioners in Washington This Week President Thelen of California Body Discusses Vital Issues

In his address as president of the National Association of Railway Commissioners at Washington this week Max Thelen gave special attention to matters affecting electric utilities. Mr. Thelen, president of the California Railroad Commission, spoke particularly of conditions with the Pacific Coast properties.

"Wherever hydroelectric utilities with steam reserves are being separately operated," said Mr. Thelen, "fuel can be saved by making interconnection between the existing systems so that the output of each company will supplement that of the others and so that the reserves of each company will be made available to all other companies. Through such interconnection a considerable portion of the existing steam reserve capacity can be entirely eliminated with a consequent material saving of fuel. One of the Western railroad commissions, on its own initiative, has taken up this matter with the electric companies of the State, and it is hoped that arrangements will soon be made, through interconnection of existing systems, so as to produce greater efficiency in their operation and to eliminate unnecessary steam reserves. At this time, more than ever, efforts should be made to bring about the most efficient operation of all electric utilities, with the attendant conservation of fuel and man power."

Calling the position of the steam railroads of the country as a whole very satisfactory, Mr. Thelen said that "the same statement cannot be made with reference to certain of the street railroads, gas and electric companies, warehousemen and other utilities. These classes of public utilities, as a whole, have not enjoyed the increase in business which has come to most of our steam railroads. To the applications of these utilities for authority to charge higher rates, based on large increases in operating expenses, frequently without commensurate increases in the volume of business, the various state commissions must give prompt and sympathetic consideration. In a number of instances higher rates have already been authorized and in other cases increases must hereafter be allowed. Is it not fair to ask that the public utilities, instead of seeking permission to shift the entire increased costs, shall share with their customers the burden caused by the war?"

Mr. Thelen discussed at some length the large problem of financing public utilities during the war and the successful policy of selling securities to the local public. Concerning the great need of hydroelectric development he said:

"The development of additional electric energy, particularly in those portions of our country in which other forms of fuel are not readily available, is a pressing problem. The further development of our industries and the increase of our national efficiency require that where water power is readily available for the generation of electric energy, its development should be encouraged. Where such water powers are on government lands, a constructive policy should be adopted so that development may proceed under conditions just and reasonable both to the utilities and to the public."

NEW TRADE ACTIVITIES OF ASSOCIATED MANUFACTURERS

Industrial and Street-Lighting Fixture Section and
Insulating Materials Section Formed to
Extend Association Idea

At the meeting of the lighting fixture section of the Associated Manufacturers of Electrical Supplies on Oct. 2, at the New York offices, it was decided that the interests of the respective manufacturers could be served best by segregating the work of the industrial reflector and street-lighting manufacturers in a separate section, the interior-lighting fixture manufacturers to continue as an independent section.

The new section will be known as the industrial and street-lighting fixture section. C. O. Baker, Wheeler Reflector Company, Boston, was elected chairman of the new section; C. E. Stephens, Westinghouse Electric & Manufacturing Company, secretary, and W. H. Jones, General Electric Company, treasurer. The section has outlined extensive plans for an active year and it is felt that it will prove of great advantage and benefit to the manufacturers interested. All manufacturers of reflectors, industrial and street-lighting fixtures and parts, members of the association, are eligible for affiliation with the section.

INSULATING-MATERIALS SECTION FORMED

Manufacturers of miscellaneous insulating materials held the second meeting at the association offices, New York, on Sept. 20, and voted unanimously to form a section in the association, to be called the insulating-materials section.

This section will include manufacturers of treated cloths, treated papers, built-up mica, raw mica, insulating varnishes, insulating cements, friction tape, splicing compound, untreated tapes and other miscellaneous insulating material.

It was planned originally to include these manufacturers as a committee of the molded or formed insulation section, but it was found that this would make the section too large and unwieldy, and it was felt that better results would accrue to all by forming an entirely separate section, where the manufacturers would have common interests.

J. G. Miles, Westinghouse Electric & Manufacturing Company, was elected chairman of the section; J. B. Adams, Mitchell-Rand Manufacturing Company, secretary, and A. E. Beling, Western Electric Company, treasurer.

WORK OF THE PORCELAIN SECTION

The porcelain section held its regular fall meeting on Oct. 3, at the association offices. The following officers were re-elected unanimously for the coming year: J. E. Way, R. Thomas & Sons Company, chairman; C. M. Semler, Pittsburgh High Voltage Insulator Company, secretary; B. B. Dinsmore, Imperial Porcelain Works, treasurer.

In accordance with the plan of the recently formed tariff committee of the association, that each section appoint a special tariff committee to work with the association tariff committee, H. R. Holmes of R. Thomas & Sons Company, East Liverpool, Ohio, and B. B. Dinsmore, Imperial Porcelain Works, Trenton, N. J., were appointed members of the section committee, Mr. Holmes being chairman. In addition to the regular

standing committees of the section, the following committees were also appointed:

Freight classification committee—B. F. McLean, chairman, Ohio Brass Company, Mansfield, Ohio; B. B. Dinsmore, Imperial Porcelain Works, Trenton, N. J.; H. R. Holmes, R. Thomas & Sons Company, East Liverpool, Ohio.

Pin-threading committee—H. R. Holmes, chairman, R. Thomas & Sons Company, East Liverpool, Ohio; B. A. Plimpton, Locke Insulator Manufacturing Company, Victor, N. Y.; C. M. Semler, Pittsburgh High Voltage Insulator Company, Derry, Pa.; E. B. Snyder, Ohio Brass Company, Mansfield, Ohio.

Committee on Japanese matters—B. A. Plimpton, chairman, Locke Insulator Manufacturing Company, Victor, N. Y.; B. B. Dinsmore, Imperial Porcelain Works, Trenton, N. J.; F. L. Bishop, Hartford Faience Company, Hartford, Conn.

OFFICERS OF MOLDED OR FORMED INSULATION SECTION

The molded or formed insulation section held the regular fall meeting on Oct. 5, at the association offices, E. B. Hatch, Johns-Pratt Company, chairman, presiding.

The following officers were elected unanimously for the coming year: R. W. Seabury, Boonton Rubber Manufacturing Company, Boonton, N. J., chairman; Henry T. Meyer, Duranoid Manufacturing Company, secretary; Joseph Rockhill, General Insulate Company, treasurer.

Lend the Price—Buy Liberty Bonds

TIMELY NEW-BUSINESS

DISCUSSION IN OHIO

Problem of Providing for Depreciation for Property
Purchased Now When Lower Values
Have to Be Faced

Appliance sales, patriotic endeavors, new-business financing and factory illumination were the chief topics discussed at the meeting of the new-business co-operations committee of the Ohio Electric Light Association at Cincinnati on Oct. 10. The meeting brought out more discussion of the broader problems facing the industry to-day than has been usual at the gatherings of this committee. At the same time ideas on the details of selling plans were not lacking.

G. E. Miller, sales manager Cleveland Electric Illuminating Company, in an address on "What Are You Doing About New Business?" outlined very clearly the position of the central station in the present situation. He reviewed the difficulties in keeping construction going apace with demand, in finding capital for extensions, and in adjusting rates so that the effect of readjustment would not react against the company. An abstract of the paper by Mr. Miller is published elsewhere in this issue.

The discussion showed that practically all Ohio companies are operating under some plan which passes on the immediate cost of extensions in whole or in part to the customer who demands service. The most serious problem confronting Ohio operators seems to be that of finding means of providing, when conditions again become normal, for the depreciation which will take place on equipment purchased now. This difficulty is

seen to be the more real on account of the practices governing valuations in rate cases.

D. L. Gaskill of Greenville, in a patriotic address at luncheon, urged utility men to assist in every way in getting the public more interested in the war and in getting people more nearly into the right frame of mind to make sacrifices for the nation.

Ward Harrison of Cleveland spoke on the money value of efficient factory lighting.

Walter E. Ott of Cincinnati spoke on appliance sales policies and gave a vacuum cleaner demonstration.

At the next meeting, which will be held in Toledo on Nov. 21, not Oct. 21 as was printed in the Oct. 6 issue of the *ELECTRICAL WORLD*, it is planned to devote the session to the subject of appliance sales, with speakers from three branches of the appliance sales industry. The speakers will be Earl E. Whitehorne, *ELECTRICAL WORLD*, New York; R. E. Flower, Erner Electric Company, Cleveland, and E. W. Quillan, Elyria, Ohio.

Do You Like Liberty?—Lend for It

REGULATIONS GOVERNING TRADING WITH THE ENEMY

New War Trade Board the Administrative Body— Sweeping Powers of Federal Trade Commission Regarding Patents

President Wilson has appointed a War Trade Board as the administrative machinery to carry out the provisions of the recently enacted trading with the enemy act. He has also proclaimed regulations for the administration of the act, giving to the Federal Trade Commission sweeping powers in regard to patents, even to the fixing of prices of articles and products necessary to the health of the military and naval forces of the United States "or the successful prosecution of the war." In addition, the President has created a Censorship Board, with full power to censor cable, radio and mail communications between the United States and foreign countries, and has announced that he will appoint an "alien property custodian" and will establish control over foreign-language newspapers printed in the United States, the transportation of enemies, clearances of vessels transporting cargo, and control over foreign exchange and transfers of gold. In some of these respects the proclamation establishes regulations for carrying into effect the espionage act as well as the trading with the enemy act.

The new War Trade Board will supersede the Exports Administrative Board, although Vance McCormick, chairman of the latter, will remain chairman of the new board. The members of the old board will go over to the new board, although several new members will be named. The headquarters of the board will remain for the present at 1435 K Street N. W., Washington.

In addition, the President will soon appoint a War Trade Council, to serve in an advisory capacity to the new War Trade Board.

The provisions of the proclamation in regard to patents and the Federal Trade Commission powers follow:

I further hereby vest in the Federal Trade Commission the power and authority to issue licenses under such terms and conditions as are not inconsistent with law, or to with-

hold or refuse the same, to any citizen of the United States or any corporation organized within the United States; to file and prosecute applications in the country of an enemy or ally of enemy for letters patent or for registration of trade-mark, print, label or copyright, and to pay the fees required by law and the customary agents' fees, the maximum amount of which in each case shall be subject to the control of such commission; or to pay to any enemy or ally of enemy any tax, annuity or fee which may be required by the laws of such enemy or ally of enemy nation in relation to patents, trade-marks, prints, labels and copyrights.

I hereby vest in the Federal Trade Commission the power and authority to issue, pursuant to the provisions of Section 10 (c) of the trading with the enemy act, upon such terms and conditions as are not inconsistent with law, or to withhold or refuse, a license to any citizen of the United States, or any corporation organized within the United States, to manufacture or cause to be manufactured a machine, manufacture, composition of matter, or design, or to carry on or cause to be carried on a process under any patent, or to use any trade-mark, print, label or copyrighted matter owned or controlled by an enemy or ally of enemy, at any time during the present war, and also to fix the prices of articles and products manufactured under such licenses necessary to the health of the military and the naval forces of the United States or the successful prosecution of the war, and to prescribe the fee which may be charged for such license, not exceeding \$100 and not exceeding 1 per cent of the fund deposited by the licensee with the alien property custodian as provided by law.

I hereby further vest in the said Federal Trade Commission the executive administration of the provisions of Section 10 (d) of the trading with the enemy act, the power and authority to prescribe the form of and time and manner of filing statements of the extent of the use and enjoyment of the license and of the prices received and the times at which the licensee shall make payments to the alien property custodian, and the amounts of said payments, in accordance with the trading with the enemy act. I further hereby vest in the Federal Trade Commission the power and authority, whenever in its opinion the publication of an invention or the granting of a patent may be detrimental to the public safety or defense or may assist the enemy or endanger the successful prosecution of the war, to order that the invention be kept secret and the grant of letters patent withheld until the end of the war.

The said Federal Trade Commission is hereby authorized to take all such measures as may be necessary or expedient to administer the powers hereby conferred.

The President Asks It—Buy a Bond

NEW COMMITTEES OF THE ILLUMINATING ENGINEERS

Will Handle Problems of Illumination for Aviation Cantonments, Lighting Practice in Industrial Establishments and Visibility at Sea

Three committees have been organized recently by the Illuminating Engineering Society to handle problems of illumination of aviation cantonments, to codify lighting practice in industrial establishments, and to carry on investigations on problems of visibility at sea. This was brought out in the report of Clarence L. Law, the general secretary, presented at the annual meeting of this society, which was held at the Engineering Societies Building, New York City, on Thursday, Oct. 11.

After the reading of the annual report of the secretary a monthly meeting of the New York Section was held. This was devoted to a color symposium by the following: M. Luckiesh, H. C. Richards, Beatrice Irwin, L. T. Troland, I. G. Priest, C. E. Ferree and G. Rand.

COAL BUREAU FOR THE INDIANA ASSOCIATION

**Committee Appointed to Investigate Advantages That
Might Accrue to Utilities from Such
an Organization**

At a meeting of the executive and advisory committees of the Indiana Electric Light Association at Indianapolis, Oct. 11, a committee was appointed to investigate the advantages that might come from an association coal bureau which would see that state electric companies were supplied with fuel, and would also co-operate with the national bodies established to regulate fuel distribution. The members are: Thomas F. English, Muncie, Ind., chairman; C. C. Perry, Indianapolis; H. H. Harrison, Indianapolis, and Thomas Donahue, Lafayette.

Mr. Donahue, who is also secretary of the Indiana association, will write to member companies to ascertain what stand they will be disposed to take in the matter of the coal bureau, as it is expected that these companies will support the bureau if it is established. J. P. Ohmer of the Indiana & Michigan Electric Company, Elkhart, presided at the joint committee meeting.

Hit the Trail, Buy That Bond Now

COAL SUPPLY CONDITIONS ARE VERY ACUTE IN OHIO

**Hope for Freer Supply When Cold Weather Closes
Navigation to the Northwest—
Stocks Are Small**

Central station companies throughout Ohio have had great difficulty for several weeks in securing a sufficient supply of coal to keep plants in operation. Even those having long-time contracts which would have entitled them to first consideration under ordinary circumstances have enjoyed no advantage over others. This is due, partly at least, to the United States government's priority order which requires the shipment of the greater part of the production in this section of the country—including Ohio, Pennsylvania and West Virginia—to the Northwest by way of the Great Lakes. Producers had taken orders from buyers in the Northwest early in the spring at high prices, and of course they would prefer to deliver this coal rather than ship to buyers who pay the lower prices which were fixed by government order a few weeks ago. This is another trouble. A third and very important one is a shortage of coal cars on all railroads.

The reason for shipping all the coal possible to the Northwest while lake navigation is open is the severity of the winters and the difficulty of sending coal by rail to that section in severe weather. That section has depended upon its supply from these coal fields for years, and the conclusion was reached that the task this fall should be accepted by the same fields.

At the office of the Cleveland Electric Illuminating Company it was said that great difficulty is experienced in getting coal just now, but that there is a very small supply on hand and a few cars have been coming in from time to time to keep the plants in operation. The Cleveland municipal plant has been on the verge of closing down several times, but a supply was received

on each occasion in time to prevent this result. Light and Heat Commissioner Davis has made several trips to Washington to consult with Coal Administrator Garfield over the situation, with the result that a sufficient amount of coal has been ordered shipped from time to time to tide the plant over the difficulty. For the last two weeks little has been said in regard to fuel for this plant, but it has little, if any, surplus to insure continued operation if shipments should fail.

Coal men say that many central station plants are operating with very short coal supplies, but they have not heard of any that have had to close down. J. M. Roan has been acting at Columbus as fuel commissioner under state authority, and has succeeded in keeping a limited supply of coal moving to most of the towns where severe shortages have occurred. Coal operators have shown a willingness to give relief whenever the authorities waived the priority order on shipments needed in the towns of the State.

Two cars of coal were received by the city light and water plants at Hamilton on Oct. 16, and a car per day has been promised, just about enough to supply both. Apparently these plants have been running close to shore for a time.

CLOSE OF LAKE NAVIGATION WILL RELEASE COAL

It is very probable that the situation will remain acute until the close of lake navigation on Dec. 1. After that the product of the mines will be released to take care of industrial and public utilities plants. Coal Administrator Garfield was in Cleveland on Oct. 12, when he consulted with city authorities and business men as to their needs and the needs of other places in the State. Homer H. Johnson, a prominent Cleveland attorney, was appointed Ohio coal administrator, and in turn he will name committees in all cities to keep him informed of their needs. He cannot dictate the movement of coal, but will work in conjunction with the federal Coal Administration. It is hoped that some relief will result from this, although domestic needs must be considered at once. Domestic supplies in all cities are very short.

The high prices all through the season prevented consumers from accumulating stocks as they usually do through the summer months. Because of this neither public service nor private plants have reserve supplies to depend upon in this emergency. Or, if they have, the stocks are so small that they amount to very little. Although prices were very high, coal men urged consumers to put in reserve stocks before the situation became so strenuous, but a majority of buyers felt that conditions were abnormal and that they would be able to get their fuel later at more reasonable figures. In this they were correct, but the pressure on the supply became more drastic until the culmination in present conditions. Nothing of this kind was ever experienced in Ohio before.

The Columbus Railway, Power & Light Company was obliged to stop cars on two occasions last week, once immediately and directly on account of shortage of proper fuel, and the other time on account of trouble primarily caused by not having proper fuel. On many occasions what has been sold to the company as fuel and looked like it on top of the car has turned out to be mostly dirt, and sometimes when such fuel has been put in storage this fall a fair crop of vegetation has grown in it. The company, however, expects that

the authorities will let it have at least enough coal to keep the property operating, as there is plenty of fuel passing by and through Columbus.

KENTUCKY STRIKE OVER

Resumption of mining operations in the southeastern Kentucky-Tennessee coal field will go a long way toward relieving a situation in the Central West which in numerous cases had brought electrical utilities to the verge of a coal famine and had subjected them to increased outlays in order to obtain the fuel they needed. Work was resumed by about 20,000 miners on Oct. 8 under an agreement by which differences during the war are to be submitted to arbitration. The strike lasted nearly two months and involved a producing area with a normal output of 50,000 to 75,000 tons of bituminous coal a day.

Dr. Garfield has telegraphed labor leaders and operators in the Southwest, where strikes are threatened, that "strikes must not take place."

Best by Test—New Liberty Bonds

TO-DAY IT IS EVERYBODY'S BUSINESS TO SAVE COAL

**Van H. Manning Says That We Cannot Scrap All
Out-of-Date Power Plants—The
Personal Problem**

Talking to a representative gathering of men who are to assist the Fuel Administration in the different states at their meeting in Washington with Dr. H. A. Garfield, Van H. Manning, director of the Bureau of Mines, Department of the Interior, said concerning the necessity of urging the economical use of fuels:

The economical use of fuel has proved to be no simple problem. The coal, the equipment, and the human variables make hard and fast general rules impossible. The Bureau of Mines has carried on extensive experiments to determine the fundamental principles of the combustion process and of furnace design, and at the same time has been making practical application of improved practice in government power plants. Many publications are available which show the progress of the work along these lines.

Americans have been as wasteful of coal as of other resources, largely because coal has been abundant. To many consumers it has seemed hardly worth while to give time and thought to the saving of coal.

Conditions have suddenly changed. To-day it is everybody's business to save coal. Coal is the foundation stone of industry. Without it the production of equipment for war must halt. Transportation facilities must stand still. One man's careless and wasteful use may mean an idle factory or a cold house for his neighbor. With the world looking to us largely for its coal supply, with increased demands at home, with a scarcity of available labor, with overtaxed transportation facilities, the consumer of coal must pause and give serious consideration to the problem which confronts the country.

If the consumers can be aroused to an intelligent consideration of the burning of coal, they can begin to save 10 per cent of the production at once. With more effort, through instruction and a moderate remodeling of coal-burning equipment, which could all be accomplished during the war, a further considerable saving can be made. The possible coal saving when present practice is compared with the best ideal practice is very large. If it were possible to supply the need of this country for light, heat and power through the highest type of mechanical devices, and if we could make a skilled coal user out of the average user, we could probably get along with half as much coal as we

are now consuming. This ideal is far beyond present realization.

The immediate problem is a difficult one. We cannot scrap all out-of-date power plants. We must start by doing the best with what we have. We must begin saving coal at once. The problem is personal. It deals with the human element. We must reach the man with the shovel.

About 15,000,000 people shovel the 20 per cent of our coal used for domestic purposes. Only about 250,000 firemen shovel the 60-odd per cent of our coal used by power plants and railroads. While we must appeal to the householder to save coal, it is vastly more important to reach the fireman through whose hands the larger part of our coal passes.

The householder must realize that when he throws a shovelful of anthracite coal into his furnace its value is equivalent to half a pound of sugar, or half a loaf of bread, or a pint of milk. He must appreciate that it is worth while to examine his house and to overhaul his heating equipment. Weather strips, double windows, pipe coverings, clean flues and chimneys, and tight fittings in ash-pit, doors, dampers and furnace parts will all pay. Damper control is one of the chief secrets of economical heating. Clean surfaces are most essential, as soot is a poorer conductor of heat than asbestos. Care, attention and taking pains will be the greatest factors in saving domestic coal.

The fireman is, however, the biggest single factor to be considered in a campaign to secure the largest saving of coal. Many manufacturers have made a serious mistake in failing to consider the fireman as a skilled worker. Too often he is treated as a roustabout. He is not well instructed or given proper labor-saving devices. As coal increases in price or becomes difficult to get, the fireman handles more and more of his employers' money. His efficiency means more in dollars and cents. This is an encouraging feature in the situation. It means a better recognition of the importance of the fireman, more efficient work on his part, and a consequent increased saving of coal. The viewpoint is changing. It is no longer cheaper to pay for the coal than to educate the firemen.

In carrying out a campaign to promote the saving of coal let the appeal be made to the householder to cut down his consumption in every way possible, but above all, give serious consideration to methods by which a systematic relationship may be established between the office and the fireman. Encourage the manufacturer to take a keener interest in his fuel consumption and to back up his fireman by giving him the best information and equipment available. This problem has two phases—first to arouse the interest of the manufacturer and his engineer and fireman and to point out the part which they can pay in relieving the present crisis in coal supply; second, to furnish whatever technical information may be desirable and which will be immediately applicable to accomplish the result sought.

Your Liberty Is at Stake—Save It

ORDER OF PRIORITY IN DISTRIBUTION OF COAL

**Railroads, the Government, Domestic Users, Public
Utilities and All Commercial Organizations
the Indicated Order**

The first of a series of orders to distribute coal on a priority basis and regulate the movement of coal cars has been issued by Fuel Administrator Garfield. It provides that the Pennsylvania Railroad, which serves about 700 mines, shall have its needs properly taken care of. Other railroads will be served through similar orders to follow soon and to comprise the first series.

Commercial coal will be distributed by the second series, giving preference in order to the government, domestic users, public utilities and all commercial organizations using coal.

INCREASE IN EARNINGS OF BOSTON EDISON COMPANY

Great Gain in Sales of Electrical Energy for Power
Results from War-Time Industrial Activity
That Has Prevailed

An increase of over \$900,000 in gross earnings is reported by the Edison Electric Illuminating Company of Boston for the year ended June 30, 1917, as compared with the previous year. For 1917 the total was \$9,255,958; the number of customers increased from 86,018 to 97,323, and the output delivered at the switchboard from 223,258,020 kw.-hr. to 249,235,384 kw.-hr.

The industrial impetus due to the war is reflected in power sales totaling 63,595,719 kw.-hr. for 1917 compared with 35,874,751 kw.-hr. in 1916. The company consumed 223,438 tons of coal this year, against 198,951 tons last year. On June 30, 1917, the coal on hand totaled 40,885 tons. The output for metered commercial lighting actually fell off this year to 86,513,020 kw.-hr., as against 89,443,403 kw.-hr. in 1916. The ratio of operating expenses to gross earnings was 55.6 per cent in 1916 and 58.74 per cent this year. Power sales increased \$414,579 this year, the total revenue from this class of business being \$1,897,286.

The average cost of coal per ton remained practically the same, being \$3.78 in 1916 and \$3.76 in the 1917 fiscal year to June 30. The total connected load of the system June 30, 1917, was 278,051 kw., of which 141,246 kw. represented lighting service and 136,805 kw. power and street railway customers. The total steam generating capacity of the company at the end of the fiscal year was 160,600 hp., the combined generator ratings being 116,400 kw. The company's employees increased from 1973 to 2186 during the year. Production cost increased from \$1,420,122 to \$1,814,533.

The principal items of expense this year were: Manufacture, \$1,814,533; electricity purchased, \$22,263; distribution, \$1,142,663; office expenses and management, \$1,196,032; taxes, \$1,022,564; miscellaneous, \$259,866; total, \$5,457,924; balance to profit and loss, \$3,798,033. The company paid 12 per cent in dividends, \$2,703,066, during the year.

Comparative earnings were:

	Year Ended June 30	
	1916	1917
Municipal commercial lighting	\$5,653,226	\$6,143,310
Municipal arc lighting	488,808	490,684
Municipal street incandescent lighting.....	377,463	394,612
Power (except street railways).....	1,482,707	1,897,286
Power (street railways only).....	197,361	202,147
Energy sold other plants.....	103,248	107,737
Total net from sale of electricity.....	\$8,302,814	\$9,235,778
Income from rentals		20,180
Total	\$8,302,814	\$9,255,958
Peak load in kw.....	72,802	80,539
Peak load date.....	Dec. 13, '15	Dec. 12, '16

Charles L. Edgar, the president, says in part in the annual report:

Numerous transmission lines, distributing lines and additional transforming apparatus have been installed, but all in the way of routine, for the purpose of taking care of the ordinary growth of the business.

During the year your company has combined with the New England Power Company in making a joint contract with the Metropolitan water board for the purchase of the hydroelectric energy generated at the Clinton dam. The water board has agreed to connect the substation at the Clinton dam with the one at the Sudbury dam, the output of which is already being purchased by your company. The comple-

tion of this construction will make it possible to transfer from the lines of the New England Power Company to the lines of your company, or vice versa, approximately 5000 kw., which will in case of emergency be of very great value.

Arrangements have also been made for connecting the lines of your company with those of the Suburban Gas & Electric Company at Revere, which latter company has connection with the Malden Electric Company and the Salem Electric Lighting Company.

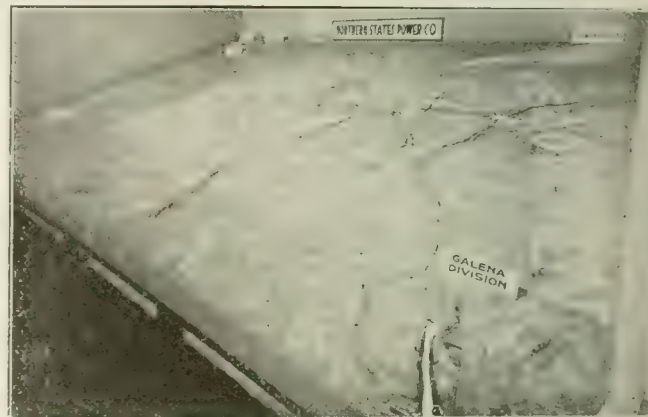
Ever since the beginning of the European war electric companies in England have been making serious efforts to connect their lines together for safety in case of emergency. We in this country are beginning to appreciate the desirability of following out this policy, and your company is doing what it can in helping to safeguard the general electric situation in eastern Massachusetts.

Take No Chances—Buy for Liberty

ELECTRICAL INDUSTRY AT MINNESOTA STATE FAIR

Minneapolis Electric Trade Gets Together to Boost
Business and Advertises Advantages of
Electricity to 200,000 People

The idea of having an electrical show at the Minnesota State Fair at Minneapolis in September was originated by the local chapter of the Jovian Order and was conducted under the auspices of that organization. The first move was to appoint a committee in charge of arrangements, and this committee named Norman



TERRITORY OF NORTHERN STATES POWER COMPANY

O'Neil of the Minneapolis General Electric Company as general manager of the show.

One of the features was a large relief map of the territory served by the Northern States Power Company in Minnesota, North Dakota, South Dakota, Wisconsin, Illinois and Iowa. The map depicted 800 miles (1287 km.) of electrical transmission system, eleven water powers with 93,500 hp. rating, and 189 cities, towns and villages served. The electrical effects were spectacular. Water powers and rivers were thrown into strong relief. The night effect was further elaborated by twinkling stars and a canopy which suggested the sky. The map, which measured 16 ft. by 20 ft. (4.8 m. by 6 m.), was prepared at the suggestion of H. E. Young, sales manager Northern States Power Company. Frequent lectures were delivered during the fair at the company's booth to interest visitors in the company customers' ownership plan.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Indiana Commission Authorizes Bond Issue.—The Indiana Public Service Commission has granted authority to the Interstate Public Service Company to cancel certain "free service" rates in Lebanon, Lowell, Kentland, Crown Point and Monticello. It has also given the company authority to issue \$41,000 bonds at not less than 80 to reimburse the treasury for betterments at various plants.

Charges for Inspection of Electric Installation.—The Philippine Islands Public Utility Commission, in a case affecting the Lucena Electric Light, Ice & Water Company, holds: "An electric company assuming the responsibility of any loss of life or property of private citizens resulting from fires caused from inadequate or defective installation is entitled to charge a fee for inspecting installations made by persons not connected with the company."

Abandonment of Line.—The Dunkirk Street Railway (leased to the Buffalo & Lake Erie Traction Company and operated by the receiver for that company) sought approval from the New York Public Service Commission, Second District, of a declaration of abandonment of portions of the constructed route of the railway in Dunkirk. It was held that before the commission approves the abandonment of a railroad operating only within the city limits, upon the ground that the road is operated at a loss, it should be shown whether the deficit arises from the operation of that road or whether its connection with and control by another road is responsible for its failure to meet expenses.

War-Time Restrictions on Service Expenditures.—The Massachusetts Public Service Commission disapproves restrictions upon new construction which were established by the New England Telephone & Telegraph Company as a result of war conditions. It says in part: "The policy of restricting telephone installations did not start with the parent company, but seems to have been adopted by the New England company upon its own responsibility, and no evidence was offered that any of the operating companies throughout the country have pursued a similar course. It also appears that the Western Electric Company has not warned the New England company of any impending shortage in materials and supplies or urged a restriction of purchases on this account during the summer; indeed, the Western Electric Company has been endeavoring by an advertising campaign to stimulate the sale of electric sup-

plies of far less basic public importance than telephone apparatus. Nor has the new policy been directly advised or suggested by the National Council of Defense or any similar public body. The execution of the policy has apparently been left very largely in the hands of the local 'counter' men, who deal in the first instance with prospective customers. Since its adoption, and up to the time of the public hearings, about 1800 out of 3000 applicants have been denied new telephone service. As the resources of the country are devoted more and more to the prosecution of the war, there will be a continually increasing need for conservation and the exercise of strict economy on the part of every individual. It is not so clear, however, that this principle has been reasonably applied in the present instance. At the outset no official announcement was made to the public or to this commission of any change of policy. Certainly the customers were given no definite means of knowing, in default of an appeal, what the instructions were or whether their privileges were being infringed. So far as the policy itself is concerned, it would have been perfectly consistent with the public interest, and desirable, for the company to have circularized its subscribers, or to have issued statements to the press setting forth the need for conservation of resources and strict individual economy in the present emergency and strongly urging the public to refrain from seeking additional and unnecessary telephone facilities. The commission, indeed, would very gladly have co-operated in such a movement. We are inclined to believe that such a policy ought not to be adopted until it has been directly advised by some central national authority representing and acting in the public interest, nor until it is made to apply, not solely in certain New England states, but uniformly throughout the entire country. The amount of conservation of basic materials and of other wealth which can be effected by limiting telephone service is relatively insignificant. Infinitely greater opportunities exist which relate to mere luxuries of living. The commission, therefore, expresses the opinion that the policy adopted by the company is not as yet justified."

Proof of Necessity for Increased Rates.—A case decided by the Maryland Public Service Commission, affecting the Kensington Railway, contains the following statement of policy: "In a case brought by patrons of the road to test the reasonableness of an increase of rates, while the burden of proof may be primarily upon the complainants, it would also appear to be a sound rule that where the increase will create a condition different from the common practice of utilities of the class to which the corporation belongs, and where the company seeks to justify it because it has assumed liabilities that are not necessary for the promotion of the specific service which the utility undertakes to perform, the burden of proof should be shifted to the corporation."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Damage from Fire in Burning on Right-of-Way.—In an action against defendant electric power corporation for damages, held, under evidence, that questions of its negligence in burning on right-of-way and whether fire was the proximate cause of the burning of plaintiff's timber and fencing were for jury, according to the Court of Appeals of Maryland in *Susquehanna Transmission Company versus Murphy* (101 A. 791).

Sidewalk Barricades About Pole.—A barricade on a sidewalk in front of a building on which alterations are being made is not required to be impassable, where openings for the ingress and egress of workmen and materials are necessary, and a substantial notice of exclusion is sufficient for persons who have reached the age of discretion, the Supreme Court of South Carolina held (98 S. E. 398). In an action for personal injury from the dropping of a monkeywrench by defendant's employee at work on a telephone pole inside a barricade, plaintiff's admission that he knew of the notice to "keep out" was irrelevant and inadmissible. In such an action testimony of an experienced telegraph lineman who qualified as an expert that it was dangerous to carry a monkeywrench in a body belt was admissible, although the witness himself had not so carried one.

Unwarranted Obstruction of Highways by Poles.—Telephone poles set against the fence along the west side of a highway in themselves did not constitute an unwarranted obstruction thereof, the Supreme Court of South Dakota held (164 N.W. 104). The right to use a public highway for telephone poles, created by law, does not relieve the telephone company from liability for injuries to persons caused by negligence or improper construction or maintenance of its line. The company had no right to construct its line in such manner as to place an unnecessary or dangerous obstruction in the highway. In an action for injuries to plaintiff sustained when tipped by a telephone-pole guy wire out of his saddle while he was pursuing along the side of the highway cattle he was assisting in driving to market, question whether plaintiff's act in leaving the traveled part of the road and proceeding at great speed along the untraveled way when it was so dark that plaintiff could not see obstructions was contributory negligence, was one for the jury to decide. In such action the question of the telephone company's negligence in constructing and maintaining the guy wire in the highway, though in the untraveled part, was also one for the jury.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

California Association of Electrical Contractors and Dealers.—The quarterly meeting of this association was held at Fresno, Cal., Oct. 12-13.

Utah Society of Electrical Contractors.—The first convention of the Utah Society of Electrical Contractors was held in Salt Lake City, Utah, Oct. 5 and 6.

Jovian Electric League, Los Angeles.—At the meeting of the Jovian Electric League held Oct. 3 Capt. J. Carl Schindler, U. S. A., spoke on "The Electrified Army."

Jovian League of San Francisco.—James W. Gerard, formerly United States Ambassador to Germany, spoke before the members of the Jovian League and the San Francisco Advertising Club at a joint meeting held Oct. 3.

Some Recent Advances in Industrial Lighting Equipment.—Ward Harrison presented a paper on "Some Recent Advances in Industrial Lighting Equipment" at the first fall meeting of the Pittsburgh Section of the Association of Iron and Steel Electrical Engineers on Oct. 20.

Cleveland Section of the Association of Iron and Steel Electrical Engineers.—The first fall meeting of the Cleveland Section of this association was held Oct. 13, and two papers were presented, "Industrial Electrical Control," by L. W. Egan, and "Electrical Reversing Blooming Mills," by R. D. Nye.

Kansas City Jovians Elect Officers.—The Kansas City Jovian League elected the following officers at its annual meeting: President, A. P. Denton; first vice-president, W. M. Hand; second vice-president, J. E. Launder; third vice-president, W. B. Saterlee; fourth vice-president, F. F. Rossman; secretary and treasurer, T. R. Harber; executive committee—P. Lloyd Lewis, M. E. Bates, J. G. Crane, E. E. Stigall.

Oklahoma Jovians Meet.—The Jovian Electric Club of Oklahoma City, Okla., held its annual election of officers recently, with the following result: President, O. K. Corken, president Corken Machinery Company; vice-president, William H. Stout, president Southwestern Electric Company; secretary-treasurer, Arthur L. Mullergren, secretary-treasurer Benham Engineering Company. The following executive committee has been appointed: O. K. Corken, chairman; William H. Stout, A. L. Mullergren, F. J. Meyer and H. E. Musson. The club holds a weekly noonday meeting and luncheon on Monday. A banquet and rejuvenation were held on Sept. 28.

Rochester Meeting of the American Physical Society.—The nineteenth meeting of the American Physical Society will be held in Rochester, N. Y., Oct. 26 and 27. The society members will be the guests on this occasion of the Bausch & Lomb Optical Company, the Taylor Instrument Company and the Eastman Kodak Company. One session will be held at the works of each of these companies, and at these sessions representatives of the companies will address the society on the scientific work of the company's research laboratories. At this meeting physicists will have an opportunity to observe the extent to which physics is being used in the laboratories and factories of these companies. The Physical Society has centered its activities around the universities. The recent growth, however, of industrial physics has made it desirable that this condition be changed, and consequently the committee on technical physics is making an attempt to secure a close co-operation between the university physicists and industrial physicists by holding at some industrial laboratory or in some industrial center once every year a meeting similar to the one announced.

Fifth Annual Convention of the Southeastern Section of the N. E. L. A.—Following is the outline of the program which will be presented at the fifth annual convention of the Southeastern Section of the National Electric Light Association, to be held at Birmingham, Ala., Oct. 24-26. The papers to be read are as follows: "Safety," by G. K. Selden of the Southern Bell Telephone & Telegraph Company of Atlanta, Ga.; "Distributing Operating Problems," by J. O. Hardin of the Georgia Railway & Power Company, Atlanta, Ga.; "Electric Contracts," by D. H. Cronheim of the Alabama Power Company, Birmingham, Ala.; "Practical Application of Transformers and Regulators," by L. W. Carnagy of the General Electric Company, Atlanta, Ga.; "The Development of the Induction Watt-hour Meter," by M. C. Rypinski and S. A. Berger of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.; "Comments on the National Electric Safety Code," by P. A. Tillery of the Carolina Light & Power Company, Raleigh, N. C.; "Sale of Securities to Our Consumers," by Carl T. Naumberg of the Henry L. Doherty Company, New York City; "Selling the Electrical Idea," by H. W. Alexander of the Society for Electrical Development, New York City; "The Effect of the War on the Electrical Industry and the Outlook," by William H. Onken, Jr., editor of the ELECTRICAL WORLD, New York City. Talks on subjects to be chosen later will be made by T. C. Martin, secretary of the National Electric Light Association, and President Kennedy of the Alabama Utilities Commission. Patriotic talks by army officers have also been arranged for. On the last day of the convention a trip will be made by boat to Lock Twelve, the site of the hydroelectrical development of the Alabama Power Company.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Engineering Registration in University of Illinois.—Undergraduate students registered in the College of Engineering of the University of Illinois twelve days after the beginning of registration for the new year included the following: Civil engineering, 151; electrical engineering, 209; mechanical engineering, 217. Total registrations in the Engineering College were 864.

Louisville Company's New 15,000-Kw. Unit in Operation.—The new 15,000-kw. turbine generator for the Louisville Gas & Electric Company was placed in operation on Oct. 3. This makes the total generating capacity of the Louisville company 32,500 kw. It is anticipated that the new turbine will materially reduce the coal consumption per unit of energy manufactured. The engineering department of H. M. Byllesby & Company, under whose supervision the recent improvements and enlargements were designed and executed, is at work on plans for the installation of another 15,000-kw. unit which has been ordered for delivery in August, 1918.

Pacific Gas & Electric Company Seeks Higher Gas Rates.—The Pacific Gas & Electric Company has filed with the California Railroad Commission an application for authority to increase gas rates in all districts except San Francisco to equal an average increase of 12½ per cent over present rates. It requests authority to manufacture and sell gas of an average heating quality of 550 B. t. u. a cubic foot, as compared with a present standard of 600. The company in its application states that if it be granted the increases in rates requested, the net return based upon its estimated revenue, operating expenses and depreciation will be 6.7 per cent on the total amount of capital invested.

Liberty Loan Committee in New York.—The sub-committee on public utilities of the second Liberty Loan in New York City includes the following: George B. Cortelyou (chairman), president Consolidated Gas Company; Nicholas F. Brady, president Edison Electric Illuminating Company of Brooklyn; Henry L. Doherty, president Doherty Operating Company; Alanson P. Lathrop, president American Light & Traction Company; Thomas N. McCarter, president Public Service Corporation of New Jersey; Thomas E. Murray, vice-president New York Edison Company; E. H. Rosenquest, president Bronx Gas & Electric Company, and Arthur Williams, general commercial manager New York Edison Company.

Guy L. Bayley, who has been engaged on hydroelectric construction work for the Department of the Interior in the Yosemite Valley on the Merced River, has resigned to become assistant to the president of the Federal Export Corporation, 115 Broadway, New York City. Mr. Bayley's immediate work will be to establish the company in the Far East. He left this week for a six months' tour of Japan, Korea, China, Siam, the Straits Settlements, Java, Sumatra and way stations. He has had previous experience in this work, having represented the American Trading Company from 1900 to 1904 in Japan. Mr. Bayley was chief of the mechanical and electrical departments



G. L. BAYLEY

of the Panama-Pacific International Exposition. When the exposition came to a close he opened an office in San Francisco as a consulting engineer.

I. A. Tenger has been appointed chief engineer of the Gold Street station of the Brooklyn Edison Company.

Prof. George B. Thomas, head of the electrical engineering department of Colorado College, Colorado Springs, Col., is on leave of absence.

W. O'Brien has been appointed successor to P. T. Davies as power sales manager of the Montreal (Que.) Light, Heat & Power Company.

S. S. Snyder has been appointed chief engineer of the Sixty-sixth Street station of the Brooklyn Edison company, succeeding G. E. Horton.

G. E. Horton, former chief engineer of the Sixty-sixth Street station of the Brooklyn Edison company, has recently been made inspector of construction for the company.

C. E. Bell has been transferred from assistant superintendent of the Paducah (Ky.) Light & Power Company to the Baton Rouge (La.) Electric Company as superintendent.

George H. Waring has resigned as vice-president and general manager of the Charleston (S. C.) Consolidated Railway & Lighting Company to become manager of the Salt Lake City (Utah) property of the American Public Utilities Company.

Men of the Industry

Changes in Personnel
and Position —
Biographical Notes

H. D. Feuers, general manager of the Fremont (Neb.) Gas, Electric Light & Power Company, has been appointed treasurer and manager of the City Light & Traction Company, Sedalia, Mo., to succeed S. B. Ireland.

P. T. Davies, manager of the power sales department of the Montreal (Que.) Light, Heat & Power Company, has resigned to become manager of the new-business department of the Southern Canada Power Company, Montreal.

H. D. Frueauff, vice-president and general manager of the Montgomery (Ala.) Light & Water Power Company, has been promoted to be assistant to the president of the Empire Gas & Fuel Company, another Doherty property.

Stanley E. Smith has resigned from his position as superintendent of the Ersley Light & Power Company, Plainwell, Mich., to go into the electrical contracting business in Otsego, Mich., having purchased the business and stock of E. A. Tubbs.

G. E. Chapman has been appointed superintendent of division "L" of the Public Service Commission of Northern Illinois, with headquarters at Lacon. For some time Mr. Chapman has been acting superintendent of the division, replacing Keene Richards, who is in the army.

A. V. Wynne, superintendent of the Mansfield (Ohio) Electric Light & Power Company, has been appointed to succeed H. D. Feuers as general manager of the Fremont (Neb.) Gas, Electric Light & Power Company. Mr. Wynne went to Mansfield from the Massillon (Ohio) Electric & Gas Company, where he was superintendent, having formerly been electrical engineer of the Trumbull Public Service Company of Warren, Ohio.

C. M. Benedict, assistant secretary and treasurer of the Charleston (S. C.) Consolidated Railway & Lighting Company, has been appointed vice-president to succeed George H. Waring. Mr. Benedict will be in charge of the operations of all departments of the company and will discharge the duties that heretofore devolved upon the general manager and report directly to the president. The office of general manager will be abolished.

S. B. Ireland, treasurer and manager of the City Light & Traction Company, Sedalia, Mo., has been transferred to the Montgomery (Ala.) Light & Water Power Company, another Doherty property, as vice-president and general manager, succeeding H. D. Frueauff. Mr. Ireland began his utility career as

a Doherty cadet at Denver. He was formerly at Fremont, Neb., and later at Bartlesville, Okla., as manager of the Bartlesville Interurban Railway Company.

Obituary

Dr. E. F. Roeber.—It is with sincere regret that we record the death of Eugene Franz Roeber, who passed away, after a lingering illness, Oct. 17. Dr. Roeber was born in Torgau, Germany, Oct. 7, 1867, and was educated at the universities of Jena, Halle and Berlin, receiving the degree of doctor of philosophy from the latter university in 1892. He came to the United States



E. F. ROEBER

in 1894 and was associated with Dr. Carl Hering in Philadelphia for some time in electrical engineering work. He became editor of the *Electrochemical Industry*, now *Metallurgical and Chemical Engineering*, at its foundation in 1902, and under his guidance that publication has become the dominating influence in the electrochemical industry. For the last fifteen years Dr. Roeber also prepared the Digest of Current Electrical Literature for the *ELECTRICAL WORLD*. He was a founder of the American Electrochemical Society, which elected him its president in 1913-14. Dr. Roeber was also a member of the American Institute of Mining Engineers, American Institute of Electrical Engineers and the American Chemical Society. He served his industry faithfully and with a degree of ability that won the respect and admiration of his colleagues and the public. To him work was a pleasure; he never shirked it, and he performed all that he undertook thoroughly. Dr. Roeber possessed a strong personality coupled with sound judgment. None will lament his loss more than those who have labored beside him these many years, and to whom he was friend, guide, counselor and inspirer. It was a delight to consult with him and a rare privilege to know him.

John Howard Hale, a member of the Connecticut Public Utilities Commission, died at his home at Glastonbury, Conn., on Oct. 12, aged sixty-five.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

DIFFERENT COMPLEXION OF ELECTRICAL MARKET

Central Stations, Railways and Telephone Companies Deferring Construction—Industrials and Government Most Important Buying Factors

At no time in the history of the electrical industry has the volume of business and the output of electrical manufacturers been larger than it is to-day. According to all reports that the ELECTRICAL WORLD has received, the volume of business billed for the current year will run more than 25 per cent in excess of 1916, when the industry was working up to the limit. The additional business has been made possible only by more efficient methods and by increased production facilities.

The market, however, is very different from what it is under normal conditions. Utilities—the central stations, railways and telephone companies—and building construction interests formerly contributed a large portion of the market. To-day these interests are noticeable in the market by their absence. Lighting companies are making no addition unless absolutely necessary. The former policy of building lines to develop new sections and districts has been put aside until different conditions obtain. Prices are too high for this development work. The railways are awaiting fare increases before spending any considerable amount of money. The telephone interests are withholding extensions because of the cost and the scarcity of raw materials. All are waiting for better financing conditions.

High prices and lack of money at low rates have acted to curtail building construction in almost every section of the country except perhaps the South and in the case of a few isolated communities elsewhere. New buildings have practically reached the bottom level and contractors are therefore finding little to do.

On the other hand, industrials and the government are in such need of electrical equipment that factories continue to work at maximum output without being able to build up stock. Industrial establishments are turning to electric drive all the time, and their requirements appear to show no abatement.

The government is taking no small part of manufacturing facilities for its own needs. The marine construction program of the government, including both the navy and the merchant ships, the cantonments, concentration camps and the forces abroad have required and still require immense quantities of electrical equipment.

UNUSUALLY LARGE HOLIDAY BUSINESS ANTICIPATED

Local Distributors Accumulating Larger Reserve Stocks of Christmas Goods than Last Year for Quick Delivery

Buying for the Christmas or holiday trade as yet has not materialized, excepting in spots. Jobbers and distributors declare that while the hardware people are making larger commitments than before, their operations are a minor factor so far as strictly holiday goods are concerned. They are maintaining customary stocks, with some of the more important establishments arranging for a special Christmas campaign in due season. The department stores are not in the market to any great extent. Their season is about opening, with the heavy buying making its appearance along in the latter part of this month and up to about the middle of November.

Local agents and jobbers are accumulating larger reserve stocks of Christmas goods for quick delivery, prices running as high as a 15 per cent increase over those of the previous period. Knowing this, department-store buyers are therefore in no rush to place orders. War conditions, which supposedly influence the public to purchase lower-priced goods, are not in evidence in the slightest degree. So far as the attitude of the buyers is concerned, the call is for the better goods at even higher prices. The current retail buying is along these lines, and it is consequently reflected in the pre-holiday commitments of the prominent department stores, and even in those of the smaller merchants carrying electrical goods. Where appliances in great quantities are needed for the approaching season, orders were placed as far back as February. In an instance of this kind the deliveries are now just being completed. It is averred by the buyer that if the booking of this order had been deferred a month later no guarantee of its delivery would have been made by the manufacturer.

A number of new appliances have appeared in the market for the holiday trade, and a large sale for them is anticipated. It is expected that a strong business will be secured—far exceeding that of any previous season—for the new heating as well as the staple heating appliances. In ranges, percolators, toasters, pads, plate warmers, flatirons, etc., it is also agreed that a new and higher selling record will be made. No change in price has occurred since Sept. 15, excepting in isolated instances for special goods of exclusive manufacture, wherein a shortage of material or expedited delivery is the presupposed cause of the advance. Current prices are, in the main, supposed to hold until the first of the year. This announcement, however, is subject to factory conditions, such as the cropping out of labor demands, already causing trouble; material supply, none too certain, and disturbances which cannot be foreseen at present.

Don't Worry About It—Buy a Bond

A WARNING TO DEALERS ON EXTENDING CREDITS

Speakers at Associated Business Papers' Convention Review Conditions Brought About by Government's War Program

The changing federal attitude toward co-operative business association work governmentally supervised, the effect of priority certificates, the shortage of labor and the possible future tightening of credits early in 1918 were the topics which again and again crept into the talks of railroad presidents, big manufacturers of basic commodities and well-known economists who spoke this week at the Chicago convention of the Associated Business Papers, Inc. Manufacturers urged that all business be acquainted with the fact that co-operative business effort and even price fixing, if it makes for national conservation and efficiency, and is governmentally supervised, will no longer land participants in prison, but will earn them hearty official support. Firms which use basic products were advised to contemplate the fact that the government's steel orders already aggregate sixty days' top-notch output of all steel mills, and these are priority orders. Moreover, government buying has hardly yet begun.

Wasting labor was decried by every speaker, one economist even suggesting that the next six months may see a radical change in this country's commercial distributing system, which permits ten jobbing-house salesmen to call upon the same customer, when one man might take the

entire order. This bold assertion was not made without a full knowledge on the part of the speaker of the advantages of the competitive system in peace times. He frankly questioned whether this economic waste of man power is one the nation can afford in war times.

Neither did the economic waste occasioned by lax methods and an overcrowded field in retail trades escape notice. Dealers will become better business men on account of the war or they will fail, was the opinion. Those who extend credit must and will see to this by refusing credit where manifest inefficiency in retailing prevails. One observer even prophesied that February of 1918 would mark the beginning of this credit-tightening period. But despite this there was no pessimism.

Help to Get It Over—Buy a Bond

FEDERAL SHIPPING BOARD IN MARKET FOR FUSES

Quotations and Delivery Dates Requested on 110,000 Fuses of the Cartridge Type and 37,500 of the Plug Type.

Quotations and delivery dates are requested on all or any portion of the following by the United States Shipping Board, Emergency Fleet Corporation, Washington, D. C.:

Item	Quantity	Article
1	35,000	3-amp. N.E.C.S. cartridge fuses, non-indicating
2	15,000	5-amp. N.E.C.S. cartridge fuses, non-indicating
3	10,000	10-amp. N.E.C.S. cartridge fuses, non-indicating
4	25,000	60-amp. N.E.C.S. cartridge fuses, indicating
5	25,000	100-amp. N.E.C.S. cartridge fuses, indicating
6	25,000	10-amp. N.E.C.S. plug fuses
7	12,500	20-amp. N.E.C.S. plug fuses

Unit shipments are to consist of one two-hundred-and-fiftieth of the above quantities. Deliveries are to start about Dec. 1, 1917, and are to continue uniformly until July 1, 1918. Alternatives will be considered on indicating fuses for items Nos. 1, 2 and 3, and for non-indicating fuses on items Nos. 4 and 5; also for refillable fuses for items Nos. 4 and 5. Sample fuses are to be submitted with proposals.

METAL MARKET CONDITIONS

No New Business Being Taken by Copper Producers to Safeguard Government Requirements

A general dullness prevailed during the week in metals. Lead has dropped another cent in price, to 7 cents. Copper, though nominally held at the government figure of 23½ cents, is not to be had from the producers except on old contracts. Sales made in the open market bring 26 cents and better. Producers are taking on no new business in order to safeguard the government in its requirements. Contracts will consume all of the available supply, it is said.

NEW YORK METAL MARKET PRICES

	Oct. 8			Oct. 16		
	£	s	d	£	s	d
Copper:						
London, standard spot.....	110	0	0	110	0	0
Prime Lake	Govt. price	23.50		Govt. price	23.50	
Electrolytic	Govt. price	23.50		Govt. price	23.50	
Casting	Govt. price	23.50		Govt. price	23.50	
Wire base	30.00	to	32.00*	30.00	to	32.00*
Lead, trust price.....		8.00			7.00	
Nickel, ingot		50.00			50.00	
Sheet zinc, f.o.b. smelter.....		19.00			19.00	
Spelter, spot	8.05	to	8.30	8.17½	to	8.30
Tin, Straits		61.25			61.12½	
Aluminum, 98 to 99 per cent..	37.00	to	39.00*	35.00	to	37.00*

OLD METALS

Heavy copper and wire.....	23.00	to	24.00	23.00	to	23.50
Brass, heavy	14.50	to	16.50	14.50	to	16.50
Brass, light	11.50	to	12.00	11.00	to	11.50
Lead, heavy	7.00	to	7.25	6.00	to	6.25
Zinc, old scrap	6.00	to	6.25	5.50	to	6.00

*Nominal.

THE WEEK IN TRADE

REPORTS from the different trade centers indicate no change over conditions of the last few weeks. Deliveries in general seem to be keeping up well. In some lines, such as lamps for instance, a shortage is felt in almost every section of the country.

Credits are receiving more and more attention although collections are holding up remarkably well.

A movement is on foot to attract capital of the building interests of the country, and to that end a campaign is about to be started in several of the larger cities.

NEW YORK

In general conditions showed no change during the week. Prices are firm, with a tendency in some lines to advance slightly, although it is generally believed in the trade that the price peak has been reached. There is a noticed tendency on the part of buyers to call for extended credits. In fact, the credit situation locally is beginning to receive considerable attention.

The annual electrical show is being held this week, and the exhibits are unusually good and the audience appreciative.

COLLECTIONS AND CREDITS.—Collections remain about normal, with no special complaint of unusual backwardness on the part of debtors. Instances of members of the trade in good standing calling for more time are occasionally mentioned. Credits are held firm, with a tendency to minimize easy accommodation.

STORAGE BATTERIES.—The plants engaged in this branch are running night and day on orders, a large portion of which is for the government, especially batteries for submarines, cruisers and battleships. Private customers are also being satisfied, with delays in shipment of from a month to six weeks. Material is reported as sufficient to meet requirements for some time to come. The Edison Storage Battery Company will make an advance on its entire line of 10 per cent Nov. 1.

ARC LAMPS.—A spurt in the sale of arc lamps is noted in connection with the interior lighting of motion-picture theaters. No particular reason is assigned for this development other than the picturesque effects of the light. At the same time the trade with steel mills and shipyards is reported as falling off, other means of lighting such large areas being available. Deliveries are classed as immediate, with prices undisturbed by current affairs.

CONDUIT.—An order for rigid conduit placed last fall is just being delivered. The delay is attributed largely to a government requirement for 1,800,000 tubes, aggregating, it is reported, 18,000,000 ft. of pipe.

COPPER WIRE.—The price of copper is so uncertain that inquiries for quotations on covered and bare wire are rather indefinite. A rod mill that had a request of this kind replied that it was paying 27 cents; consequently the distributor of the finished goods was naturally "up in the air" as to what his selling figure would be. The latest price for copper in small lots for immediate delivery is 28 to 30 cents. It follows, therefore, that the official status of 23½ cents is nominal only.

GENERATORS AND MOTORS.—As has been pointed out in these columns before, generators of large size are sold up to 1920. Manufacturers state that a unit may be squeezed in and delivered ahead of this dating once in a while, but any new plant in the market for apparatus cannot depend upon delivery for a long time ahead. The demand for motors is not so active.

BATTERIES.—Pronounced activity has developed for dry batteries, a demand jobbers are finding it difficult to meet. Prices seem to be a secondary matter to deliveries. Telegraph and telephone accessories are also in strong demand.

GLASSWARE.—Globes and bowls are held firm at cur-

rent prices. A further advance may be formulated. The shortage of help in all classes is becoming acute in this district. Particularly is this true of electricians, who are in great demand at the navy yard.

CHICAGO

Business in the Chicago territory is holding up well, the main activities being such as reflect the industrial expansion. Copper in some quarters is believed to be not so high as it ought to be when the actual supply of copper that can be had for non-war activities is considered. Preparations for the holiday trade are beginning to be made. Jobbers report that collections are coming in in good shape.

COPPER WIRE.—The base on rubber-covered wire is mainly at 35 cents, there being a few firms which quote 34 cents. The opinion of jobbers on this price seems to be divided. Some say it is a price fair to all concerned; others say it is really too low, considering the actual supply of copper in the market. They cite the further fact that manufacturers in war goods will continue to get priority shipments of copper, and there is a very real possibility that non-munitions purchasers will have to pay a round premium for their share of the red metal.

INDUSTRIAL ELECTRIC TRUCKS.—Chicago manufacturers report their output sold in some cases as much as a year ahead.

STORAGE BATTERIES.—With storage batteries used in submarines, on airships, in trench signaling systems and in every other branch of war activity, there seems little chance of a decrease in the prices or in the demand.

ELECTRIC PLEASURE CARS.—Light cars are moving well. One dealer has sold about thirty in the last few months.

HEATING APPLIANCES.—Devices are selling fairly well, and a more active market is expected.

CHRISTMAS TRADE.—Jewelers are complaining that early Christmas trade has not been up to expectations. This has not deterred manufacturers of electric appliances from stocking up on holiday goods and laying plans to move them through the trade. One of the big concerns, anticipating the troubles of the dealer with clerk shortage, has worked out a plan to help the dealer sell his full quota in spite of the difficulty.

BOSTON

Business continues to show a moderate recession and collections are somewhat harder than a week or two ago. The second Liberty bond campaign is undoubtedly a factor in checking the flow of money through normal channels. Central stations show no general tendency toward departing from their policy of taking in sail with regard to new business unless distinctly off-peak characteristics are in evidence. Commercial departments of public utility companies are quieter than for many years, with a few exceptions where the disposition to encourage development marks an unusually sanguine management. Jobbers are still very busy and large stocks are being carried in many lines of merchandise. There is a decided scarcity in pole-line hardware and in electric radiators. The lamp situation is a bit quieting, despite assurances from some quarters that the threatened shortage is exaggerated. Motor stocks at the factories are improving, though irregular demands discount the certainty of being able to procure prompt shipments of particular sizes. Central station earnings are very satisfactory, but anxiety concerning the coal situation is holding back business. The demand for hydroelectric power exceeds the available supply and funds are urgently needed for immediate development of New England resources within easy reach of a better market in the Northeast than the industry has ever before seen. Military and naval activities are increasing, and the stimulating influence of the forthcoming governmental destroyer plant to be built at Squantum is already a factor in the labor and material mar-

ket. Prices will advance 10 per cent Nov. 1 on two types of alkaline battery plates.

MOTORS.—Deliveries are on the whole better, even in sizes above 25 hp. In some quarters the opinion is held that the industrial demand has reached its maximum for the present, though increased sales of motors for indirect and direct war service are anticipated.

STORAGE BATTERIES.—An advance of 10 per cent is scheduled for Nov. 1 on the "A" and "B" type of Edison battery plates. Large purchases of batteries are reported for naval service and for industrial truck operation. Deliveries on batteries are very fair, four weeks being a normal quotation. Electric delivery wagons for laundry service are growing in popularity in some of the smaller cities of New England. In the automobile battery field (gasoline cars) business is spotty. Recently a number of 6-volt outfits have been sold by a Springfield (Mass.) dealer for the lighting of country churches in locations remote from central station service.

LAMPS.—A decided shortage is apparent in miniature lamps for automobiles, due to government orders. An order for 10,000 such lamps was placed a few days ago for gun-sight service. Carbon lamps are also scarce, and the prospects are that there will be a scarcity in many other lines soon. The domestic demand for lamps has doubled and the foreign demand has increased sevenfold in the last year, according to one large jobber. Prices are holding firm.

POLE-LINE HARDWARE.—A shortage is noted here, although the present demand is reported to be slackening.

CONTROLLING APPARATUS.—Government orders are booming sales. Insulating material used in motor starters is scarcer, and deliveries are accordingly made more difficult.

AUTOMOBILE STARTERS.—Sales are falling off somewhat, due to a decrease in car sales. "Closed-Car Week" at Boston did not stimulate purchases as much as some dealers expected.

MOTOR-DRIVEN FARMING MACHINERY.—Great interest is being shown in this auxiliary branch of the electrical application field, and at the recently opened Eastern States Agricultural Exposition in Springfield, Mass., an active campaign is on to develop more popular appreciation of the benefits of electricity on the farm through exhibits and manufacturing representation.

ELECTRIC RADIATORS.—Stocks are practically exhausted; prices are holding firm, and the shortage of sheet steel is impeding production.

ATLANTA

All sources report business as being excellent. Jobbers and dealers state that the volume of sales in nearly all lines continues heavy, with an increasing activity in seasonal goods due to the advent of brisk fall weather, which arrived earlier this year than was expected.

The cantonments have stimulated a demand for all electrical specialties such as the men are permitted to use in the barracks.

The Blue Ridge Power Company, Spartanburg, S. C., has placed contracts covering equipment for its development on the Green River near Saluda, S. C., which include two 2500-kw. vertical units with Pelton waterwheels, transformers and station equipment. It is proposed to convey water to the power house, a distance of one mile, using an 8-in. wooden flume. Energy will be transmitted to Spartanburg.

STORAGE BATTERIES.—Branch offices and service stations of the various manufacturers report a large volume of business; in fact, more than they can conveniently take care of. Sales in certain quarters are reported as being more than 100 per cent better to date than last year. Deliveries, however, do not seem to be improving.

ELECTRICAL INDUSTRIAL TRUCKS.—More activity seems to be developing in this line, as reflected by a number of substantial orders being placed. One large fertilizer manufacturer lately purchased eighteen 2-ton trucks, to be

utilized mostly in the shipping departments of its various branch factories. A few scattered orders have also been placed by the government for the movement of supplies in the quartermaster depots. The present scarcity of labor in this section is directing the attention of many industrial interests to this type of labor-saving equipment, which should tend further to stimulate this line and open up a good future market.

INDUSTRIAL CONTROL DEVICES.—The manufacturers of these devices have enjoyed a good market in the Southeast for 1917. Estimates place sales to date as registering an increase of 40 per cent over 1916. Deliveries have been very poor, and the prospects are that they will be worse.

SERIES INCANDESCENT SYSTEMS.—Manufacturers state that the demand in this line has been very strong, and sales are double those of last year. Shipments to date have been good; delivery promises run from six to eight weeks.

POTENTIAL REGULATORS.—Demand for both feeder and generator voltage regulators is very strong. Shipments on the generator type are much better than on the feeder type. The former are promised for two months, as against three to four months for the latter.

CABLE.—Requirements of this section for 1917 have shown an average of 60 per cent increase over 1916. The demand continues steady for the heavy sizes, but the deliveries are very discouraging.

HEATING APPLIANCES.—Jobbers report an unprecedented volume of sales for most of the household devices during the past week.

LIGHTING FIXTURES.—The building of residences and apartments in Atlanta's burnt section has begun in earnest and is reflected in a big business in fixtures. Dealers report this year's volume of sales as being a record breaker.

POLES AND LINE MATERIAL.—The central stations are still experiencing considerable difficulty in securing poles for rush work. This is probably due to the rural sources holding for a price advance. Reports from certain sections indicate a slight improvement in hardware deliveries.

SEATTLE

A noticeable decrease in sales is noted during the past week. This applies particularly to sales of motors, wire, and on conduit supplies to shipyards, especially those engaged in steel ship construction. An authority in the electrical industries states that during the last week sales to shipyards dropped off 50 per cent, this being due to a strike in the shipbuilding plant. There was no decided increase in prices, and dealers expect no increase, believing the peak has been reached. Stocks are low and in certain lines they are exceedingly hard to obtain. This applies particularly to lamps and large sizes of rubber-covered wire. Stocks on lamps and wire are very low.

Standard lines, such as conduit, porcelain, small motors used by shipyards and household appliances, are coming through satisfactorily. The feature of the week's business was the continued heavy sales of domestic appliances, including washing machines, ranges, heaters, toasters and devices introduced and pushed by a campaign to lighten the home work. The sale of house-wiring devices was very light. There is practically no building under way or projected.

Freight conditions in Washington are reported satisfactory. Oregon, however, is complaining of a shortage of cars.

Fall business, from present indications, will not be so heavy as expected. The authorities believe the last three months of the year will show a falling off, as compared with the first nine months. The lumber mills and the government bought more heavily last week than in the week previous. Business from the mills is expected to increase, and projected buildings at the American Lake cantonment and Fort Stevens, Ore., mean new business in wiring devices.

The sawmills production continued approximately 75 per cent of normal, according to reports from 137 representative mills in Oregon and Washington. The indications point to an increased demand from the mills when all resume ac-

tivities. The aircraft division of the army has placed an order for 10,000,000 ft. of selected fir to be distributed among the Washington mills, and a Philadelphia shipbuilding plant an order for 8,000,000 ft. of lumber, with the fir emergency committee, to be distributed among the Oregon and Washington mills.

Approximately 7000 shipyard employees in three fields and twelve wooden yards in Portland who have been on strike have agreed to accept the findings of the federal labor adjustment board, which opened its session in Portland Oct. 14. The Metal Trades Union, representing 9000 metal trade workers, balloted in Seattle Oct. 15 on the question of returning to work under temporary agreements. Oct. 20, midnight, is time set for the coast-wide strike of 6000 telephone operators, linemen and electricians, employees of the Pacific Telephone & Telegraph Company.

Credits and collections for the last week were satisfactory.

CABLE.—Government demand was heavy during the last week. Prices are steady.

MOTORS.—There is heavy demand from the government and a normal demand from the lumber mills and industrial plants. Prices are about the same. Shipment is very slow.

FARM LIGHTING SETS.—The campaign for farm lighting outfits is justified in the Northwest. A continued interest is shown and there is an increase in sales.

HEATING EQUIPMENT.—The Electric Sales Corporation, has recently closed a contract for installation of the Apfel system of electric heating in the new Paul High School at Paul, Idaho. Contract was awarded to the Apfel system, as a result of the satisfactory service the system gave last winter in the Caledonia Hotel at Rupert, Idaho.

SAN FRANCISCO

Conditions are better than in October last year, but at present indications are that less business will be done this month than in September. Very little building is under way, excepting that connected with the industrial plant extension and work incidental to war orders. An uncertainty in present market conditions exists, probably because the present quieting down is the first suggestion of having passed the peak of recent good business.

LAMP CORD.—This week it is quoted at \$26.90 per 1000 ft. of No. 18 cotton-covered, which is lower than previously reported. Stocks are poor and deliveries very bad.

ELECTRIC HEATERS.—Unusual activity has been shown this fall and several companies are installing air heaters, with a considerable percentage of electric ranges. This movement is the more pronounced because coal in San Francisco now costs the householder about \$14 per ton, and with oil high electric heating is more favorably regarded. Although 600 to 1500 watts are ordinary sizes, orders for sizes up to 3 kw. are being received.

ELECTRIC FANS.—The season is over and there is little demand for fans in California excepting in the warm weather; but fan orders have not yet been placed for ships under construction, which will mean considerable business.

TRANSFORMERS AND MOTORS.—Several power companies are making strenuous efforts to compensate the shortage of motors and transformers by taking out such equipment wherever not vitally needed and reinstalling it at critical points. With very high wages and a labor shortage this is an unsatisfactory method, but it is practically impossible to get motors and transformers in the larger sizes, and deliveries are promised only on very long terms.

SWITCHES.—The stock of knife switches is poor and deliveries are slow. Material for safety switches to be made up by Pacific Coast licensees is hard to get, and the stocks are extremely poor.

HOLIDAY TRADE.—Preparations are being made for a heavy Christmas trade. Already there is an active demand from agricultural regions, and more is anticipated after the payment for fall crops. This trade is calling especially for vacuum cleaners, washing machines and other labor-saving devices.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of last week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List, per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor

No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE PER 1000 FT.—NEW YORK

Single-Conductor

Less than coil.....	\$61.00 to \$71.00
Coil to 1000 ft.....	59.17 to 68.87

Twin-Conductor

Less than coil.....	\$105.00 to \$135.00
Coil to 1000 ft.....	70.00 to 130.95

DISCOUNT—CHICAGO

Single-Conductor

Less than coil.....	+10%
Coil to 1000 ft.....	—10%

Twin-Conductor

Less than coil.....	+10%
Coil to 1000 ft.....	—10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	+10% to 12%
1/5 to std. pkg.....	10% to 20%
Std. pkg.....	34% to 44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+20% to 12%
1/5 to std. pkg.....	List to 20%
Std. pkg.....	30% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28	.29

BATTERIES, DRY—Continued CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 30.....	.35	.35
50 to barrel.....	.31 to .3175	.32 to .3275
Barrel lots.....	.28 to .2875	.29 to .2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. Per Coil	List, Per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip.....	\$75.00	\$69.75
3/8-in. double strip.....	75.00	72.00
1/2-in. single strip.....	100.00	93.00
1/2-in. double strip.....	100.00	96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 100 Ft.
3/8-in. single strip.....	\$75.00	\$63.75
3/8-in. double strip.....	78.75	71.25
1/2-in. single strip.....	100.00	85.00
1/2-in. double strip.....	105.00	85.00-95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
5/8.....	.15	2.....	.55
3/4.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

	Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$55.00	\$24.50	\$21.50
1/4-in.—	60.00	27.00	23.50

NET PER 1000 FT.—Chicago

	Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$36.67-\$55.00	\$27.50	\$23.10-\$24.75
1/4-in.—	\$40.00-\$60.00	\$30.00	\$25.20-\$27.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List Elbows, List

1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.60
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb....	6% 8%
2500 to 5000 lb....	9% 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb....	3.8% 5.8%
2500-5000 lb....	6.8% 8.8%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	\$5.00
Discount .....	.30%

CHICAGO

List	\$5.00 to \$6.00
Discount .....	.25%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK.

	Per 100 Net
Less than 1/5 std. pkg.....	\$5.75
1/5 to std. pkg.....	4.50
Standard package, 500. List, each, \$0.07.	

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.....	\$6.25
1/5 to std. pkg.....	5.25
Standard package, 500. List, each, \$0.07.	

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B	100	\$0.27
60-watt—B	100	
100-watt—B	24	.36
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulbs, 3 1/8 in., frosted:		
15-watt—G	50	.50
25-watt—G	50	.50
40-watt—G	50	.50
Round bulbs, 3 3/4 in., frosted:		
60-watt—G	24	.72
Round bulbs, 4 1/8 in., frosted:		
100-watt—G	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.....	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.....	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.).....	\$34.88
Coil to 1000 ft.....	26.52

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.).....	\$36.56 to \$36.88
Coil to 1000 ft.....	27.42 to 27.66

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100.....	\$20.00 to \$29.00
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CHICAGO

Net per 100.....	\$14.58 to \$38.35
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OUTLET BOXES

Nos.	List, per 100
101—A, A1 1/2, 4 S.C., 6200, 320.....	\$30.00
102—B.A., 6200 S.E., 300, AX, 1 1/2, 4 S.....	30.00
103—C.A., 9, 4R, B 1 1/2.....	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.....	20.00

DISCOUNT—NEW YORK

	Black List	Galvanized List
Less than \$10.00 list..	List	List
\$10.00 to \$50.00 list..	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list....	40%	35%
\$10.00 to \$50.00 list....	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.....	\$20.00
1/5 to std. pkg.....	15.00
Standard package, 2200 List per 1000,	\$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg....	\$15.80 to \$20.54
1/5 to std. pkg.....	13.00 to 19.24
Standard package, 2200 List per 1000,	\$20.

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net	Std. Pkg.	3500 Std. Pkg.	4000
		5 1/2 N.C.—Solid Nail-it—N.C.		
Less than 1/5 std. pkg.....	\$24.30			
1/5 to std. pkg.....	12.15			

CHICAGO

	Per 1000 Net	Std. Pkg.	3500 Std. Pkg.	4000
		5 1/2 N.C.—Solid Nail-it—N.C.		
Less than				
1/5 std.	\$11.85 to \$18.00	\$20.75 to \$30.75		
1/5 to std. pkg	9.00 to 11.10	16.30 to 24.20		

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/2-in. cap key and push sockets	500	\$0.33
1/2-in. cap keyless socket..	500	.30
1/2-in. cap pull socket.....	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	Net
1/5 to std. pkg.....	20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	Net
1/5 to std. pkg.....	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:				
30-amp. S. R. S. T.....		\$0.80		
60-amp. S. P. S. T.....		1.20		
100-amp. S. P. S. T.....		2.25		
200-amp. S. P. S. T.....		3.48		
300-amp. S. P. S. T.....		5.34		
30-amp. D. P. S. T.....		1.20		
60-amp. D. P. S. T.....		1.78		
100-amp. D. P. S. T.....		3.38		
200-amp. D. P. S. T.....		5.20		
300-amp. D. P. S. T.....		8.00		
30-amp. 3 P. S. T.....		1.80		
60-amp. 3 P. S. T.....		2.68		
100-amp. 3 P. S. T.....		5.08		
200-amp. 3 P. S. T.....		7.80		
300-amp. 3 P. S. T.....		12.00		
Low Grade:				
30-amp. S. P. S. T.....		0.42		
60-amp. S. P. S. T.....		0.74		
100-amp. S. P. S. T.....		1.50		
200-amp. S. P. S. T.....		2.70		
30-amp. D. P. S. T.....		0.68		
60-amp. D. P. S. T.....		1.22		
100-amp. D. P. S. T.....		2.50		
200-amp. D. P. S. T.....		4.50		
30-amp. 3 P. S. T.....		1.02		
60-amp. 3 P. S. T.....		1.84		
100-amp. 3 P. S. T.....		3.76		
200-amp. 3 P. S. T.....		6.76		

DISCOUNT—NEW YORK

Less than \$10 list.....	+5% to 5%
\$10 to \$25 list.....	11% to 16%
\$25 to \$50 list.....	14% to 24%

DISCOUNT—CHICAGO

Less than \$10 list.....	+5% to 5%
\$10 to \$25 list.....	11% to 16%
\$25 to \$50 list.....	14% to 24%

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT NEW YORK

Less than 1/5 std. pkg.....	Net
1/5 to std. pkg.....	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+20% to net
1/5 to std. pkg.....	Net to 15%
Std. pkg.	20%

SWITCH BOXES, SECTIONAL CONDUIT

	List, Each
Union and Similar—	
No. 155	\$0.34
No. 160 .....	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list.....	List	
\$2.00 to \$10.00 list.....	20%	
\$10.00 to \$50.00 list....	30%	

DISCOUNT—CHICAGO

	Black	Galvanized
Less than		
\$2.00 list	25% to 50%	15% to 40%
\$2.00 to \$10.00	20%	
list	25% to 50%	20% to 40%
\$10.00 to \$50.00	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	\$6.00
Discount	30%

CHICAGO

List price	\$4.50 to \$5.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

No. 18, less than full spools.....	\$0.49
No. 18, full spools.....	0.45

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	\$0.65 to \$0.6585
No. 18, full spools.....	0.55 to 0.5585

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
11	\$18.00	\$14.00	\$11.25
12	27.51	23.58	19.85
10	38.43	32.94	27.45
8	54.39	46.62	38.85
6	86.10	73.80	61.50

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14 ...	\$18.00	\$16.00	\$14.00
12 ...	27.79-28.63	23.82-24.54	19.85-22.5
10 ...	34.44-38.78	30.47-31.57	27.70-28.7
8 ...	48.84	43.13-44.77	39.20-40.7
6 ...	68.25-70.80	62.05-64.00	55.85-57.6

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.....	\$37.25
25 to 50 lb.....	36.25
50 to 100 lb.....	35.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.....	\$40.35 to \$42.00
25 to 50 lb.....	39.35 to 41.00
50 to 100 lb.....	28.35 to 40.00

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

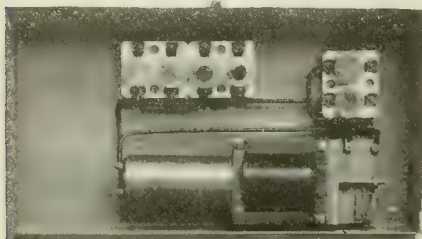
	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.....	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.....	100	.54
5-amp. three-point.....	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.....	100	.66

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Sign Flasher

A sign flasher that eliminates all motor drive and complicated mechanism for flashing signs is made by the Automatic Electric Controller Company of Seattle, Wash. Essentially the device consists of a solenoid which actuates a stem. This stem is attached to an oil dashpot at the lower end which slows



NO MOTOR DRIVE IN THIS SIGN FLASHER

up its movements and permits of regulating speed of operation within wide limits. The upper end of the stem projects above the solenoid and operates the circuit breaker. This breaker controls the solenoid circuit only. The load circuit is made and broken under oil in the dashpot. These flashers are made in two stock sizes. The one illustrated is designed for loads up to 2500 watts alternating current or 1000 watts direct current any voltage. The next size will handle 5000 watts alternating current and 2500 direct current.

Motor-Controlling Panels

The Igranic Electric Company, Ltd., of 147 Queen Victoria Street, London, England, has recently developed the "Conspede" and "Varispede" motor-control panels.

The "Conspede" panels, which are for constant-speed motors, comprise a heavy-duty motor-starting switch with automatic no-voltage release and two single-pole magnetically operated clapper switches (used as circuit breakers) with automatic overload release. The starter is interlocked with the clapper switches. When the handle of the starter is moved in a clockwise direction (for the purpose of starting the motor) a roller turns so that the metal part of its periphery is in contact with the sectors on the face of the starter and the operating coils of the clapper switches are thereby excited, but if the handle is moved ever so slightly in an anti-clockwise direction, the roller is turned so that the porcelain or insulating portion of its periphery comes into contact with the sectors and the circuit to the operating coils of the clapper switches is thereby opened.

The "Varispede" panel comprises (in addition to what has already been described) a shunt-field regulator so interlocked with the starter that it is always short-circuited during the starting operation, thus insuring the motor full field strength at starting.

Both of the panels are inclosed in what are called pillar-type housings, which effectually protect the switch gear from damage and which are suitable for installation in any convenient position on the floor of an engineering or other workshop. Each panel has a cast-iron base with feet suitable for bolting to the floor. The whole of the switch gear is built on a strong pipe frame supported from this base. The top of the housing consists of a massive cast-iron crown, and between the crown and base the



TYPES OF MOTOR-CONTROLLING PANELS

housing is of heavy-gage wrought iron, the top and bottom edges of which fit into grooves in the crown and base. This wrought-iron intermediate portion is fitted with glazed hinged cast-iron doors on the front, giving a good view of the switchgear inside, and with hinged cast-iron doors on the back, which give access to the resistances and interconnections. The cast-iron crown is secured by two nuts, screwed on to the upper end of the pipe frame, and this arrangement makes it easy, when more perfect access is required to the interior than is afforded by the doors, to lift off the crown and the whole of the rest of the housing from the base by removing these two nuts.

Steel-Guttered Cabinets

Two types of steel-guttered cabinets, one for surface and the other for flush mounting, are made by the Aurora Steel Products Company of Aurora, Ill. The construction, it is pointed out, makes it possible to furnish these cabinets with either 2-in., 3-in. or 4-in. (5-cm., 7.6-cm. or 10-cm.) wiring gutter, entirely covered by the front of the cabinet. The cabinets are made of 14 and 16 gage steel in various sizes and depths varying from 3 in. to 12 in. (7.6 cm. to 30.5 cm.).

Pony-Type Snap Switches

Pony-type snap switches are being made by the General Electric Company, Schenectady, N. Y., with the standard pony size base, but equipped with porcelain covers and handles so that the switches can be used in exposed places where they are liable to be subjected to corroding influences from the weather.

These new snap switches are made in single-pole, 3-amp., 250-volt, 5-amp., 125-volt sizes, with both closed and slotted bases, as desired, and in indicating or non-indicating types.

Adjustable Floor Lamp

The floor lamp shown in the accompanying illustration is made in either verde antique or statuary bronze and is offered to the trade by the Western Electric Company of New York. The reflector may be adjusted to any angle. The lamp is equipped with a split ball joint which will not cut the cord, a

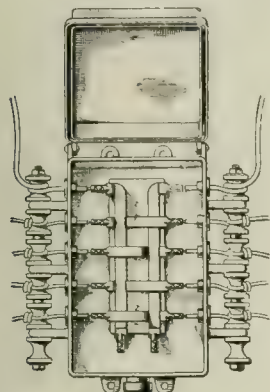


REFLECTOR MAY BE ADJUSTED TO ANY ANGLE

thumb screw that fits the finger and a locking-device cushion grip which prevents scratching of the brass tubing. The diameter of the base is $8\frac{1}{4}$ in. (21 cm.) and it is heavily weighted to prevent upsetting. This lamp is also made in the table portable type.

Distribution Box

The Canton Specialty Company of Canton, Ill., has placed on the market a distribution box for use on overhead construction in districts where more than one customer's service lead is taken from a distribution pole. The

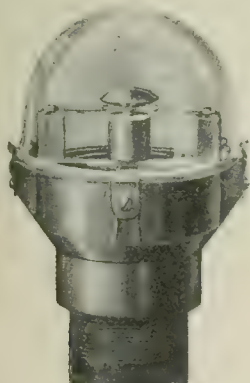


CAST-IRON BOX WITH SLATE BASE

box itself is of light cast iron, approximately 15 in. long, 8 in. wide and 5 in. (38.1-cm. by 20.3-cm. by 12.7-cm.) deep. The lid hinges at the top and is fitted with a felt gasket to make the box approximately watertight. Inside the box is a slate base upon which are mounted two busbars carrying lugs to which the customers' service wires are extended through porcelain thimbles in the side of the box. In practice the secondary lines are connected to these busbars, and the service lines radiate from them to the customers' premises, the strain being taken by distribution racks attached to the side of the box.

Air-Pressure Relay

An indicator for use in connection with air-cooled transformers, arranged to operate an audible alarm to notify operators of failure of air supply, has been developed by the Electrical Development & Machine Company of Philadelphia. This device consists of a cup-shaped metal base so arranged as



FOR USE WITH AIR-COOLED TRANSFORMERS

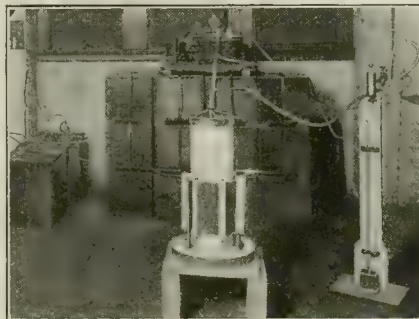
to provide for the free movement and support of a ground aluminum valve plate, which carries a post supporting a contact disk. The lower part of the metal base is arranged for screwing on a 2-in. (5.08-cm.) iron pipe. This pipe is used for the purpose of taking

air pressure from the air chamber direct to the signal device.

The two contact points for closing the alarm circuit are arranged on the top of the casing, so that the disk, which is fastened to the aluminum valve post, will close the circuit properly when the pressure in the air chamber drops below a safe operating point. The contact points on top are protected by an oval glass cover. The operation of the device is such that the aluminum valve will rise and remain closed when any pressure over approximately $\frac{1}{2}$ oz. (14 g.) is delivered in the air chamber.

High-Frequency Induction Furnace

A furnace which presents a radical departure from usual furnace practice and embodies the first employment of oscillatory currents for the generation of heat and production of temperature has been placed on the market by the Pyroelectric Instrument Company of Trenton, N. J. By reason of the highly effective induction possible



NO IRON IS USED IN THIS FURNACE

without the interlinkage of a magnetic with an electrical circuit, currents can be set up in the containing crucible in the case of a non-conducting melt, or in the melt itself if this melt has sufficient conductance to permit the flow of current. It is pointed out that no iron is used. Thus it is possible to raise the temperature of a melt in a crucible until its resistance becomes low enough to permit the generation of heat in the substance itself, after which the temperature producible is limited only by the durability of the insulation and refractory container.

Since this furnace operates by induction, conditions of the melting chamber may be controlled perfectly. Consequently it is possible to produce temperatures exceeding 1600 deg. C. in the partial vacuum or pressure, with any conceivable atmosphere, and if desired, without the contaminating influence of carbon.

The furnace works on a two-phase commercial circuit, 60 cycles, 220 volts, with balanced load at unity or slightly leading power factor. This furnace has been developed by Dr. E. F. Northrup of Princeton University in conjunction with the Pyroelectric Instrument Company, under the direction of the Ajax Metal Company of Philadelphia.

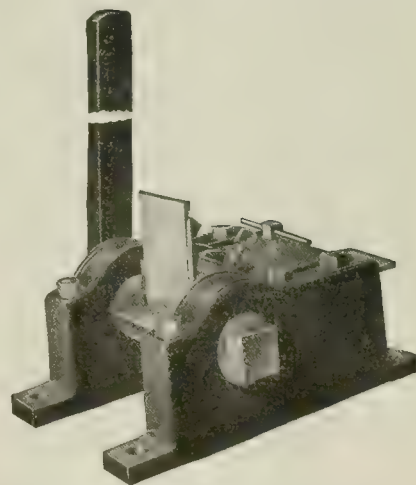
Electric Automobile Heater

An electric automobile heater which does away with the installation of a complete garage heating system is being manufactured by the Metal Specialties Company of Chicago. The heater is 12 in. (30.5 cm.) long, equipped with a handle at one end and a hook at the other. It hangs under the hood near the carburetor, engine and radiator, distributing the heat where it is most needed. It is furnished with 10 ft. (3.05 m.) of cord and an attachment plug for any electric light bracket. It is made for use on a 110-volt current, either direct or alternating. This device, the maker points out, prevents freezing to the cooling water in the motor car and facilitates starting on cold mornings at a cost decidedly lower than that of the garage heater.

Busbar-Bending Machine

A machine that bends equally well all copper bar sections up to and including 6 in. (15.2 cm.) in width and $\frac{3}{8}$ in. (9.5 mm.) in thickness is here illustrated. The bar is run through the bed and clamped firmly in place. The operation of the bending arm causes a bending jaw to carry the bar end up to a true right angle or any inside angle more obtuse. The adjustable top-holding clamp may be set, allowing for a slight spring-back, so that with any one section of bar any number of right-angle bends may be reproduced by the complete travel of the operating lever.

The bending jaw does not roll or wipe the moving portion of the bar, but simply follows it through the bend. This feature prevents the possibility of the piece sliding through the machine bed after commencing the bend. By use of the gage face on the rear end of the machine any number of pieces



WILL BEND 6-IN. COPPER BAR SECTIONS

may be bent with proper allowance so that they will lie together evenly spaced in a stack after they have been bent.

This machine is manufactured by the General Devices & Fittings Company of Chicago.

Trade Publications

RESISTANCE UNITS.—The Wirt Company of Philadelphia has prepared a bulletin descriptive of its Di-El-ite resistance units.

TABLE STOVES.—The Standard Stamp- ing Company of Huntington, W. Va., has prepared a leaflet descriptive of its stand- ard table stoves.

WASHING MACHINE.—The "1900" Washer Company of Binghamton, N. Y., has issued a bulletin descriptive of its "1900" gravity washer.

STEAM TRAPS.—The Fisher Governor Company, Marshalltown, Iowa, has pre- pared bulletin No. 1101, descriptive of its Fisher steam trap type No. 33.

GRAPHIC INSTRUMENTS.—The Ester- line Company of Indianapolis, Ind., has prepared a bulletin which describes briefly the Esterline Graphic efficiency instru- ments.

PRESSURE PUMPS.—The Worthington Pump & Machinery Corporation, 115 Broad- way, New York, has prepared a bulletin descriptive of its Worthington pot-valve pressure pump.

OPTICAL PYROMETER.—An optical pyrometer for factory use is described in bulletin 860, published by the Leeds & Nor- thrup Company, 4901 Stenton Avenue, Philadelphia, Pa.

SELLING MEDIUM.—"Selfast," a device that displays goods in motion, is illus- trated and described in a bulletin prepared by the Herberts Engineering Company, Inc., 10 East Forty-third Street, New York City.

METER EQUIPMENT.—Metropolitan protective service and meter equipment No. 3600 is illustrated and described in a bulle- tin prepared by the Metropolitan Engineer- ing Company, 35 Vestry Street, New York City.

LAMPS FOR MOTION-PICTURE STU- DIOS.—Bulletin No. 77, descriptive of Cooper Hewitt electric lamps for motion- picture studios, is being distributed by the Cooper Hewitt Electric Company of Ho- boken, N. J.

COAL MINE EQUIPMENT.—"Tippie at Powhatan in Pocahontas Field" is the title of book No. 322, now being distributed by the Link-Belt Company of Chicago, Ill. This booklet is a reprint from *Coal Age*, May 26, 1917.

STORAGE-BATTERY LOCOMOTIVES.—The Ironton storage-battery locomotive, type D-1, for gathering and haulage in coal and metal mines and in industrial plants is described in bulletin No. 11, prepared by the Ironton Engine Company of Ironton, Ohio.

WIRES AND CABLES.—Paranite wires and cables are illustrated and described in a bulletin prepared by the Indiana Rubber & Insulated Wire Company of Jonesboro, Ind. This bulletin, which consists of 112 pages, gives information and prices on the complete line of wire cable made by this company.

MOTORS AND TRANSFORMERS.—Bulletin No. 41,021, descriptive of RF ad- justable speed motors, has been prepared by the General Electric Company of Sche- nectady, N. Y. This company has also prepared bulletin No. 46,030, descriptive of its portable instrument transformers, types P2 and R2.

HEAT INSULATION.—The Magnesia As- sociation of America has prepared a bulle- tin the title of which is "Let 85 per Cent Magnesia Defend Your Steam." This bulle- tin is a study of the cause and prevention of heat losses in the transmission of steam for power or heating purposes, addressed to the architect, engineer and owner.

HEATING DEVICES.—The General Elec- tric Company of Schenectady, N. Y., has prepared bulletin No. 49,115A, descriptive of its industrial electric heating devices. These devices include air-tempering ovens for carbon and high-speed steels, melting pots for lead and tin alloys, oil-tempering bath and induction circulation water heat- ers.

REFLECTORS.—"Holophane Develop- ments for Type 'C' Lamps" is the title of a new publication issued by the Holophane Glass Company, Inc., 340 Madison Avenue, New York City. It is a semi-technical treatise, in the form of a catalog, dealing with the newest lighting units which this company has designed for the type "C" lamp.

OIL FILTERS.—The Burt Manufacturing Company of Akron, Ohio, has prepared a bulletin descriptive of its oil filters, exhaust heads and ventilators. This bulletin in- cludes information on the Cross, American

and Warden oil filters, the Burt oil-filtering system, the Burt exhaust head, the Stand- ard exhaust head, the Burt combination skylight and ventilator and the Burt rotary ventilator. It has 128 pages, is well illus- trated and shows care in its make-up.

OXY-ACETYLENE PROCESS.—"Turn- ing Waste Into Profit" is the title of a new book just issued by the Prest-O-Lite Company, Inc., of Indianapolis, Ind. It is devoted exclusively to the possibilities of reclaiming broken and worn machinery and metal parts for service by the oxy-acety- lene process. Containing eighty-two illus- trations, it pictures and describes repre- sentative examples of reclamation welding work in practically every field of the indus- trial world.

Trade Notes

THE LACLEDE-CHRISTY CLAY PROD- UCTS COMPANY has moved its general office to Suite No. 1653, Railway Exchange Building, St. Louis.

THE WARD LEONARD ELECTRIC COMPANY of Mount Vernon, N. Y., is now represented in St. Louis, Mo., by the Morse Engineering Company.

CHARLES R. ABLETT, for many years New York representative of the Hygrade Lamp Company, has gone into business as the Charles R. Ablett Company, lamp specialists, 30 Church Street, New York City.

C. F. LOMONT until recently with the McGraw-Hill Publishing Company in Chi- cago, has become connected with the Elec- tric Service Supplies Company, Philadel- phia, as its representative in the North and Northwest, with headquarters in Min- neapolis.

THE SOUTHWEST GENERAL ELEC- TRIC COMPANY, with offices at Dallas, Houston, San Antonio, El Paso, Oklahoma City and Tulsa, has recently taken the agency in its territory for the Consolidated Utilities Corporation of Chicago, manu- facturer of Matthews farm lighting plants.

THE BROWN INSTRUMENT COM- PANY, Pittsburgh, Pa., has purchased a large piece of ground lying to the south of its factory, which now extends along Wayne Avenue from Windrim Avenue on the north to Roberts Avenue on the south. This purchase will permit large extensions to the plans as may be required.

EDWARD D. McCORMACK has estab- lished an electrical brokerage business with offices in the Bank of Hamilton Building, Toronto, Can. Mr. McCormack, who was for many years manager of the Canadian General Electric Company, will execute commissions in connection with the buying or selling of electrical appliances and sup- plies, construction material, etc.

THE J. B. FERRY COMPANY, Cedar Rapids, Iowa, has arranged a slogan prize contest, opened during October, in con- nection with products which it handles. Ten prizes from merchandise will be awarded to contestants who send in the most nearly correct solutions to a set of trade-slogan puzzles contained, with instructions, in a special circular to be had on application. Any person connected with any central station or electrical firm is eligible to com- pete. Prizes will be awarded as soon after Nov. 1 as possible, and the names of the winners will be published.

THE VULCAN STEEL PRODUCTS COMPANY, New York City, has opened an office in Havana, Cuba, under the man- agement of G. O. Simpson. In connection with this office there will be maintained a permanent exhibition of machinery and steel and iron products. Branches of the Vulcan company are now maintained at Paris, France; Hongkong and Shanghai, China; Yokohama, Japan; Milan, Italy; Barcelona, Spain; Melbourne and Sydney, Australia; San Juan, Porto Rico, and Singa- pore, Straits Settlements. It is also rep- resented in all the world's important trade centers.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., announces another increase in wages for its shop employees aggregat- ing nearly \$2,000,000 a year, effective Oct. 16. All employees observing shop hours, except munition workers, will receive an additional bonus of 10 per cent if they are on a salary or time-rate basis, and of 7 per cent if they are on a piece, premium or task basis. The 20,000 shop employees of the Westinghouse company form one of the most highly skilled organizations in the country. Wage increases granted since the outbreak of the European war now amount to about 60 per cent of the former average compensation.

New Incorporations

THE GREENWICH (CONN.) ELEC- TRIC COMPANY has been incorporated with a capital stock of \$15,000 by Ralph Draughn, Raymond M. Boden and Charles W. Dewey.

THE TEXARKANA (ARK.) BATTERY COMPANY has been incorporated with a capital stock of \$10,000 by G. H. Logan, William S. James and C. Ordeman, all of Texarkana.

THE STAMFORD (CONN.) ELECTRI- CAL CONTRACTING COMPANY has been chartered with a capital stock of \$15,000 by Clifford Peck, Andrew D. Parker and Oren D. Maxim.

THE JOHNSON POWER TRANSMIS- SION COMPANY of Seattle, Wash., has been incorporated with a capital stock of \$2,000 by William A. Blackwood, J. D. Johnson and Adair Rembert.

THE CONTINENTAL BATTERY COM- PANY of Brooklyn, N. Y., has been char- tered by A. T. and J. M. McCafferty and E. Zeigler, 620 West 135th Street. The company is capitalized at \$5,000.

THE RENARD-STARY ELECTRIC COMPANY of Los Angeles, Cal., has been incorporated with a capital stock of \$25,000. The directors are: C. A. Renard, N. L. Starey and C. L. Chandler.

THE GARY (IND.) ELECTRIC COM- PANY has been incorporated with a capi- tal stock of \$5,000 to deal in electrical fix- tures. The incorporators are: Lloyd B. Snowden, Vaughn Snowden and David L. Snowden.

THE LALEY-OLIVER ELECTRICAL COMPANY of Fargo, N. D., has been in- corporated with a capital stock of \$25,000. The incorporators are: E. E. Oliver, M. A. Baldwin and C. W. McRoberts, all of Fargo, N. D.

THE ELECTRICAL CONTRACTORS' CORPORATION of Waterbury, Conn., has been incorporated with a capital stock of \$1,000 by John H. Gilliland, Ralph J. Vaughan of Waterbury, and H. M. Whit- ing of Bradford.

THE NUNN ELECTRIC COMPANY of Oklahoma City, Okla., has been incorpo- rated with a capital stock of \$25,000 by J. E. Nunn of Amarillo, Tex.; O. T. Jenkins of Oklahoma City, Okla., and Galen Crow of Guthrie, Okla.

THE NEW HAVEN (CONN.) ELEC- TRIC COMPANY has been chartered by Raymond M. Boden, Harvey L. Voshell and Clifford A. Peck. The company is capitalized at \$60,000 and proposes to do a general electrical business.

THE AUTOMATIC SIGNAL & SIGN COMPANY of Canton, Ohio, has been in- corporated with a capital stock of \$10,000 to manufacture signals. P. G. Myers is president of the company and John A. Wertz is secretary and treasurer.

THE ELECTRIC CONTRACTING & SUPPLY COMPANY of New London, Conn., has filed a certificate of organiza- tion at the office of the Secretary of State. The company is capitalized at \$15,000. The incorporators are John E. Gill, Clifford Peck and Charles W. Dewey.

THE ELECTRIC SERVICE & POWER EQUIPMENT COMPANY of Grand Rapids, Mich., has been chartered with a capital stock of \$11,000 by William G. Brummeler, 18 Lafayette Avenue, S. E.; Joseph Brown, 510 Wealthy Avenue, S. E., of Grand Rap- ids, and D. R. McDuffee of Saginaw.

THE CUMANU LIGHT & POWER COM- PANY of New York, N. Y., has filed ar- ticles of incorporation under the laws of the State of Delaware with a capital stock of \$50,000 to build and operate power plants. The incorporators are: Arthur W. Britton, Samuel E. Howard and Joseph F. Curtin.

THE DALLAS (Tex.) POWER & LIGHT COMPANY has been incorporated with a capital stock of \$150,000 by Harry M. Durning of New York, N. Y.; J. F. Strick- land, W. D. Head and C. F. Calder of Dallas. The company proposes to operate and maintain street car and interurban railway lines.

THE PACIFIC ELECTRO METALS COMPANY of Bay Point, Cal., has been in- corporated by F. B. Ellis, Joseph Smyth, A. McCharles, J. H. Stern and William Muller. The company is capitalized at \$100,000 and proposes to acquire and main- tain mills, smelting and reduction plants. Carson City, Nev., is given as the prin- cipal place of business.

New England States

MANCHESTER, N. H.—The Manchester Traction, Light & Power Company has awarded a contract to Whitcomb & Kavanaugh, 6 Beacon Street, Boston, Mass., for the erection of a new power station.

BURLINGTON, VT.—The City Council has granted the Burlington Light & Power Company permission to erect electric transmission lines in certain streets of the city to transmit electricity from its plant at the gorge (so called) to the works of the Vermont Milk Chocolate Company.

RUTLAND, VT.—The Rutland Railway, Light & Power Company has been awarded a contract by the Patch Manufacturing Company to furnish energy (335 hp.) at the plant of the latter. The Rutland company will also erect immediately a new electric transmission line from Castleton Corners to Hampton, a distance of about 6 miles, to furnish electricity to the Staso Milling Company. The contract calls for 2400 hp.

BOSTON, MASS.—An agreement has been reached between the Boston Elevated Railway Company and the Massachusetts Waterways Commission whereby a connection will be built between the new South Boston Fish Pier and the Boston Elevated Railway, work on which will begin at once. The proposed line will be constructed by the commission and leased to the railway company.

BROCKTON, MASS.—The Hub Gore Company has awarded a contract to the Tremaine Electric Company, School Street, for equipping its new plant on North Warren Avenue for electrical operation.

NEW BEDFORD, MASS.—The J. C. Rhodes Company is contemplating the construction of an addition to power house, 20 ft. by 40 ft., at its plant at 128 Front Street, to cost about \$10,000.

BRISTOL, CONN.—The Chamber of Commerce is considering plans for the installation of an ornamental lighting system in the business district. The Bristol & Plainville Tramway Company has the contract for street-lighting.

HARTFORD, CONN.—Contract has been awarded by the Connecticut Steel Company for a one-story addition, 101 ft. by 195 ft., to its plant.

Middle Atlantic States

BATAVIA, N. Y.—Arrangements are being made by the City Council for using Niagara power for operating the municipal street-lighting system during the present shortage of coal.

BROOKLYN, N. Y.—The Public Service Commission has awarded the contract for the completion of construction and station finish in the Fourth Avenue Subway and the Center Street loop subway to D. C. Serber, at \$69,084.

BROOKLYN, N. Y.—Plans have been prepared by the New York Municipal Railway Corporation, 85 Clinton Street, for the erection of new signal towers, circuit-breaker houses, etc., at its Coney Island terminal. W. S. Menden is chief engineer of the company.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company has been awarded a contract by the United Shoe Machinery Company for furnishing electricity at the plant of the latter. The installation to include two large electric welders, 30 arc furnaces, 45 hp. in motors and one 10-kw. tempering bath. The power company has recently put its new plant in operation, which is now supplying electricity to the western portion of its territory.

BROOKLYN, N. Y.—Bids will be received at the office of the Mayor, City Hall, borough of Manhattan, until Oct. 24 for the installation of a single unit lighting system in drill shed, etc., Fourteenth Infantry Armory, Eighth Avenue and Fifteenth Street, Brooklyn; also for installation of a new lighting system in the Forty-seventh Infantry Armory, Marcy Avenue and Hayward Street, Brooklyn. Blank forms and other information may be obtained at the office of the Armory Board, Room 6, basement, Hall of Records, borough of Manhattan.

BUFFALO, N. Y.—The Lehigh Valley Railroad Company is planning to build a boiler house at its shops, to cost about \$26,000, at South Ogden and Dingens Streets, and also a boiler house, machine shop, blacksmith shop and storehouse, at a cost of about \$50,400, at the foot of Tift Street.

DUNKIRK, N. Y.—The Atlas Crucible Steel Company is considering extensions to its plant, including the construction of a new transformer station.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

NEW YORK, N. Y.—Plans have been prepared for the construction of an addition, 25 ft. by 85 ft., one story, to the power plant of the New York Edison Company, at 666 First Avenue, to cost about \$7,000.

NEW YORK, N. Y.—The Ice Manufacturing Company, 1480 Broadway, is contemplating the construction of a new transformer station. Plans are being prepared by Mortensen & Company, 405 Lexington Avenue, architects and engineers.

OLEAN, N. Y.—Plans are being prepared by the Board of Water Supply for the construction of a new pumping station in connection with its proposed new filtration plant. The new plant will have a capacity of 2,500,000 gallons per day and will cost complete about \$75,000. William Sheehan is commissioner.

PRINCE BAY, S. I., N. Y.—The S. S. White Dental Company is considering extensive improvements in its power station, to cost about \$11,000.

ROCHESTER, N. Y.—Plans have been prepared by the General Railway & Signal Company for the erection of a power house at its works in Lincoln Park. E. E. Jackson is manager.

CALDWELL, N. J.—Plans are being considered by the township committee for the installation of a new street-lighting system on the Fairfield Road. This thoroughfare is about 6 miles long.

CAMDEN, N. J.—Plans are being prepared for the erection of a new power house for R. M. Hollingshead at 112 Ninth Street.

GIBBSTOWN, N. J.—The installation of an electric-lighting system in Gibbstown is under consideration.

IRVINGTON, N. J.—Permit has been granted to the Irvington Manufacturing Company, 124 Coit Street, Irvington, for the construction of an addition to its power plant.

PERTH AMBOY, N. J.—Arrangements have been completed, it is reported, by the Public Service Electric Company for the installation of a new steam turbine, condenser, generator and auxiliary apparatus at its local power station.

TRENTON, N. J.—The City Commission is considering the installation of an electric street-lighting system from Calhoun Street to the Log Basin.

ASHLEY, PA.—Extensive improvements are being made to the local shops of the Central Railroad of New Jersey, including extensions to the power plant.

BEAVER CITY, PA.—When the present street-lighting contract expires, which is not until next year, a new lighting system will be installed. It is proposed to replace the arc lamps now in use with incandescent lamps, to be erected on the curb instead of the center of the street.

CHELTENHAM, PA.—Contract has been awarded by the Hoffman, DeWitt & McDonough Company to the William Linker Company, 331 Cherry Street, Philadelphia, for the construction of a new power house, 52 ft. by 60 ft., one story, at its local plant.

ERIE, PA.—The General Electric Company is planning to build a large power house in connection with its proposed plant in Erie.

GIRARDVILLE, PA.—The Borough Council has awarded the Schuylkill Light, Heat & Power Company of Centralia a contract to furnish electricity to operate its street-lighting system.

GREENSBURG, PA.—Revised plans are being prepared by Paul Bartholomew for the construction of a new power house, 55 ft. by 65 ft., to cost about \$30,000, for the Westmoreland County officials.

HALIFAX, PA.—The Millersburg (Pa.) Electric Light, Heat & Power Company has begun work on the installation of a new electric street-lighting system in Halifax.

MARIETTA, PA.—The Pennsylvania Railroad Company, it is reported, is contemplating the installation of a large electric crane, etc., at its local freight yards.

MONT ALTO, PA.—Electricity to operate the new electric street-lighting system, to be installed at once by the borough officials, will be furnished by the Waynesboro Electric Light & Power Company.

PHILADELPHIA, PA.—The Philadelphia Suburban Gas & Electric Company is

erecting a new electric transmission line from Phoenixville to Black Rock.

PHILADELPHIA, PA.—Bids will be received by the Department of Public Safety for lighting the streets of the city for a period of one year from Jan. 1 to Dec. 31, 1918.

PHILADELPHIA, PA.—Contract has been awarded by the Philadelphia Felt Company for the construction of an addition to its power house at its plant on Frankford Creek.

PHILADELPHIA, PA.—Plans have been prepared by the Pennsylvania Railroad Company for the construction of an addition, 25 ft. by 50 ft., to the power house at its West Philadelphia shops, to cost about \$7,000.

PHILADELPHIA, PA.—The Philadelphia Electric Company has awarded a contract to Fred A. Havens & Company, 845 North Nineteenth Street, Philadelphia, for construction of addition to its power station "R" on Kensington Avenue, to cost about \$20,000.

PHILADELPHIA, PA.—The Unit Construction Company has awarded a contract to John N. Gill & Company, Otis Building, Philadelphia, for the construction of a new power house at its new plant to be erected at Fifty-seventh and Gray Avenues, at a cost of about \$83,000.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 22 for the construction of a dispensary building, including electrical work, at the navy yard, Philadelphia. Drawings and specifications (No. 2557) may be obtained upon application to the above bureau or to the commandant of the navy yard named.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 29 for electric wiring and lighting systems for the foundry and machine and electric shop at the navy yard, Philadelphia. Drawings and specifications (2603) can be obtained on application to the above bureau or to the commandant of the navy yard named.

PHILADELPHIA, PA.—Extensive improvements are contemplated by the American International Corporation at its local shipyards, including the installation of air compressors and pumps, to cost about \$218,000. The company also is planning to double the capacity of the power house at its Bristol plant. The present building is about 75 ft. by 150 ft. New equipment will be installed in the power house at a cost of about \$1,000,000.

PHILADELPHIA, PA.—The Fort Mifflin Shipbuilding Company of Philadelphia, recently incorporated with a capital stock of \$10,000,000, is preparing plans for the construction of a shipbuilding plant on the Delaware River, near League Island. The plans provide for the construction of shipways for 16 vessels, machine shops, brass and iron foundry, boiler works, blacksmith shop, wood-working plant, etc.; also an industrial railway and a series of traveling cranes. Arthur Masters is president and Leonard E. Harris is consulting engineer.

PITTSBURGH, PA.—Contract has been awarded by the City Council to the Wilson Construction Company, Fulton Building, Pittsburgh, for the construction of an addition to the power house at the Mayview works, to cost about \$29,993.

POTTSTOWN, PA.—The Industrial Foundry & Machine Company is reported to be considering the construction of a new power plant.

READING, PA.—The Metropolitan Edison Electric Company has begun work on the installation of a new underground conduit system in Penn Square and other streets in the city to replace overhead-wire system.

READING, PA.—T. A. Wilson & Company, Second and Washington Streets, have awarded a contract to the Beard Construction Company of Reading for the erection of a brick power house, 25 ft. by 45 ft., at its plant.

READING, PA.—The Reading Brewing Company has awarded the Metropolitan Edison Electric Company a contract for furnishing electricity at its works. The brewing company is planning to equip its plant for electrical operation, at a cost of about \$10,000.

SHAMOKIN, PA.—The City Council has adopted plans for a street-lighting system in connection with the signing of the new contract in December.

SHARON, PA.—The contract for wiring the new houses under construction in the Shenango Land Company's plot, east of Sharon, for the American Sheet & Tin Plate Company, has been awarded to the Shenango Valley Electric Company.

CUMBERLAND, MD.—Plans, it is reported, have been approved by the Kelly-Springfield Tire Company of Akron, Ohio, for the construction of a new plant at Cumberland, to cost about \$5,000,000. The proposed project will consist of a one-story machine shop, 100 ft. by 150 ft.; the main building about 700 ft. by 900 ft.; electric power station, 150 ft. by 150 ft., and other buildings. The cost of the equipment and machinery is estimated at about \$1,000,000, for which some contracts have been awarded. S. Diescher & Sons, Farmers' Bank Building, Pittsburgh, Pa., are consulting engineers.

CHARLESTOWN, W. VA.—The West Virginia Water & Electric Company has been granted a permit to erect a power house on Slack Street, to cost about \$10,000. Contract has been awarded to James L. Montgomery for construction of building.

KINGWOOD, W. VA.—The Preston County Power Company is contemplating extensions to its system.

TRIAD, N. C.—Plans are being considered by the Town Council for the installation of an electric-lighting system in Triad.

WELCH, W. VA.—The Solvay Collieries Company is contemplating the installation of new power equipment at its Exeter Colliery.

WHEELING, W. VA.—The City Council is considering three propositions concerning the Wheeling Electric Company's franchise, any one of which the city may accept for a period of ten years: First, that the Wheeling Electric Company pay \$500 per year for the franchise and light the city building; second, that the company pay to the city 2 per cent of its gross commercial business; third, that the company furnish the city with 550 street lamps at \$30 each per year. The ordinance was granted ten years ago. At present the city is using the first provision. It is expected that the present investigations will result in the Wheeling Electric Company taking over the lighting of the city. The installation of a new street-lighting system is also under consideration.

CAPE CHARLES, VA.—Plans have been prepared for the construction of a power house, 40 ft. by 53 ft., for Hickie Kellogg, to cost about \$10,000.

NORFOLK, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 29, for furnishing and installing two electrically-driven capstans at the navy yard, Norfolk. Drawings and specifications (2591) may be obtained on application to the above bureau or to the commandant of the navy yard named.

NORFOLK, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 29 for remodeling Quarters H, Marine Barracks, Norfolk, Va., including electrical work, heating, plumbing, etc. Drawings and specifications (No. 2617) may be obtained on application to the above bureau or to the commandant of the navy yard, Norfolk, Va.

WEST POINT, VA.—Work has begun on the construction of a new plant for the York River Shipbuilding Corporation, Mutual Building, Richmond, on the Mattapani River, near West Point, to cost about \$250,000. The plans provide for the erection of ten buildings and an electric power plant.

WINCHESTER, VA.—The Board of County Supervisors has granted the Northern Virginia Power Company permission to erect electric transmission lines from Winchester to Boyce, along the Winchester and Berry's Ferry turnpike.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 19 for furnishing three fitting-out cranes of 350 gross tons capacity at the navy yards, Norfolk, Va., New York, N. Y., and Philadelphia, Pa. Drawings and specifications (No. 2587) may be obtained on application to the bureau or to the commandants of the navy yards named.

WASHINGTON, D. C.—President Wilson has approved the location at Sheffield, Ala., of the initial ammonia and nitric-acid plant to be constructed by the government with part of the \$20,000,000 recently made available by Congress for the creation of a new source of supply of nitrates in making powder for the government. Sheffield is located on the Tennessee River, just below the Muscle Shoals and is near the phosphate beds of central Tennessee.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 8 for furnishing and installing lighting fixtures in the United States post offices at Berlin, N. H.; Bur-

lington, Wis.; Cameron, Tex.; Charlton, Iowa; Fort Morgan, Col.; Frederick, Md.; Hammond, La.; Hiawatha, Kan.; Madison, S. D.; Maquoketa, Iowa; Marion, Ky.; Martins Ferry, Ohio; Martin, Tenn.; Media, Pa.; Mena, Ark.; Pulaski, Va.; Reading, Mass.; Richfield, Utah; Savanna, Ill.; Statesboro, Ga.; Wahoo, Neb., and Wematchee, Wash.; the United States post office and court house extension at East St. Louis, Ill., and the post office and court house extension at Huntington, W. Va. Drawings and specifications may be obtained at the above office.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Norfolk and Charleston, Schedule 1525—miscellaneous single, portable, switch-board type, direct-current ammeters, 950 steel reflectors, miscellaneous nickel chromium resistance ribbon, miscellaneous cambric insulating tape; Schedule 1524—25,000 solid covered arc-lamp carbons, 9500 unglazed porcelain tubes. Norfolk, Va., Schedule 1525—miscellaneous back and front connected switch contact blocks and clips, miscellaneous cartridge type, fuse blocks, 1900 yd. pigtail copper ribbon, 400 lb. spring copper ribbon, 1300 rolls varnished silk tape. Philadelphia, Pa., Schedule 1525—miscellaneous hard and soft plate carbon, 132 electric flatirons, 6 lb. to 8 lb. Boston, Mass., and Philadelphia, Pa., Schedule 1525—miscellaneous contact ferule fuse clips, miscellaneous grade B pressed mica tubing. Various, Schedule 1525—245 double-pole combination plug and switch cut-outs, miscellaneous plug type inclosed fuses, miscellaneous 4-amp. glass tube fuses, link fuses, 21,000 non-water-tight portable guards, 5600 shade holders, miscellaneous electric soldering irons, 126 white masthead lanterns, miscellaneous red, green running lanterns, miscellaneous grades A and B pressed plate mica, miscellaneous soldering paste, miscellaneous Edison base attachment plugs, hard rod rubber, cotton asbestos sleeving, miscellaneous wall incandescent lamp sockets, miscellaneous copper-covered, saddle insulated staples, miscellaneous back-connected knife switches, indicating snap switches, plain muslin insulating tape, miscellaneous copper cable terminals, miscellaneous hard-rubber tubing. Norfolk, Va., and Mare Island, Cal., Schedule 1524—20,900 solid and split porcelain knobs. Charleston, S. C., Schedule 1525—Six type C white signal lanterns. Boston and Norfolk, Schedule 1525—2050 lb. flexible plate mica, 7500 yd. oiled-insulating muslin, 750 lb. insulating fish paper. Portsmouth and Charleston, Schedule 1525—250 5-amp. hooded receptacles. Boston, Mass., Schedule 1525—5000 illuminating set socket rings. Brooklyn, N. Y., Schedule 1525—25,400 4-amp. sockets, 64,000 two-hole connection boxes for ten-wire terminals; 830 lead-acid type storage battery testing outfits. Mare Island, Schedule 1525—210 ft. grade B pressed mica tubing. Application for proposal blanks should give the schedule desired by number.

North Central States

HIGHLAND PARK, MICH.—The Council has decided to ask for bids for 66 ornamental iron lamp standards to be erected around the new reservoir.

WAYLAND, MICH.—Owing to the high price of coal the C. H. Brush Light & Power Company has closed down its plant, leaving the town without electrical service. Plans are being considered to ask the Consumers' Power Company to extend its transmission line to Wayland to light the town.

CINCINNATI, OHIO.—A new power plant is included among the improvements contemplated by the Sayers & Scoville Company. New machinery is now being installed in the new addition to its works.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until Oct. 26 for one motor-driven, power-house type coal crusher for the division of water. Specifications may be obtained at the office of the commissioner.

PORT CLINTON, OHIO.—The Northwestern Ohio Railway & Power Company, Ohio Building, Toledo, is considering the installation of a 5000-kw. turbo-generator at its local power plant.

BENHAM, KY.—The United States Coal & Coke Company is reported to be considering the installation of an electric-lighting plant.

HELLIER, KY.—The Greenough Coal Company of Uniontown, Pa., is considering the construction of a new power plant, 45 ft. by 70 ft., at its local works.

MURRAY, KY.—Bonds to the amount of \$20,000 have been voted for the installation of an electric-light plant and water-works system.

NORTH MANCHESTER, IND.—The capital stock of the Eel River Telephone Company has been increased from \$40,000 to \$80,000.

HARLEM, ILL.—Plans are being considered by Brown Brothers for the installation of an electric-light plant. Equipment, it is understood, has been purchased.

JOLIET, ILL.—The City Council is considering the installation of a new street-lighting system. It is proposed to install 250-cp. nitrogen-filled lamps, equipped with refractors. It is estimated that the proposed new lighting system would save the city \$8,100 per year.

WILMETTE, ILL.—The Village Council has offered to grant the request of the Public Service Company of Northern Illinois to build a substation at the terminal of the Northwestern Elevated Railroad at Linden Avenue, under the condition that the company agrees to erect the building according to specifications furnished by the village. The proposed station is to furnish energy to operate the elevated railroad.

KIEL, WIS.—The Kiel Woodenware Company is contemplating an addition, 80 ft. by 320 ft., to its plant, and also an extension to its steam generating plant, involving an expenditure of from \$65,000 to \$75,000. Plans are being prepared by the Thomas S. Watson Company, Majestic Building, Milwaukee, consulting engineer.

MILWAUKEE, WIS.—Plans are being prepared by the Pawling & Harnischfeger Company of Milwaukee for the erection of another extension to its machine shop, 50 ft. by 160 ft. A 500-kw. addition to power plant is nearly completed. The company manufactures electric traveling cranes. O. A. Ruemelin is vice-president and general superintendent.

STEVENS POINT, WIS.—The Jackson Milling Company, it is reported, is planning to build a dam across the Wisconsin River, to cost about \$500,000. It is expected to have the dam, power house and transmission lines completed by September, 1918.

WAUPUN, WIS.—The Rock River Valley Hemp Mills of Waupun is planning to build an addition to its power house, 30 ft. by 30 ft., in which a 150-hp. engine will be installed.

LAKEFIELD, MINN.—Bids will be received by H. J. Hayden, clerk of board of education, independent district No. 3, Lakefield, until Nov. 2 for the construction of a general high school building and a manual training building; also bids for heating, ventilation, electric wiring, electric fixtures and furniture. Plans are on file at the Builders' Exchanges at Minneapolis, St. Paul and Mankato. Copies of plans and specifications may be obtained at the office of Kirby T. Snyder, architect, Plymouth Building, Minneapolis, upon deposit of \$15.

OWATONNA, MINN.—Bids will be received by John Dinsmore, secretary of the independent school district No. 1, Owatonna, until Nov. 6 for construction of high school building as follows: (a) General contract; (b) plumbing; (c) electrical construction; (d) heating and ventilation; (e) sheet-metal (ventilation); (f) temperature regulation; (g) fans, motor drives and heaters; (h) air washers and humidity control equipment; (i) vacuum heating equipment. Plans and specifications may be obtained at the office of Nels S. Jacobson, architect, Owatonna, upon deposit of \$25 for (a) general contract, of which \$18 will be refunded upon return of plans; \$15 deposit will be required for each set of plans for contracts (b), (c) and (d), the latter including the work required in contracts (e), (f), (g), (h) and (i), of which \$11.50 will be refunded upon return of plans.

DAVENPORT, IOWA.—Bids will be received by the board of education of the independent school district of Davenport, 1130 Main Street, Davenport, until Oct. 31 for the construction of three intermediate school buildings in Davenport. Separate bids will be received for one or more of the three buildings as follows: General contract, electric wiring, plumbing, and for the combined heating and ventilating apparatus. Drawings and specifications may be seen at the office of Temple & Burrows, Savings Bank Building, Davenport.

DES MOINES, IOWA.—The Board of State Railroad Commissioners has granted the Des Moines Electric Company a franchise to erect and operate electric transmission lines in Polk County.

MOORHEAD, IOWA.—Work is progressing rapidly on the construction of the new electric-lighting plant in Moorhead.

BETHANY, MO.—Bonds to the amount of \$4,500 have been voted for the installation of an oil engine in the municipal electric-light plant.

FREDERICKTON, MO.—The Missouri Public Utilities Company of Cape Girardeau, it is reported, has offered to purchase the municipal electric-light plant at \$16,000. An election will soon be called to submit the proposal to the voters.

HARRISONVILLE, MO.—L. K. Green & Sons, owners of the local electric-light plant, it is reported, are building a central power plant at Pleasant Hill.

HIGGINSVILLE, MO.—Plans are being considered for the installation of an ornamental lighting system on Russell Street.

KANSAS CITY, MO.—Contract has been awarded by the Kansas City Light & Power Company to the Foundation Company, 233 Broadway, New York, N. Y., for construction of foundations for its proposed new electric generating station, to cost complete from \$3,000,000 to \$4,000,000. The company has placed orders with the General Electric Company of Schenectady, N. Y., for two 20,000-kw. turbo-generators. Plans and specifications were prepared by Sargent & Lundy, consulting engineers of Chicago, Ill.

MOUND CITY, MO.—The Mound City Electric Light & Ice Company, it is reported, has been granted a franchise to supply water in Mound City. The City Council has decided to abandon the municipal water system.

NETTLETON, MO.—Arrangements have been made with the Hamilton (Mo.) Light & Power Company to furnish electrical service in Nettleton. The company already has a transmission line through Nettleton to Breckenridge.

VERSAILLES, MO.—The municipal electric-light plant was recently destroyed by fire.

FAIRBURY, NEB.—The Council has decided to extend the municipal electric-lighting service to the limits of the city at the west end of Second Street and to furnish electricity to light the new bridge.

LINCOLN, NEB.—The Platte Valley Telephone Company is contemplating an issue of \$50,000 in bonds, the proceeds to be used for extensions and improvements.

YORK, NEB.—The Public Service Company has applied to the State Railway Commission for a franchise to erect an electric transmission line from Stromsberg to Osceola.

BELOIT, KAN.—We are informed that the city of Beloit is not considering the proposal submitted by the Concordia (Kan.) Electric Company to furnish electricity here, as reported in the issue of Sept. 29. The company submitted a proposition to the City Council, but it was rejected without investigation, as the city is operating a municipal plant at a profit. The city favors municipal ownership of all public utilities and is now building a new power plant, setting a new boiler, providing a new foundation for the installation of a new 300-kva. turbine, erecting a new radial brick chimney, installing a new steam heater, filtration plant and pumping station. All transmission lines have been placed underground in the business district and conduits have been laid in 34 blocks for ornamental lamps in the streets that have been paved this year. F. A. Darst is superintendent of the water and light department.

BENNINGTON, KAN.—The Markley Company has been granted a 20-year franchise for furnishing electricity in Bennington and also a contract for street lighting for a period of 20 years.

CANEY, KAN.—Steps, it is reported, have been taken to establish a municipal electric-lighting plant in Caney.

COLUMBUS, KAN.—Improvements to its local system, to cost about \$10,000, are under consideration by the Home Telephone Company.

CUBA, KAN.—The Council is considering a proposal submitted by the Concordia Electric Light Company to furnish electricity in Cuba.

HAVEN, KAN.—The electric-light plant of the Haven Electric Light & Ice Company has been closed down.

HUNTER, KAN.—The installation of an electric-lighting system in Hunter is under consideration.

HUTCHINSON, KAN.—A petition has been presented to the City Council by residents of the extreme eastern section of the city for an extension of the electric-lighting system to that part of the city.

TOPEKA, KAN.—All bids submitted for the extension of the ornamental lighting system from Tenth to Eleventh streets on Kansas Avenue have been rejected as being too high, the lowest being \$4,100.

Southern States

WARRENTON, N. C.—Plans are being prepared by Gilbert White of Durham, N. C., for a municipal electric-light plant (about 300 kw.) for Warrenton. A. G. Elliott is city manager.

CORNELIA, GA.—The Wofford Shoals Light & Power Company is contemplating the erection of an electric transmission line, 5½ miles long, to connect the Clarksville system with the local system. Later the company will probably extend its lines to Lula. Additional (future) water power development is under consideration.

TAMPA, FLA.—The Tampa Electric Company is planning an extension to its Hyde Park-Michigan line.

MEMPHIS, TENN.—The Tri-State Baptist Board has awarded the contract for the erection of an eight-story annex to its hospital, 78 ft. by 150 ft., to the James Alexander Construction Company of Memphis, at \$200,000. The cost of the lighting fixtures, etc., is estimated at \$8,000 and elevator at \$4,000.

MONTGOMERY, ALA.—The Montgomery Light & Traction Company is contemplating an extension of its street railway service to Camp Sheridan.

TUSCALOOSA, ALA.—The Tuscaloosa Railway & Utilities Company is considering an extension to its power station and car house.

WAYNESBORO, MISS.—The City Council is considering an issue of \$6,000 in bonds for the construction of an electric-light plant.

DRUMRIGHT, OKLA.—Steps have been taken by local business men for the installation of an ornamental lighting system to extend along the entire street district which is to be paved. The cost is estimated at \$10,000.

EUFAULA, OKLA.—Plans prepared by J. L. Lowe for construction of power plant at the river have been accepted by the City Council. It is proposed to erect a building for boiler, pumping station, etc. Bids, it is understood, will soon be asked for.

MEDICINE PARK, OKLA.—Plans are being considered by J. Elmer Thomas, of Lawton, State Senator and owner of Medicine Park, for extensive improvements here, which will include an electric-lighting plant.

OKMULGEE, OKLA.—The Pioneer Telephone & Telegraph Company has awarded the general contract for construction of a telephone exchange in Okmulgee to Reinhart & Donovan of Oklahoma City. The cost of the building is estimated at about \$47,000. G. R. Potter is local manager.

TISHOMINGO, OKLA.—The question of establishing a municipal electric-light plant is under consideration.

VINITA, OKLA.—The construction of a hydroelectric power plant, to cost about \$2,000,000, is under consideration by the Southwestern Power Company to supply electricity in Vinita and neighboring towns and cities. The plans provide for the erection of three dams across Grand River, similar to those at Lowell, Kan. Charles H. Collins, First National Bank, Vinita, is reported interested.

DALLAS, TEX.—Plans are being made by the Dallas Railway Company for the construction of five car lines and extensions, for which iron and other material have been ordered. Approval of the Board of Commissioners must be obtained before work on the proposed extensions can begin.

Pacific and Mountain States

INDEX, WASH.—Contracts have been awarded by the Town Council for equipment for the municipal electric-light plant. G. N. Miller & Son of Seattle have charge of construction work.

SEATTLE, WASH.—The War Department has awarded a contract to the Aero Alarm Company of Seattle for the installation of aero automatic fire-alarm systems in 330 buildings in 16 National Army cantonments and a similar number of National Guard cantonments in various parts of the United States. The first buildings to be equipped will be the warehouses where foodstuffs are stored. The company has also been instructed to make the necessary alterations in the Aero Alarm installations in the steamships Great Northern and Northern Pacific, recently taken over by the federal government.

WASHOUGAL, WASH.—The Northwest Electric Company has applied to the County Commissioners for an extension of its franchise privilege to supply electricity

in the eastern part of the county near Camas and Washougal.

HOULTON, ORE.—The Milton Creek Logging Company is installing an electric power plant to furnish electricity for lighting its offices, camps and employees' dwellings. The contract for initial wiring covers 42 buildings.

MAPLETON, ORE.—The local electric-lighting system is reported to have been purchased by the North Star Power Company.

BURBANK, CAL.—Electric furnaces will be installed in the new foundry building, 60 ft. by 120 ft., being erected at the new plant of the Moreland Truck Company, 1701 North Main Street, Los Angeles.

EUREKA, CAL.—Work will begin at once by the Western Gas & Electric Company of Eureka on laying the cable for the transmission of electricity to the Rolph shipyards and later to the Fay plant.

MOJAVE, CAL.—An election has been called to submit the proposal to form a lighting district in Mojave to the voters.

SAN DIEGO, CAL.—The Board of County Supervisors has granted the San Diego Consolidated Gas & Electric Company a 50-year franchise to extend its electric transmission lines throughout the county.

SAN FRANCISCO, CAL.—The Board of Supervisors has granted the Municipal Railways a franchise to construct a new street car line from the west portal of the Twin Peaks Tunnel to Twentieth and Taraval Streets. The Supervisors have also set aside \$90,000 of the municipal railroad fund to be used in the construction of the proposed extension.

TAHOE, CAL.—Plans are being considered by Lora J. Moore of Tahoe for the development of a hydroelectric plant on Slim Jim Creek in Placer County, to cost about \$10,000.

MONTICELLO, UTAH.—The Blue Mountain Irrigation Company is contemplating an issue of \$60,000 in bonds, it is reported, the proceeds to be used for improvements to its light and water plant.

SALT LAKE CITY, UTAH.—Equipping the Denver & Rio Grande Railroad between Salt Lake City and Helper for electrical operation, it is reported, will be undertaken soon after the merging of the railroad with the Missouri Pacific and the Western Pacific railroads.

DOUGLAS, ARIZ.—The Douglas Traction & Light Company is contemplating building an extension to Pirtle in the near future.

SNOWFLAKE, ARIZ.—Steps have been taken to organize a company to install an electric-light and power plant to supply electricity in Snowflake and Taylor. The company will be capitalized at \$50,000. The stockholders of the Snowflake & Taylor Irrigation Company are interested in the project.

TAPCO, ARIZ.—The new electric plant of the Arizona Power Company in Tapco has been started, assuring an adequate supply of power for mining interests around Jerome.

Canada

KASLO, B. C.—The ratepayers have recently voted to appropriate \$1,500 for improvements to the municipal electric-light plant and the same amount for water-works extensions.

CHAPLEAU, ONT.—The installation of an electrically operated pumping unit in the municipal pumping station, to cost about \$6,000, is under consideration.

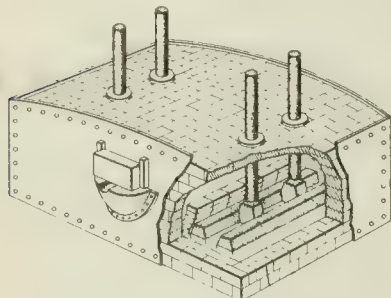
CORNWALL, ONT.—Application has been made to the Minister of Public Works at Ottawa by the Power Development Company, recently incorporated with a capital stock of \$500,000, for permission to build a dam in the St. Lawrence River, near Cornwall.

PERTH, ONT.—New equipment, consisting of boilers, engine, generators, etc., will be required for the soap factory which is being built for Henry K. Wampole & Company, Herriott Street, Perth. The cost of the plant is estimated at about \$50,000.

PETERBORO, ONT.—The construction of an addition to its plant at Peterboro, to cost about \$40,000, is contemplated by the Canadian General Electric Company of Toronto. E. G. Paterson is superintendent of the Peterboro plant.

PORT COLBORNE, ONT.—The municipalities of Port Colborne and Humberstone are considering the question of entering into a contract with the Hydro-Electric Power Commission of Ontario for energy. The Ontario Power Company owns and operates the distribution systems in both of these municipalities.

- 1,242,132. **ELECTRIC CLOCK**; Gustav Blumberg and John A. Butkus, Baltimore, Md. App. filed Oct. 13, 1915. Entirely devoid of springs in the time train.
- 1,242,171. **ELECTRIC WELDING**; Henry Geisenhoner, Schenectady, N. Y. App. filed March 16, 1915. Effects of scale, dirt, etc., between the work and an electrode in opposing the welding are overcome.



1,242,275—Electric Furnace

- 1,242,209. **ELECTRIC HEATER**; Wilbur A. La Motte, Elizabeth, N. J. App. filed Nov. 14, 1915. Fluid may be heated to any desired temperature in a simple and efficient manner.

- 1,242,250. **ELECTRIC FURNACE CONTROL**; John A. Seede, Schenectady, N. Y. App. filed May 8, 1916. Arc type.

- 1,242,255. **FARM GATE**; Silas R. Skaggs, Richland Springs, Tex. App. filed Sept. 25, 1916. For either opening or closing the gate upon the pulling of an operating cable.

- 1,242,260. **LIMIT SWITCH FOR HOISTING MACHINE**; Fred L. Stone, Schenectady, N. Y. App. filed July 24, 1915. Designed for use in connection with a system of mine hoisting mechanism in which the cage must be slowed down before it arrives at the landing.

- 1,242,267. **SAFETY DEVICE FOR STARTING MECHANISMS**; Brice P. Swyers, Pittsburgh, Pa. App. filed June 14, 1913. Automobiles.

- 1,242,275. **ELECTRIC FURNACE**; Irving R. Valentine, Schenectady, N. Y. App. filed May 12, 1917. Improvements.

- 1,242,284. **LOAD-REGULATING SYSTEM**; William L. Waters, Milwaukee, Wis. App. filed July 22, 1914. Improvements.

- 1,242,326. **FUSE BLOCK**; Henry H. Curtis, Springfield, Mass. App. filed Sept. 23, 1914. For use in double-branch wiring.

- 1,242,333. **AUTOMATIC LINE CLOSER FOR SERIES ELECTRICAL CIRCUITS**; Bert S. Eddy, Elmira, N. Y. App. filed March 26, 1917. Primary object of the invention is the provision of an auxiliary normally open circuit for any series lines, the same being automatically closed upon an interruption in the main circuit, provision being made for restoring the device in its open position when the main line is restored.

- 1,242,337. **ELECTRICAL DISTILLING APPARATUS**; Charles H. Fulton, St. Louis, Mo. App. filed Dec. 7, 1916. Improvement.

- 1,242,341. **ELECTRIC FURNACE**; Charles H. Fulton, St. Louis, Mo. App. filed Feb. 23, 1917. Electrically connecting the co-operating columns of briquettes together in such a manner that there is no liability of the circuit being interrupted in case one column of a pair shrinks or becomes slightly deformed, owing to arcing or any other cause.

- 1,242,349. **AUTOMATIC ALARM**; Herbert E. House, Los Angeles, Cal. App. filed Nov. 30, 1914. Improved electric bell-circuit-closing mechanism of the spring-controlled type.

- 1,242,371. **SHUTTLE LOCK**; Frank M. Pierce, Chicago, Ill. App. filed Jan. 2, 1916. For tire-wrapping machines.

- 1,242,442. **MAKING PIG IRON**; Ernest Humbert, Welland, Ontario, Can. App. filed May 17, 1917. Furnace is charged with the scrap and a quantity of coke or coal or other carbonaceous material proportioned to the carbon content of the scrap and that desired in the pig iron to be produced.

- 1,242,457. **ELECTRIC CIRCUIT**; Matthew H. Loughridge, Bogota, N. J. App. filed July 17, 1916. Particularly for a compound arrangement of circuits in which characteristics may be introduced into the conductors of said circuit at various points to vary the operation of an electric translating device in said circuit.

Record of Electrical Patents

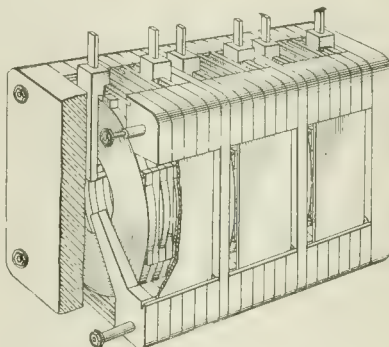
Notes on United States Patents
issued on October 9, 1917

- 1,242,464. **ELECTRIC METALLURGICAL FURNACE AND METHOD OF OPERATING THE SAME**; William E. Moore, Pittsburgh, Pa. App. filed Nov. 27, 1916. Employs a relatively long arc and high voltage, and in refining acts to reduce the length of this arc (to zero if desired) and to reduce the voltage without materially altering the current.

- 1,242,472. **DEVICE FOR MEASURING ELECTRICAL ENERGY**; John S. Piper, Yonkers, N. Y. App. filed June 12, 1914. Consists in connecting two watt-hour meters of the electrometer or other type in series with each other and with the load in such manner that when one meter is running in the proper direction to measure the electrical energy or power consumed by the load the other meter will tend to run backward.

- 1,242,483. **WORK AND TIME INDICATOR**; William H. Shuster, Jr., and Allen L. Grammer, Philadelphia, Pa. App. filed Nov. 18, 1916. New.

- 1,242,497. **POLYPHASE REACTANCE COIL**; Philip Torchio and Harry R. Woodrow, New York, N. Y. App. filed March 15,



1,242,497—Polyphase Reactance Coil

1917. Consists, first, in a construction employing a plurality of sets of coils of the "pancake" type, the coils of each set being connected in multiple and respectively connected to currents of different phase, and, second, in the construction of the casing wherein said sets of coils are supported and inclosed.

- 1,242,498. **X-RAY APPARATUS**; Julius B. Wantz, Chicago, Ill. App. filed Nov. 5, 1914. Improvements in table whereby a table of compact form adapted to be operated in various ways for either stereoscopic or picture work may be provided.

- 1,242,499. **THERMO-ELECTRIC GENERATOR**; Hartwell W. Webb, Cresskill, N. J. App. filed March 17, 1913. Particularly adapted for utilizing the waste heat of the exhaust gases of internal-combustion engines.

- 1,242,533. **LOOM FASTENER**; John J. Duck, Toledo, Ohio. App. filed March 23, 1917. Particularly intended for holding one or more non-metallic flexible looms in place at outlet boxes.

- 1,242,549. **APPARATUS FOR CHANGING DIRECT ELECTRICAL CURRENTS INTO INTERRUPTED ALTERNATING CURRENTS**; Anatole C. Henry, New York, N. Y. App. filed March 2, 1917. Improvements.

- 1,242,552. **AUTOMATIC FIRE ALARM**; Milton F. Humphries, Morrin, Alberta, Can. App. filed June 30, 1915. Regulated to operate at predetermined temperatures.

- 1,242,554. **ELECTRODE HOLDER**; Raymond O. Jackson, St. Louis, Mo. App. filed Feb. 23, 1917. Improvement.

- 1,242,575. **SIGNAL MECHANISM**; Silvestro Milano, New York, N. Y. App. filed Feb. 11, 1915. Adapted to be operated auto-

matically by the presence of gas in a room or apartment, or by smoke or fire therein, so as to awaken persons sleeping in said apartment, whereby asphyxiation of the sleeper or loss of life by fire is prevented.

- 1,242,581. **METHOD OF AND APPARATUS FOR ELECTRICALLY MAKING OPENINGS IN METAL PLATES**; Thomas E. Murray, Jr., Brooklyn, N. Y. App. filed July 13, 1917. Improvement.

- 1,242,616. **SECTIONAL HIGH-POTENTIAL INSULATOR**; Sol. S. Sonneborn, Brooklyn, N. Y. App. filed Dec. 9, 1916. Employed as bushings for insulating transformer leads and the like from what is usually a grounded, perforated barrier of conducting material through which the conducting lead must emerge and from which it must be insulated.

- 1,242,625. **SYSTEM OF SIGNALING FOR MINE HOISTS**; Max A. Whiting, Schenectady, N. Y. App. filed July 21, 1916. To prevent the overwinding of the cages when men are being lifted.

- 1,242,632. **SYSTEM OF ELECTRICAL DISTRIBUTION**; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed June 22, 1915. Relates to systems of radio communication, and still more specifically to continuous-wave systems in which a high-frequency alternator is employed as the source of alternating-current energy of radio frequency.

- 1,242,637. **ELECTRICAL CONNECTOR**; Charles C. Armstrong, Marysville, Ohio. App. filed July 24, 1916. For use in connecting flexible conductors with portable heating devices, such as heaters for table use, sadiroms and the like.

- 1,242,649. **TRANSFORMER WINDING**; Frederick F. Brand, Pittsfield, Mass. App. filed Sept. 28, 1916. Provides intermediate taps for windings without too appreciably increasing the exchange current between the conductors, as, for example, without effectively nullifying the transposition of the conductors.

- 1,242,656. **ELECTRIC BATTERY**; William R. Clymer, Lakewood, Ohio. App. filed April 17, 1916. Consists of two or more superposed cylindrical dry cells with the top of the lower cell electrically connected to the bottom of the cell immediately above.

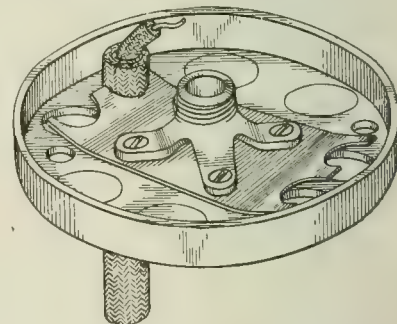
- 1,242,687. **ELECTRIC HEATER**; August Harth, Chatham, N. J. App. filed Aug. 29, 1916. Portable.

- 1,242,695. **METHOD OF AND APPARATUS FOR ELECTROPLATING WIRE CLOTH**; Ralph O. Hood, Danvers, Mass. App. filed March 1, 1916. Article is caused to travel horizontally above the normal level of a body of electrolyte between, or in the presence of, anodes of suitable construction, and the electrolyte by suitable means is raised so as to flood the article and make proper contact with the anode or anodes.

- 1,242,763. **ELECTROMAGNET**; Pierre Bossu, Paris, France. App. filed Dec. 19, 1913. Improvements.

- 1,242,816. **SIGNALING APPARATUS**; Petrus van Santen Kolff, Philadelphia, Pa. App. filed Nov. 16, 1916. Applicable where the speed of one shaft or the average speed of a plurality of shafts is to be indicated, through electrical mechanism, upon one or more indicating instruments.

- 1,242,833. **SMELTING PROCESS AND APPARATUS**; Ezra A. Mathers, New York, N. Y. App. filed Dec. 20, 1911. Improvements.



1,242,533—Loom Fastener

- 1,242,861. **SIGN FLASHER**; Conrad D. Pruitt, Berkeley, Cal. App. filed Oct. 6, 1914. Improves and simplifies the means for completing the various combinations of circuits which go to form the letters in the sign and is especially designed to provide means for simply and easily effecting changes in the combination of these circuits whereby the message flashed by the sign is readily changed.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN
Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, OCTOBER 27, 1917

No. 17

Action Is Needed

THE central station industry is beginning to feel the bite of the war. There is no serious trouble yet, but many a manager is worrying about the continuance of his coal supply, and many another knows only too well that the fuel costs in the coming season may be somewhat disastrous. Now, the maintenance of public power and light service is a matter of vital importance. We cannot go back to gas and oil, and reversion to steam means tremendous waste of fuel. Meanwhile coal strikes are on, railway strikes are threatened, and freight service is getting further and further behind the game. Somehow or other, in order to meet the growing requirements of industry, public service corporations must obtain an opportunity to run if the country is to prosper and show increased rather than decreased output. Some of the efforts to help the fuel outlook have been as destructive as constructive. Much well-intentioned advice has been given, as, for instance, the recent request that tradesmen should cease using electric signs so as to save the coal that is not being mined because the labor situation is not controlled with a firm hand. The water powers on the public domain are still locked up tightly, so that no relief is coming at present from that all-important source. Only the other day Director Garfield found large stores of coal carefully hoarded by industries not in the line of war needs, the owners of which were still calling for added supplies.

If we throw off the brakes that are being put on by timidity, conservatism and rapacity on the part of various members of the community and drive ahead to organize the country's industries with close reference to present needs, the fuel outlook will be less perilous. There is ample power at hand and sound public opinion will support whatever radical action is necessary. Observation and report in the great cities of the country do not indicate, in spite of the declared shortage of labor, any considerable decrease in the number of loafers. Why not try the Maryland plan on a large scale? If government control of the coal mines is necessary to keep up the output let the government, in spite of hidebound traditions, go to it promptly. The public utilities of the country must run, and however they may try to economize fuel, a certain minimum must be furnished them at all hazards lest our civilization be put out of joint and the industries vital to the war and to the provision of real necessities for the population be crippled.

If the electric roads cannot run to their fullest capacity, a very important means of transportation for men and material will be seriously damaged. The elec-

tric roads of this country can be of immense service in the handling of local freight, thereby relieving the main lines of transportation. If they have not freight franchises and means of connecting trackage with the lines whose burdens they are to relieve, it is up to the authorities to loosen requirements made for peace times and to see to it that every wheel useful to the country's work is kept turning. Above all, cut loose the petty tangle of objections that block the development of water powers, and let the country get at the earliest possible moment energy for running mills and factories and railroads without calling on an already short fuel supply. As it now is, big enterprises meaning vast gain to the country's resources are stopped by snarls of red tape or petty objections raised in behalf of half a dozen flat-boats a month. We should let go the brakes on the industrial machinery and see to it that things are done irrespective of the timid conservatism which shrinks from going ahead in time of need.

Regarding Underground Distribution

A BRIEF paper in this issue by M. Labov shows a very practical method of keeping track of the underground distribution of a company using both the overhead and underground systems and subject to the ordinary conditions of shifting distribution and disused services. The starting point is a standard distribution map showing the location of manholes, length and number of ducts, location of services and so forth. These maps are kept on file in a loose-leaf binder, and when a new service is necessary the full data are at hand for the layout of the service and the connections to the various lines. Then, monthly, all the underground properties are summed up and subdivided according as they belong to the main or the secondary distribution systems, classified according to the paving involved, and added to a regular inventory showing the ensemble of the details. This gives a general conspectus view of the underground layout. In connection with it is a neatly tabulated form, shown in the paper, which summarizes the house services, curb services and risers, whether used or unused. This covers the secondary distribution system. The rapid changes in such items make it difficult to keep them in the inventory form, but the tables give the facts in the case, from which the conditions in any emergency that arises can be promptly ascertained. In a growing system of distribution such details are notoriously hard to keep track of, and the forms worked out in this instance should be of very material assistance to many an electric company.

The Electric Furnace in Metallurgy

WE PUBLISH this week an abstract of an important paper by Dwight D. Miller regarding the use of the electric furnace in fields outside of the iron and steel industry. It is only recently that serious efforts have been made to utilize electric heat on a large scale for other metallurgical work, in spite of the fact that its advantages are very conspicuous. It is a well-known fact that alloys have to be handled somewhat tenderly. Some of them are very seriously subject to oxidation, others tend to separate if incautiously overheated, and still others have a very narrow range of working temperature within which they can be successfully cast. Some, indeed, are difficult to cast at all under ordinary conditions; for example, magnalium, which of late years has been finding many uses. For these critical cases of metallurgy the electric furnace has very much to recommend it. It is efficient; the heat can be accurately concentrated; the temperature can be brought with precision to any desired point and can be utilized in any kind of an atmosphere or even in vacuo; it produces quick and clean heat and avoids a great deal of the labor and space required with furnaces of the ordinary type. All these things result in less waste and better working conditions, tending to higher efficiency in the labor employed. Again, the power can be measured with precision and kept down to a minimum for the work required, and there is besides a large saving in fuel, now a matter of serious consequence.

A number of types of furnaces for the metallurgy of brass and other alloys have recently been put into at least experimental use, and the results are altogether promising. They are in general of two classes, the arc and the resistance types, although the two methods are in at least one instance combined. All are designed for alternating current, since the power supply in this country is generally either three-phase or single-phase. Much of the work will naturally be done on brass and similar alloys, and experiments show that the energy consumption is moderate, and that the brass produced, from the absence of oxides and impurities, is of improved quality in tensile strength. In one instance it was found that the energy required for remelting red brass for castings was at the rate of only about 250-kw.-hr. per ton and the efficiency of the furnace somewhere around 75 per cent. The power required seems not to be materially different for the arc and resistance types, and in both, too, the power factor is very high, from 96 per cent up. The load is therefore a desirable one from the standpoint of the distributor of electricity. Besides the use of furnaces in brass working, they are also in service for silver, copper and various bearing metals, alloys of accurately determined character.

The net result of the experiments seems to show that the losses of metal are small, a matter particularly important in working silver; that the quality of the product is remarkably well maintained, and that the casting is good. As to costs, the results are on the whole economically sound, especially when the handling of fuel and ash is considered as well as the direct saving of labor. The furnaces already employed run in capacity

from 30 lb. or so (about 14 kg.) in the silver industry up to a ton in some of the alloy working, so that the experience covers a wide range of capacity as well as material. Experiments are now under way for still further saving of labor by the electric furnace through making castings directly from the furnace itself. This can be accomplished either by picking up the furnaces, if of small size, and bringing them to the pouring floor, or in larger works by carrying the molds to the furnaces on conveyors. All this shows an extremely promising beginning of what is likely to be a very important application of electric power. It is one that may prove to be of no little importance as an advantageous load for central stations and as reducing very materially the net cost of manufacture with an additional chance of material improvement in the quality of the product.

Education for Industrial Research

THREE papers were read at the recent Philadelphia convention of the American Institute of Electrical Engineers on different aspects of industrial research. As reported in the *ELECTRICAL WORLD* for Oct. 13, the subject evoked much discussion from a large assemblage. One remarkable feature of the papers was that all three were in close mutual agreement on various points, so much so in fact as to elicit from one of the authors an amusing virtual apology for the apparent unanimity and an assurance that the papers had been written independently and without consultation.

The trend of the discussion showed that the last ten years have brought about a considerable change in industrial demand with relation to research. Formerly it was expected that the technical colleges should prepare their graduates in the fundamentals of engineering, with a view to entering manufacturing salesmanship, only a limited number of graduates being needed in manufacture. More recently it has been recognized in this country that all of the executive officers engaged in technical manufacture, besides the designers, engineers and salesmen, have to be well grounded in applied science. Now there is a specific demand for technically trained graduates who are competent to take junior positions in industrial research work.

It was pointed out by more than one speaker that since it took a regular four years' course at a technical college to produce, on the average, an engineering graduate of the minimum standard attainments, it was necessary, under ordinary conditions, for the students possessing research ability to take a fifth or extra graduate year of special research college grade, in order to prepare themselves for posts in industrial-research laboratories. This being a generally accepted proposition, it was very desirable that the industries which had already experienced benefits from the policy of maintaining their own industrial research laboratories should foster the development of researchers by founding research fellowships or scholarships in the universities or technical colleges. An industry might very properly and profitably establish one or more unrestricted research fellowships in an engineering col-

lege without thereby creating any commercial jealousies. Without the aid of such fellowships technical students almost always seek to enter business life immediately after graduation, whether they have research ability or not; whereas, under the stimulus of such fellowships, those who had already manifested an inclination for research would be enabled to develop themselves by an extra year of laboratory work into properly qualified researchers. Such specially gifted and selected men might be depended upon to advance the industry in which they subsequently enlisted.

It has to be remembered that industrial research, although it has paid splendidly in many cases and is likely to do so again in many more, is likely to pay only when the men employed in research have special gifts or abilities in that direction. There can be, and there should only be, a relatively small number of technically trained young men graduating from the colleges of the country to take up industrial research work effectively. The majority are likely to have gifts and aspirations for other posts, such as designers, managers, constructors or salesmen, all of which are in demand. Industrial research will have a magnificent future if properly selected men go into it, and if men who are not gifted that way are induced to keep out of it.

Fundamental Data of Photometry

A VERY important research paper by Coblentz and Emerson has just been published as No. 303 of the scientific papers of the Bureau of Standards. We commend it to the special attention of all who are interested in photometry, and particularly in the heterochromatic photometry which of late has been assuming so much importance. It is a thorough study of the average eye in relation to its sensibility to light of various colors. The particular importance of the work may be appreciated from the fact that the authors have plotted in one composite mass of visibility curves the carefully measured results obtained from 125 observers. No work with which we are acquainted gives data anything like so complete. To the student of physiological optics the results are particularly striking as showing what of course has been long understood, but

never so fully and completely proved, that what one may call "normal" color vision is only an average of variables. A few of the observers studied had what would ordinarily be called partial color blindness—that is, variation from average color vision considerable enough to respond to somewhat rough tests, and particularly to cause material confusion in colors. But the curves from these cases pass by imperceptible gradations through average values to values in the opposite direction.

A glance at the composite curves shows with the utmost distinctness that the variations between eye and eye present gradations so gradual that the most which can be said is that there is an approximate average curve from which variations of small degrees are the rule and not the exception. The ensemble curves also show very beautifully the fact familiar to the physiologist that variations in color sensibility affect the red more commonly than the green or blue, the green probably being subject to the least variations. It is particularly striking to note the number of cases in which red perception took the plus instead of the minus sign, twenty-six of the subjects showing in greater or less degree this peculiarity, first noted by Lord Rayleigh and subsequently confirmed by others. On general principles plus color variations should be as common as minus variations, and they probably are so in fact, although not often detected by the rather crude tests of the early ophthalmologists.

From a purely practical standpoint the work of Coblentz and Emerson has a very important bearing on heterochromatic photometry. It shows the frequency and amount of probable errors in measuring lights of various colors and incidentally serves to emphasize the greater regularity and probably greater precision of measurements obtained on lights of different colors by the flicker method. The data obtained are sufficiently extensive to permit an average by which the visual sensation of light can be correlated to radiant energy, affording therefore a sounder basis for physical photometry than has hitherto been available. We cannot here do more than touch on the valuable data presented by this paper, and we commend it to critical reading by those interested in the subject.

BEGINNING with the first issue of November, the ELECTRICAL WORLD

The Coming Issues

will publish a series of articles on the application of electric motors and control apparatus to various industries. The series will comprise approximately sixteen articles, the first eight of which are planned to contain a well-worked-out treatment of the fundamental aspects of the whole problem. The series will be prepared by Prof. C. E. Clewett of the University of Pennsylvania, which institution is now engaged in perfecting a course on the same subject. In addition, articles are expected from specialists on control and motor applications. These will appear from time to time during the same period and after the completion of the series mentioned. Among the subjects which will be treated are the following: Electric power for industrial operation; central station power for the industries; distribution of

electric power in the factory; attitude of machine-tool builders to motor drive; a study of group and individual motor drives; speed, torque and power in machine-tool motor work; constant and adjustable speed motors for factory drives; fundamental features in the problem of industrial control; problems in motor drive for lathes; operation of motor-driven planers; motors and control for crane operation; operation and control of motor-driven fans and blowers; modern methods of electric drive in steel mills; motor applications in textile mills; the application of flywheels to motors; use of the graphic meter in motor application. Other articles next week will be one on the minimum-cost method of designing transformers and another on the steps taken by a Middle West company to standardize outdoor substations. Interesting subjects from the public policy viewpoint will also be discussed.

The Electric Furnace for Non-Ferrous Metallurgy

Advantages Derived from the Use of Electric Heat in This Industry, Types of Furnaces Under Experimentation or in Commercial Use, and Data on Performance Under Various Conditions

SOME of the many advantages to be gained by the use of electric furnaces in metallurgical processes involving non-ferrous metals were brought out by Dwight D. Miller of the engineering department of the Society for Electrical Development at the recent annual meeting at the American Institute of Metals in Boston. A brief review was given of the development in the use of electric furnaces in the steel industry of this country, together with an account of what has been and is being done to develop an efficient furnace for the non-ferrous industry, particularly in the manufacture of brass. Classifications of the various types* of electric furnaces are given in the original paper, together with a general description or outline of their construction, principles of operation and control, and advantages to be gained by their use. Finally results which have already been obtained in the commercial field were presented.

Although the electric furnace has been in use in this country in the steel industry for slightly over eleven years (about 471 furnaces of seventeen different makes being in use throughout the world), it is somewhat remarkable that only intermittent attempts have been made to develop a similar furnace for the commercial production of copper and its alloys, such as brass and bronze, until within the last three or four years, especially so since the many advantages to be gained by the use of the electric furnace have been fully demonstrated and recorded in its application to the steel industry.

Specifically, some of the many advantages to be gained from electric heat include:

1. Greater thermal efficiency, since electric energy is changed into heat without loss and utilized at many times the efficiency of combustion devices.
2. More positive and accurate control of both time and temperature.
3. It can be concentrated at any desired point and confined to a definite area.
4. It can be produced in the exact quantity and at the temperature desired, and these conditions can be duplicated at will.
5. It produces "clean heat" and allows of greater flexibility of operation.
6. It can be utilized in any atmosphere, oxidizing, neutral, reducing or even a vacuum.
7. By its use greater product for a given time is produced and its quality improved.
8. Saving in time, labor and space with the attendant saving in overhead, real estate and taxes.
9. Much improved working conditions, resulting in higher labor efficiencies.

There is a large saving in space and labor due to the fact that the storage of coal and ashes, together with the labor required for handling them, is done away

with. Then, too, one electric furnace capable of handling a 1200-lb. (543-kg.) melt replaces six pit crucible furnaces handling 200 lb. (90.7 kg.) each, and yet occupies no more space than one of these furnaces when the space required for handling coal and ashes is taken into consideration. Again, it takes no longer to melt the 1200 lb. in an electric furnace than it does to melt the 200 lb. in the crucible. In almost all instances, in fact, the time is shorter. All of which means that there is a large saving, both in space required and in time, of pounds of metal melted per square foot of operating area, with the attendant saving in overhead, real estate, taxes and labor.

Since it is standard and practically universal practice to measure the electric power used by a furnace by means of at least a voltmeter and an ammeter mounted on the operating board, the total input can be seen at a glance and easily recorded. In case a graphic recording instrument is used, the record is made automatically for the entire day's run so that the amount of power used each minute or hour can be read from it. Thus a complete power record in this case is made without any effort of the operator.

In melting non-ferrous alloys a large part of the metal loss is occasioned through volatilization of the zinc content. This again is dependent upon both the temperature used and the rate of heating as well as upon protection against the oxidizing influence of air. Having found out by experimentation just what these factors should be for a given alloy, those exact conditions which produce the best results can be duplicated at will time and time again on account of the ease, flexibility and nicety of control possible with the use of electricity.

PRESENT PROGRESS AND DEVELOPMENT

The furnaces which have been designed and are now under experimentation include the Gillett furnace (indirect-arc type), patent assigned to the government, Department of the Interior, Bureau of Mines; the Conley furnace (molded-resistor type), controlled by Florance & Hampton, 1270 Broadway, New York; the Thomson-FitzGerald furnace (reverberatory resistance type), controlled by John Thomson, 253 Broadway, New York; the Northrup furnace (induction type without iron core), controlled by the Ajax Metal Company, Philadelphia, and the Hering "pinch-effect" furnace, controlled by Carl Hering, Philadelphia, although an option is held by the Ajax Metal Company for handling brass in the furnace. Other furnaces are under experimentation, but the companies interested in them are averse to giving any information thereon.

The Gillett furnace, invented by Dr. H. W. Gillett, is an indirect-arc furnace so designed as to bring about a violent agitation of the charge by a rocking motion. Some tests have been conducted during the past summer, but the results cannot be made public at this time.

The Conley furnace, invented by William H. Hamp-

*Some of the information contained in the author's papers was taken from two pamphlets, "Industrial Heating as a Central Station Load: Part I, Electric Furnaces; Part II, The Utilization of the Heat of Electric Energy," prepared by the writer and recently issued by the Society for Electrical Development.

ton, is a resistance furnace of the molded-resistor type, in that the charge is melted in an open graphite crucible which closes the secondary circuit. The voltage is applied directly to the sides of the crucible, the latter being inclosed in an iron-plate casing packed with Kieselguhr. Hand control is used for varying the voltage in the primary circuit and consequently in the

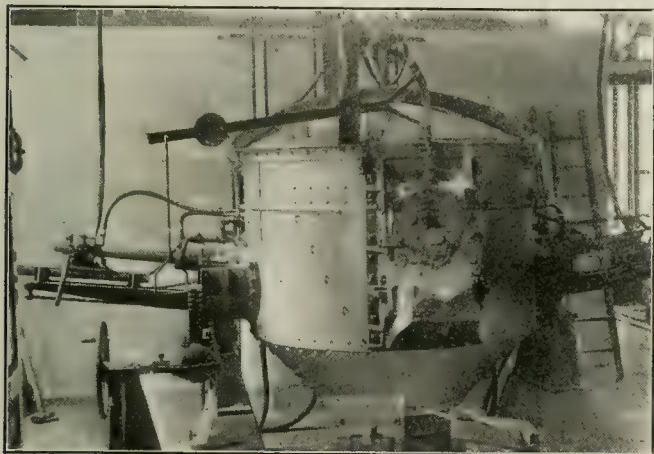


FIG. 1—INDIRECT-ARC-TYPE FURNACE FOR NON-FERROUS METALLURGY (RENNERFELT)

secondary circuit. The furnace is capable of melting 100 lb. (45.3 kg.) of copper with 12 kw.-hr. input. The power factor is practically unity—98 to 99 per cent.

The Thomson-FitzGerald furnace, invented jointly by John Thomson and Francis A. J. FitzGerald, is a resistance furnace of the reverberatory type, the heating effect being produced by radiation from especially formed resistors and reflection from the walls and roof of the furnace inclosure. The apparatus, which is designed for the purification of spelter containing metals, has been tested chiefly for the fuming of impure zinc. While the furnace has been successful in producing extremely pure zinc, no performance data are available for publication.

The Northrup furnace, invented by Prof. Edward F. Northrup, has been under experimentation for the last year, during which time some data have been obtained. The furnace is an absolutely new departure in furnace design and principle of operation. It employs oscillatory current at very high voltage, the oscillation being produced by discharges from a condenser and being conducted to a series of closed coils which are mounted concentrically on cylindrical crucibles and insulated from each other. A 20-kw. Northrup furnace will melt 45 lb. (20.4 kg.) of brass scrap in thirty-five minutes, starting from the cold. Temperatures as high as 1600 deg. C. are readily obtained. The furnace is admirably adapted to make melts in vacuum and is now being used by the author for melting both glass and electrically conducting materials.

"So far as the writer is aware," said Mr. Miller, "nothing is being done at present with the Hering 'pinch-effect' furnace, which has been fully described in the technical press."

COPPER-ZINC-ALLOY FURNACES

The furnaces that are in actual commercial practice for handling copper-zinc alloys include the Ajax Wyatt furnace, controlled by the Ajax Metal Company, Philadelphia; the Foley furnace, controlled by Charles B.

Foley, Inc., 170 Broadway, New York; the Baily furnace (reverberatory resistance type), controlled by the Electric Furnace Company of America, Alliance, Ohio; the Rennerfelt furnace (indirect-arc type), represented by Hamilton & Hansel, 17 Battery Place, New York; the Snyder furnace (direct-arc type), controlled by the Industrial Electric Furnace Company, 53 West Jackson Boulevard, Chicago, and the Hoskins furnace (resistance type), controlled by the Hoskins Manufacturing Company, Detroit, Mich.

The William A. Rogers Company, Ltd., which uses Baily furnaces, states that virtually no metal losses are involved when handling silver using two crucibles holding approximately 500 oz. (14 kg.) each, that the metal appears more homogeneous, and that a better melt is obtained. The first heat takes about one hour and thirty minutes, while the others take approximately one hour, the average total time for charging, melting and pouring being approximately one hour and seven minutes. The company can get about eight heats (of two crucibles each) in a day of ten hours.

The pouring temperature is around 2200 deg. Fahr. (1209 deg. C.), although no pyrometer is used, the temperature being judged by the color. The furnaces operate with a constant input of 30 kw., which figures out 960 kw.-hr. per ton. The electrodes in the silver furnace are replaced once every three months, but as they use the butts left over from the annealing furnaces this renewal costs them practically nothing.

The Otis Elevator Company has two Baily annealing furnaces of 300 kw. and 150 kw. capacity for treating steel and brass castings. About the only trouble experienced has been an occasional cracking of the resistor troughs, thereby necessitating patching. These two furnaces are energized by one three-phase trans-

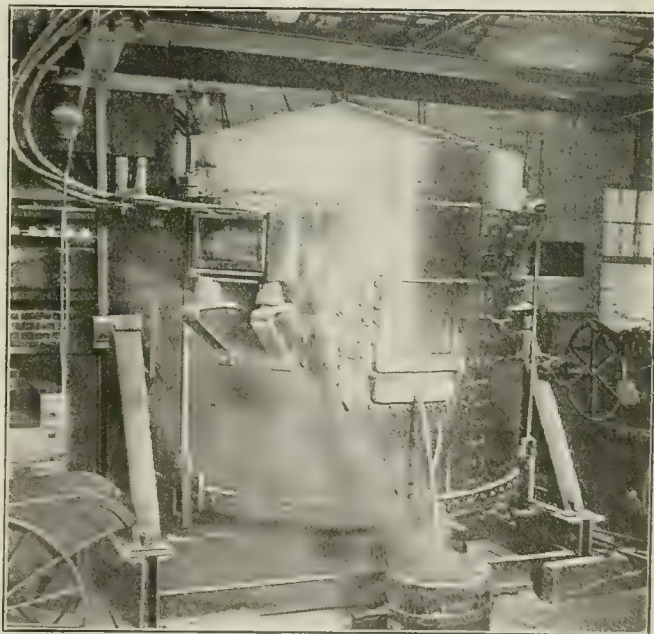


FIG. 2—RESISTANCE-TYPE REVERBERATORY FURNACE WITH HEATING ELEMENT IN ROOF (BAILY)

former, the large furnace operating two-phase and the smaller one single-phase. The troughs are in series, thus producing an even balanced load.

The castings treated vary from 3 lb. (1.4 kg.) up to 7000 lb. (3175 kg.) each. The larger furnace can handle a charge up to 12,000 lb. (5443 kg.) of metal,

while 7500 lb. (3402 kg.) can be charged in the small furnace. The metal is treated at a temperature ranging from 1500 deg. Fahr. to 1850 deg. Fahr. (815 deg. C. to 1026 deg. C.) and heated for from sixteen to twenty hours. Starting with a furnace temperature of approximately 750 deg. Fahr. (398 deg. C.) and running up to an annealing temperature of 1600 deg. Fahr. (871 deg. C.), at which time the current was shut off, the cost per ton was approximately \$7, the total time the power was on being nineteen and three-quarters hours.

At the Lumen Bearing Company, Buffalo, copper, lumen metal, phosphor and manganese bronze are being handled in Baily furnaces. The charge is 600 lb. (272.2 kg.), consisting of scrap and ingots. Short test runs on both lumen metal and phosphor bronze under far from ideal conditions resulted in a consumption of 12 kw.-hr. for lumen and 22 kw.-hr. for phosphor bronze per 100 lb. (0.49 kw.-hr. per kg.). The company states, however, that as soon as it gets to running ten hours per day six days in the week it expects to reduce these figures to 10 kw.-hr. and 17.5 kw.-hr. respectively, basing this expectation on making the hardener used with lumen metal, and which forms 28 per cent of the melt, separately in a crucible.

The lumen metal is poured from 1250 to 1600 deg. Fahr. (754 to 871 deg. C.), the phosphor bronze at approximately 2200 deg. Fahr. (1209 deg. C.). The heats average about one hour so that eight or nine heats can be made in a ten-hour day according to conditions. The metal loss will vary from $2\frac{1}{2}$ to $3\frac{1}{2}$ per cent for the lumen metal, the test on the phosphor bronze showing 2 per cent.

With the idea of getting the hearth in good condition a melt of copper amounting to 1512 lb. (685 kg.) was run just previous to the test run on phosphor bronze. This was held for four hours and twenty minutes with a consumption of 24.8 kw.-hr. per 100 lb. (5.5 kw.-hr. per kg.), starting with the furnace hot. The charging was done in nine separate lots extending over three hours while six pours were made, ranging from 2000 deg. to 2100 deg. Fahr. (1094 deg. to 1150 deg. C.) in forty minutes. Under these conditions the figures given should not be considered as a true indication of the performance of the furnace when handling copper. It is possible to charge manganese bronze immediately after a lumen heat since the zinc which might be left in the furnace would have no injurious effect on the manganese bronze.

Of the two furnaces installed one has been in operation for six months and the other for two months. During this time there has been only one renewal of the bottom, costing about \$50, with some slight patching in addition. The second furnace, however, is not run every day.

Regarding savings the statement is made that with coke costing \$4 and crucibles 4 cents there is a saving made by using electricity at 0.75 cent per kilowatt-hour, which is virtually what is paid. In addition, the labor of carrying the coke and ashes is eliminated together with the space for their storage.

The Hoskins Manufacturing Company gives the following information regarding the performance of several of its furnaces: "The smaller, holding one crucible, usually gives four to five heats of 23 lb. (10.4 kg.) each per day, but we have no power figures on it. It is lined with $4\frac{1}{2}$ in. (11.4-cm.) magnesite back of the resistor

and $4\frac{1}{2}$ -in. (11.4-cm.) firebrick back of this. This brick lining has to be rebuilt every six to eight weeks and is patched every Saturday. The larger furnace, taking two crucibles, is lined with $4\frac{1}{2}$ -in. (11.4-cm.) carborundum bricks just back of the resistor, with 3-in. (7.6-cm.) powdered silica back of this, and finally with $2\frac{1}{2}$ -in. (6.4-cm.) Kieselguhr brick back of this. This furnace has to be rebuilt every three to four months, and it is patched every Saturday. In it the current is turned on every morning at 4.30, increased at 7 a. m. to probably 40 kw., when charging begins, and later run at 50 kw. to 60 kw. Five heats of 23 lb. (10.4 kg.) each are usually turned out per day, the first at about 11 a. m. and the others every one and a third to one and a half hours, using for the day from 450 kw.-hr. to 525 kw.-hr. These alloys are poured at about 2900 deg. Fahr. (1589 deg. C.)."

RESULTS OF TESTS ON BRASS

The results of five tests on yellow brass (65 to 85) showed an average of 49 kw.-hr. per 100 lb. (1 kw.-hr. per kg.), pouring at 1950 deg. Fahr. (1063 deg. C.). The melt was made in a 70-lb. (31.8-kg.) crucible in an

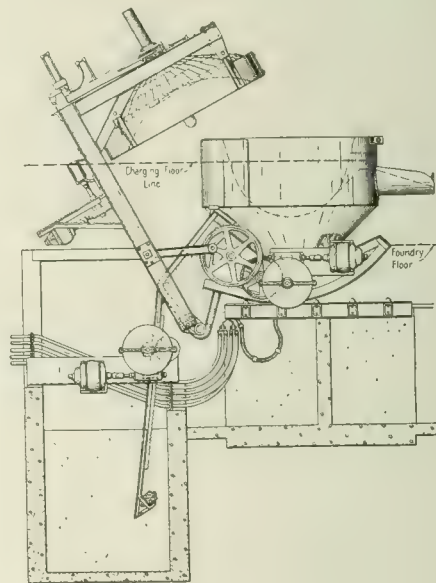


FIG. 3—DIRECT-ARC FURNACE WITH REMOVABLE ROOF TO PERMIT CHARGING THROUGH TOP

FC furnace. The total time per heat outside of the first, which took two and a half hours, was approximately one hour. Eight tests on red brass showed an average of 36.5 kw.-hr. per 100 lb. (8 kw.-hr. per kg.), pouring at about 2150 deg to 2175 deg. Fahr. (1170 deg. to 1190 deg. C.). The first and average heat took the same time as for yellow brass. No metal loss was given in either case.

"The only installation of Snyder furnaces handling non-ferrous metals of which I am aware," said Mr. Miller, "is that at the Chicago Bearing Metal Company. The power factor is in the neighborhood of 60 per cent." The furnaces have a capacity of about 2000 lb. (907 kg.) of metal per heat, and the average power consumption is not over 300 kw.-hr. per ton (333 kw.-hr. per t.). They operate twenty-four hours per day, Sundays excepted, and handle a heavily leaded bronze such as is used for railway car and locomotive bearings. The composition of the metal is approximately 75 per cent copper and the balance is lead, tin and miscellaneous

impurities in that order of importance, the lead running about 15 per cent. The metal is poured at approximately 2100 deg. Fahr. (1148 deg. C.), and while the metal loss is fairly high, mostly lead and some copper, about \$12,000 net is saved per month by doing away with the crucibles, since these two furnaces replace forty to fifty coke and oil-fired furnaces. The high metal loss follows naturally from the use of a direct-arc furnace, since it is bound to produce a superheated top layer in the bath.

Rennerfelt furnaces of 1/3 ton (302 kg.) and 1200 lb. (544 kg.) capacity are in operation at the Gerline Brass Foundry Company's plant, Kalamazoo, Mich., and at the Philadelphia Mint respectively. At the mint some French and Italian coins composed of almost pure nickel have been handled, the lining standing up very well although the melt was at a high temperature. They use a ganister bottom with silica brick linings. This furnace should give a very good account of itself in handling alloys of this nature.

In the furnace at the Gerline brass foundry red brass, enamel tank (half red and half yellow brass with not over 22 per cent zinc content) and monel metal have been handled, but not much success was attained with yellow brass ingots. The furnaces could not handle yellow brass borings at all. This was only to be expected since neither the direct nor the indirect arc type of furnace is suited for handling alloys containing metals which volatilize at comparatively low temperature unless some method is provided for overcoming the superheated top layer.

While too much reliance should not be placed on operating figures obtained as the result of experimental runs, and this remark will apply to those previously given, still as an indication of what may be expected the following results are given:

Out of four heats making monel-metal castings, three showed no metal loss and the fourth heat a loss of 3.3 per cent. The average of the actual melting time was three hours and forty-eight minutes, with a kilowatt-hour consumption of approximately 1300 kw.-hr. per ton (1444 kw.-hr. per t.). The average charge was 549 lb. (249 kg.) with an average electrode consumption of 5 lb. per ton (2.5 kg. per t.).

The results of seven heats making enamel-tank castings under fair operating conditions showed an average metal loss of 3½ per cent, with an average of actual melting time of one hour and forty-eight minutes. The average kilowatt-hour consumption was 537 kw.-hr. per ton, while the electrode consumption was 2.8 lb. per ton (1.4 kg. per t.). The average charge was 580 lb. (263 kg.).

Ten heats were selected from those making red brass castings as representing fair working conditions. The results show the average charge to be 532 lb. (241 kg.), with an average of actual melting time of one hour and fourteen minutes. The average kilowatt-hour consumption was 437 kw.-hr. per ton (485 kw.-hr. per t.) with an electrode consumption of 2.8 lb. per ton (1.4 kg. per t.).

It should be noted that the kilowatt-hours required for making red brass castings are less than those for enamel tank, which simply goes to show that experimental figures cannot be relied on for commercial practice. In order to obtain figures of value full and complete data as to all conditions should be recorded.

Regarding the whole question of labor savings, it can be stated that arrangements have already been worked out whereby pouring castings or blanks direct from the furnace can be accomplished. In the case of small furnaces these can be picked up bodily and brought to the pouring floor, while in the case of the larger-sized furnaces the molds can be arranged to pass under the spout by means of a conveyor system.

It should also be noted that very little use is made of the pyrometer for accurate recording of temperature of melt. "This, in my opinion," said Mr. Miller, "is a mistake and much to be regretted, since the primary object of the use of the electric furnace is to reduce metal losses by more accurate control and to keep full and complete daily records which can be used in determining the best practice and eliminating preventable losses."

ANALYSIS OF ACCIDENTS TO LINEMEN AND GROUNDMEN

Most Accidents Are Avoidable, Chicago Safety Bureau Points Out—Precautions to Be Taken Are Given

An analysis of nearly 6000 accidents to employees of public utility companies in several states shows that a larger percentage of accidents occurred to linemen than to employees in any other occupation connected with electric service. This is probably due to the fact that more linemen were employed by the companies reporting accidents than any other class of men. From a close analysis of all accidents it has been found that a large percentage of them are avoidable. The chief accidents occurring to linemen only are as follows:

	Per Cent
Striking or struck by material.....	18.8
Electric shock	11.4
Wire, glass, sharp edges.....	10.0
Handling tools	9.4
Struck by falling bodies.....	9.4
Lifting or moving material.....	9.4
Falls from pole.....	7.3
Acid, solder or compounds.....	6.0
Fall from elevation (other than poles).....	6.0
Fall on level over material.....	5.4
Injured by spurs.....	4.0
Fall from vehicle.....	2.0
Run down by vehicle.....	0.7
Injured by animal.....	0.7

Nearly 20 per cent of the accidents occurring to groundmen were due to being struck by falling bodies. Tools should never be thrown up to linemen on poles, nor should linemen drop tools when through with them. A canvas toolbag, securely fastened to the end of the hand-line, should in all cases be used in raising and lowering tools and materials.

The analysis also shows that the majority of the accidents occurring to linemen are not caused by electric current, as is sometimes believed. Thirty-six fatal accidents were found among 2670 reports, and of these twenty-six were caused by electric current (70 per cent occurring to linemen). The remainder were caused by falls, machinery in operation, and heat or gas. Wearing rubber gloves would reduce the hazard of electrical contact considerably, while the use of spurs and safety belts would minimize accidents from falls.

These points were brought out in a recent issue of a bulletin distributed by the Bureau of Safety, Chicago.

The Central Station Industry in War Time

Notwithstanding Terrible Coal Conditions and High Cost and Scarcity of Materials and Labor, It Is Confidently Proving Its Great Economic Value and Its Progress Is Assured

BY WILLIAM H. ONKEN, JR.

Editor ELECTRICAL WORLD

SINCE the war began in Europe so rapid has been the growth of our industry that its kilowatt-hour output has been doubled. The pace, now that the United States has entered the conflict, must be quickened still more because the government needs maximum production in all industries. Every ounce that can be turned out in our mines, mills and factories can be used, and even then it is doubtful if we shall have enough. Co-operation and co-ordination of effort are more essential to the industry now than ever before.

In all parts of the country the labor situation is disquieting and indications are that it will become worse as the war progresses. The trouble is that we are trying to do more work than there is labor to do it with. Ere long we shall have 2,000,000 men in arms, and since it requires at least four times as many men to keep them supplied with food, raiment and munitions, 10,000,000 men will be engaged directly or indirectly in pursuits contributory to the war.

The electrical industry must face this condition with the others and govern itself accordingly. If the entire level of living costs is raised, we must naturally expect to bear some of the burden. Losses in men we shall experience, but we shall be

able to operate just the same. Properties in the eastern provinces of the Dominion of Canada have had as high as 35 per cent of their working forces engaged in the war and have managed not only to get on without them but to supply more energy besides.

Fortunately, central stations do not require so large a force of men in their operation as some other industries, so that the irreducible limit of labor may not be reached. There is no danger of shut-down from such a cause, but it is well to recognize that in the world at large labor is of increasing scarcity and that governments as well as private industries must face that fact.

COAL SUPPLY

No other single condition confronting the industry is so serious, and despite all that the government may do, the chances are that it will become worse this win-

ter. Happy is the man with a hydroelectric system.

Coal production has increased but not sufficiently to meet the demand, and the transportation facilities of the country have already broken down. A point has been reached above which prices rise only through competitive bidding against the same sources of supply, sources that cannot be further increased. Such panic-made prices are uneconomic, but wherever production can be increased or a saving accomplished there is a possibility for gain either to the producer or the consumer or both.

Manufacturers of electrical generating machinery are working to the limit on steam turbine units and now large turbines cannot be had in less than two years or more. Roughly speaking, there will be installed by the end of next year 60 per cent more steam generating equipment than there was in existence the first of last year. Huge generators are displacing smaller units; the tendency toward the consolidation of companies and the concentration of supply from large stations is more pronounced than ever, and the industrial world is turning more and more to the central station for power. Moreover, with the larger units and with the better design, great

economy in labor has been made possible. The transformation when complete will mean a decrease in fuel consumption per kilowatt-hour generated to about one-half of what it was in 1912.

In 1912 the total coal consumption in a steam station was considered very good if it was as low as 2.5 lb. per kilowatt-hour. To-day generating units as large as 30,000 kw. are in service, with others as large as 70,000 kw. under construction. Steam pressures range from 200 lb. to 250 lb., superheat to 200 deg., and vacuums hover around 29 in. A kilowatt-hour can be generated in a modern station from 10.5 lb. of steam, and the total coal consumption has dropped to 1.5 lb. per unit. When steam pressures have been raised to 300 lb. or 350 lb. and the degree of superheat to 250, further economies may be looked for.

It is surprising what a large saving is made possible

WAR'S EFFECT ON THE INDUSTRY

This paper, presented by Mr. Onken, editor of the ELECTRICAL WORLD, before the Southeastern Section of the National Electric Light Association at Birmingham, Ala., in session Oct. 24 to 26, reviews critically, but with strong faith in the future, the various conditions which the war emphasizes in the central station industry. Among the points outlined in this abstract are the following:

Since the war began in Europe our kilowatt-hour output has been doubled.

We shall experience losses in men, but we shall be able to operate just the same.

The tendency toward consolidation of companies and concentration of supply from large companies is more pronounced than ever.

The cry for power must strike with hollow mockery the ears of the water-power obstructionist.

Immense increases in cost of fuel, material and labor indicate that there must be readjustment of rates.

After this conflict the principle of supply from a central source will be established more firmly than ever, for the war has proved that efficiency of production is more important than accumulated wealth.

by the mere substitution of a modern turbo-generator for less modern equipment in a central generating station. The advance in steam station practice since 1912 has been so great that if all of the electrical energy generated that year were turned out from steam-driven stations, the same output to-day with the apparatus now available could be generated with a saving of at least 15,000,000 tons of coal. To that extent is the central station industry a potential conserver of fuel and a benefactor of mankind.

THE IMPERATIVE NEED OF WATER-POWER DEVELOPMENT

In view of the fact that some 60,000,000 hp. is continuously going to waste in the streams of the country, it is beyond comprehension why an enlightened people like ours should not only fail to encourage but should blindly bar the way to the development of a great natural resource so important to the well-being of the nation. When we consider the benefits which have already accrued to industry from the water powers now developed and recall how we have besought, appealed and pleaded for legislation to permit further development, we contemplate the present unhappy power situation with pain and sorrow. How the cry for power must strike with hollow mockery the ears of the water-power obstructionist!

Be it said to the credit of our industry that it is not content to remain idle. If we cannot build hydroelectric systems we turn to steam stations; but that does not alter the fact that the burning of fuel to produce electricity that might be produced from falling water is not conservation. It is true that notwithstanding obstacles, water-power development has been and is going on.

REFORM IN RATES

Immense increases in the cost of fuel, material and labor indicate that there must be a readjustment of rates. For many years the tendency in the price of electrical energy has been steadily downward in the face of rapid increases in the price of every other human necessity, but when the cost of wire and cable has increased 138 per cent, pole-line hardware 125 per cent, electrical generating apparatus from 30 per cent to 100 per cent, and labor and coal command what the traffic will bear, optimism is no longer possible.

It is, of course, expected of every utility that its management will seek in every way possible, by taking advantage of every advance in the art and by other methods, to maintain the present service at the present rates. When all that can be done has been done toward effecting economies, no commission or court will refuse increases in rates if such are found absolutely necessary. Increases must be applied with discretion, however. In my judgment it would be inexpedient to increase the cost of service to residence consumers.

If the industry can pull through the crisis without having to resort to increased rates, this will redound to its everlasting credit. By co-operation and the interchange of electricity from one system to another through interconnection of systems, further economies are possible with apparatus already installed. No general rule can be applied, however. This much is certain, that in many modern and well-managed utilities profits have been wiped out or even converted into

losses, and hence a general upward movement in rates is necessary.

THE FINANCIAL SITUATION

An eminent banker conversant with the public utility field said in 1913 that \$4,000,000,000 a year of fresh capital could profitably be used in the development of the electrical industry in the United States for the following five years, and what amount the call for new capital might reasonably be expected to reach after 1918 no one could predict. That estimate must be revised. Right now the industry could use a great deal more than that amount, but even a far less sum cannot be had. The country's offering of billions of Liberty bonds has taken the credit market away from the utilities at the very moment when the demands for service and the need for money are most pressing.

A little exertion in disposing of some of the securities over the counters to private citizens or local banks is good policy, and such holdings would have been the means of saving many a local situation. Cut off from the regular sources of supply, it is incumbent on central station managers to devise ways and means to furnish moneys for extensions and developments for home capital. Many utility companies that have recently tried it find that the interest and dividend moneys which previously went elsewhere and which are now paid to individuals in the communities they serve have had a most salutary effect on all questions involving public relations.

Money will be forthcoming to sustain an industry so vital to a nation as ours. The American people demand good service, advanced and progressive, together with developments which will keep in step with the growth of the country. Fortunately, over-expansion and inflation have been impossible in the central station industry because of high costs and restricted profits. If anything, the industry has not expanded enough.

It is generally recognized that not only is the central station a conserver of fuel, but it is also economical in the use of capital, so that its claims of priority for both fuel and capital are unassailable.

THE PROSPECTS OF A GREATER INDUSTRY

Never in the history of the nation has the central station been in a better position. After this conflict the principle of supply from a central source will be established more firmly than ever, for the war has proved that efficiency of production is more important than accumulated wealth. Electricity has ever been one of the greatest factors in the productiveness of industry, and the central station is recognized as the most economical source of supply.

Establishments operating from isolated plants have been forced by the exigencies of the war to turn to the central stations for added power, or by reason of inability to obtain coal or because of its high cost have been content to let the local lighting company carry their entire load. A transformation that would have normally taken place ten years hence has been brought about almost over night. Having experienced the reliability and economy of central station service, most of these factories will never return to isolated plants. War teaches conservation of energy and resource. Hopeful of serving still more effectively, the industry looks forward with serene confidence to the future.

MAINTAINING RECORDS OF UNDERGROUND DISTRIBUTION

Method Employed by an Eastern Company—Forms of Records Employed—Examples of How Method Is Carried Out

BY M. LABOV

In order to enable the engineers of the Flatbush Gas Company (electrical department) to ascertain quickly and accurately the kind and size of conduit and cable used in any part of their system, and the source of supply, this company has adopted the system of maintaining maps and records described here. To show the underground distribution system a map is used drawn on standard-size sheets 12 in. by 27 in. (30 cm. by 68 cm.), scale 40 ft. to 1 in. (12.2 m. to 2.54 cm.) each street being drawn on a separate sheet or sheets, according to the length of the street. These sheets are arranged alphabetically in a loose-leaf binder which is kept on file in the drafting department. This map designates the location of all manholes, length and number of ducts between manholes and location of lamp posts, etc. When

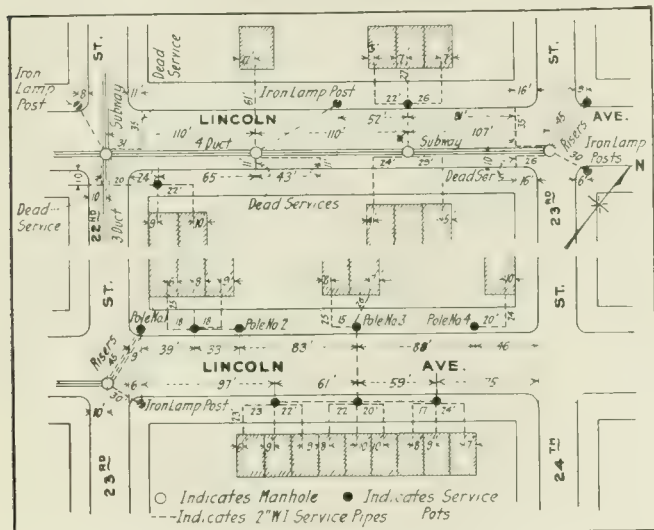


FIG. 1—METHOD OF INDICATING POSITION OF MANHOLES, DUCT SERVICES, ETC.

application for electric service is made by a prospective consumer, this map is referred to, to ascertain if the applicant is near enough to the company's lines to warrant supplying the electric energy. If the application is accepted, a drawing is then made showing the proposed layout of the new service and where it is to be connected to the lines. Copies of this drawing are made and attached to an application for a city permit to open such portion of the roadway and sidewalk as may be necessary to install the service. This method is also used in applying for a city permit to extend duct lines or to build manholes.

A copy of this drawing is given to the foreman of the construction gang, who follows it as closely as the conditions will allow. In case the existing sub-surface structures interfere with the installation of the service in the way the drawing calls for, he is to use his own judgment to overcome the obstacles he encounters. When this work is completed draftsmen make the necessary measurements of the work as it is installed, and these data are turned in to the drafting department to be plotted on the map.

The various sub-surface properties are summed up monthly from these data and subdivided into main and secondary distribution systems, then classified according to the original paving above the installations and added to an inventory which shows the total length in trench feet, the kind and number of various sizes of ducts and manholes, and the trench feet of original paving.

NO. OF FEET OF VARIOUS KINDS OF DUCTS				TOTAL NO. OF TRENCH FEET OF ORIGINAL PAVEMENT			
ASPHALT	MACADAM	GRANITE	DIRT	ASPHALT	MACADAM	GRANITE	DIRT
2760 79	67 14 42	755 33	20899 95	310	109	21089 09	
NET TRENCH FEET OF PRESENT PAVEMENT				TOTAL			
ASPHALT	MACADAM	GRANITE	DIRT	ASPHALT	MACADAM	GRANITE	DIRT
44 0 76	427 17 16	346 33	136 11 84	1 09	21089 09		
MANHOLE INVENTORY				TOTAL			
TYPE SPECIAL	TYPE A	TYPE B	TYPE C	TYPE D	TYPE E	TYPE F	TYPE G
45	497	378	21	333	30	102	19 58
FIBER AND WROUGHT IRON DUCT LAID DURING THE MONTH OF				TOTAL			
NO. OF FEET OF VARIOUS KINDS OF DUCTS	ASPHALT	MACADAM	GRANITE	DIRT			
45	497	378	21	333	30	102	19 58
NET TRENCH FEET OF ORIGINAL PAVEMENT				TOTAL			
ASPHALT	MACADAM	GRANITE	DIRT	ASPHALT	MACADAM	GRANITE	DIRT
2760 79	67 14 42	755 33	20899 95	310	109	21089 09	
NET TRENCH FEET OF PRESENT PAVEMENT				TOTAL			
ASPHALT	MACADAM	GRANITE	DIRT	ASPHALT	MACADAM	GRANITE	DIRT
44 0 76	427 17 16	346 33	136 11 84	1 09	21089 09		
MANHOLE INVENTORY				TOTAL			
TYPE SPECIAL	TYPE A	TYPE B	TYPE C	TYPE D	TYPE E	TYPE F	TYPE G
45	497	378	21	333	30	102	19 58

FIG. 2—INVENTORY OF VARIOUS KINDS OF DUCTS UNDER DIFFERENT PAVEMENTS

ing and present paving over duct lines. This is classed as the main distribution system. The secondary distribution system consists of house services, dead or curb services and risers. These data are kept in tabulated form as shown.

The keeping of an inventory for the main distribution sub-surface properties is very simple for the reason that the classification of ducts and types of manholes is seldom changed. It has been found to be very difficult to keep an inventory of the secondary distribution sub-surface properties, because of the fact that they are constantly changing. In Fig. 3 these services are grouped under their respective classes. For example, take the dead-service class, which shows a total number of 827 dead services, and the number of feet of dead services is classed under its respective paving. If five lamp posts are set on five dead services, that changes the dead services into lamp services and five services have to be subtracted from the dead-service class. These are added to the lamp-service class, and the total length of these dead services aggregates 200 ft. (60.9 m.) and

NO. OF FEET OF 2" W. PIPE UNDER ASPHALT PAVING				NO. OF FEET OF 2" W. P. UNDER MACADAM PAVING				NO. OF FEET OF 2" W. P. UNDER DIRT				TOTAL NO. OF FEET OF 2" W. P. UNDER DIRT				NO. OF FEET OF PIPE UNDER DIRT				TOTAL NO. OF FEET OF PIPE UNDER DIRT				TOTAL NO. OF SERVICES															
SERVICES				5789.0				4657				4580				674				293714				362515				10440				522				5096			
DEAD SERVICES				22485				3190				2620				50				2111				18460				TOTAL NO. OF DEAD SERVICES, 1873											
LAMP SERVICES				2233				1476				1886				50				2111				18460				TOTAL NO. OF LAMP SERVICES, 520											
RISERS				13729				98				501				897				3987				18045				TOTAL NO. OF RISERS, 434											
SIZE				65								195								260				120				6											
4"				37								72				59				602				360				10											
WROUGHT IRON CONDUIT LAID DURING THE MONTH OF																																							
62 Services Laid												9 Service Poles Added																											
2 Services Removed												31 Dead Services Laid																											
573' 18"												31 Dead Services Laid																											
Total 333'												8 Dead Services Removed																											
Total 153'												2 Lamp Services Laid																											
Total 27'												2 Lamp Services Removed																											
Total 240'												81 Risers Removed																											
Total 118'												7-3 Risers Removed																											

FIG. 3—RECORD OF LIVE AND DEAD SERVICES

is divided as follows: 80 ft. (24.4 m.) in asphalt, 50 ft. (15.2 m.) in dirt and 70 ft. (21.3 m.) in macadam. This amount is transferred from the dead-service class to the lamp-service class.

On the other hand, if a dead service is extended to run into premises a similar transfer is made, but from the dead-service class into the house-service class. Or take

another class, such as risers. These risers connect the overhead with the underground distribution system by cables running through wrought-iron pipe which extend from the manhole to a pole and also up the pole. The number of risers on the pole depends upon the number of cables which are required at this particular part of the line to connect the underground with the overhead system. In this case it is assumed that the pole removed has had three risers on it. The risers are cut off at the butt of the pole, which leaves the remaining part of these wrought-iron pipes lying in the ground

connected to the manhole and terminating at the curb. These wrought-iron pipes are then placed in the dead-service class, and a transfer is made from the risers to dead service, with the exception of that portion of wrought-iron pipe which extends up the pole, which is removed from the sub-surface property inventory.

At some later date two of these three riser pipes, which are now classed as dead services, are put into operation again. On one there is a lamp-post set, and the other is extended to the consumer's premises where two or more transfers take place.

Commercial Department War-Time Measures

An Analysis of Labor Conditions as They Affect Central Stations in All Parts of the Country, of Economies Now Practiced, and of the Problems Involved in Business Extension

AN INCREASING interest in the steadily accumulating influences of the war upon the central station business is plainly evident. It is bringing up new problems from sources that, though apparently not affecting all utilities at present, will undoubtedly spread across the country long before the war has reached its end—unless good fortune sends peace sooner than military experts anticipate.

The effect of war conditions on the public service company creates a far more complicated crisis than in the case of an ordinary manufacturing or merchandising business. There as costs go up relief can as a rule be found immediately through increased prices. But the central station is denied that privilege in almost every state in the country, except by course of law through an appeal to the governing utility commission. It finds itself beset from two sides therefore—first by the tremendously increased expenses through the higher cost of almost everything that it must buy, and second by the loss of valuable and profitable employees to the national service—at just the time when logically all hands would be buckling down in a concerted effort to increase the revenue by harder work and in that way restore the balance between income and expense as far as possible.

It is plainly evident that the man whose temperamental tendency is to sit tight in times of stress and see what trouble is going to do to him cannot afford to try it now, because his growing costs will eat him up if he refuses to defend himself. On the other hand, the man who in the past has always met attacks by taking the offensive in his own hands with a campaign of creative business building finds that this time things are different, for not only are his forces depleted at the outset, but he must contend with the higher cost of line materials. Besides, indications generally are that his expenses will continue to climb higher. Furthermore, it is more than probable that new selective drafts will call out more and more of his young men into the National Army this year and next year and as the war progresses.

In the past other difficult problems have presented themselves, but generally the answer was to be found in the past experience of others. To-day there is no precedent. European utilities can offer little or no

help because of the distinct commercial and service differences. There is one way open, however, and that is in the wider dissemination of information regarding present practice wherever it is found.

With the aim, therefore, of laying the facts before the industry and making accessible the best suggestions which have been developed up to now, the ELECTRICAL WORLD has been in communication with a large number of central stations scattered widely throughout the country and in cities differing in both size and character and noted for their fruitful action in time of emergency. The results, while somewhat meager, are nevertheless stimulating and bring out two striking facts. First, there is a general agreement in theory that the way out lies, not in appeal for higher rates, but through a combination of practical measures of conservation both in operation and administration and an increased selling activity and effectiveness. But in almost direct contrast stands out the second fact—the actual. There seems to be a very widespread tendency as well to accept the higher expenses as inevitable, and for each man to look gratefully upon the fact that so far he has lost few employees and to hope that the industry will find the answer before the lightning strikes that town.

THE EAST AND THE WEST

Every manager who has expressed himself on this subject has shown keen interest, as was to be expected. But Eastern men have said, "It hasn't hit us yet, but we understand some of the Western companies have taken measures." Western men have made the self-same answer, and said that they would be most interested to hear what was happening in the East, "where things were more acute."

As a matter of fact, however, it is well known that the situation is in no way sectional. Expenses have gone up everywhere, and as the war proceeds the meter readers, bookkeepers, accountants, salesmen—men from every department—will be called out. If their places are not filled or their work done in some other manner, then the service will be limited and the income of the company affected. There can be no doubt of the result. Every effort is being bent to save through operation, and the results will loom large in the balance sheet, but

it is equally important that strict attention be paid to the commercial department. A real opportunity lies in taking on more good business, which means more good profits that will pay the war-time costs and maintain needed dividends. The time is ripe, therefore, for every manager to get into action and to whip into shape plans that will prevent even a partial paralysis of growing power, should he be forced to lend his most productive men to Uncle Sam at a time when costs may be still higher.

VARIOUS METHODS FOR ECONOMIZING

To effect these war economies and help swell the profits from present and added business in the present necessity, different companies have tried different things. In some places monthly meter readings and billing have been discontinued and a bi-monthly or tri-monthly system inaugurated, whereby one-half or one-third of the meters are read each month and billed. This brings immediate relief in these departments not only in releasing employees for other work but also in cutting down the billing expense materially. In other cases while each customer is still billed each month a change has been made to the continuous reading plan, which affords a measure of relief and economy. This system has been in operation for years in some cities. Along kindred lines, other companies have introduced appreciable economies by using post-card bills and thereby saving, in addition to labor and stationery, one cent on each postage stamp. Others have discontinued the return of receipts when bills are paid and begun delivering all bills by boy, making bills for all appliances sold an extra item on the monthly service bill, and in the case of combination companies, combining the gas and electric bills, a saving in each operation from the meter reading on. Others have arranged to have bills paid directly to the bank instead of the company's office.

These are all established practices, though many object to the post card and with some reason. All these measures are mentioned as being considered, however, quite generally as practical expedients. The question is how many man-days of labor and how many dollars can be saved thereby? Can one or two or more employees be shifted by this means from present work to assist in other places where the loss of men is going to bring an urgent need? Can expenses be reduced thereby? Those who are using them find the results practical and up to the needs of the moment.

Another point which many men have pointed out specifically as offering results is in the restriction of expenditures for all line extensions. In one city the company now pays no more than \$25 toward the cost of reaching any customer. In another the limit is fixed at \$20. In one place the burden of expense entirely is put on the customer for whom the line is run, but for every additional customer who is later taken on the line a refund is made.

A still different plan in successful operation on one system has been devised to divide equitably the cost between customers. Over a line extension, say, to four customers—A, B, C and D—each consumer is charged only with his share of the section of the line he uses. That is, A pays one-fourth the cost of the line between its beginning and his own transformer, because all four of them are using it. B pays his fourth of the line

as far as A's house, and one-third of the line from A to B; C pays a fourth to A, one-third from A to B, and also one-half from B to C, the section of the line which he shares with D only. D pays his fourth to A, his third from A to B, his half from B to C, and all the cost from C to D, which he alone is using.

The point is, however, that in these war times the central station is entirely within its rights in practicing a policy of conservation that puts the burden of extensions on the customer. It is clearly a vital issue and one that must be carefully thought out in each community. It is a necessary war measure, but necessitates the greatest tact and justice. One manager covers this phase of it graphically. He writes:

"Our efforts at curtailment in the running of extensions to connect up residences and lighting customers mean that a very considerable part of our time is taken up in refusing such applications and in explaining to the applicant why we are unable to serve him at the present time in such a manner as to make him feel satisfied with a postponement in obtaining service.

"As the number of such applications increases there is a constantly growing number of residents who want service and who have been refused, and naturally they get together and are inclined to become restless and more insistent. They are apt to get their alderman to come into the office with them, which of course makes it a still more difficult matter to turn them down gracefully, and unless they are closely watched a number of them frequently get together and send in a petition to the City Council. Again, such actions are apt to sow the seed which may lead to serious trouble, and as this situation is increasing daily, you will appreciate that a considerable amount of work is required of the salesmen in keeping track of this situation, neither allowing it to grow to proportions which may become serious nor spending money and using material for business which would be very unprofitable and undesirable at this time."

All this is negative, however—an effort to save money. The central station must not stop at conservation. What seems to be needed most is a big two-fisted effort to increase the revenue. This note is sounded from all quarters.

As a special war measure one Southern company has made a concentrated selling campaign to produce small power business and by co-operation with various manufacturers' agents has found new markets for coffee pulverizers and refiners, meat grinders, bone grinders, peanut-butter makers, washing machines, vacuum cleaners, electric carbonating machines, vulcanizers, churns and innumerable similar devices, and in the last three months has sold more coffee and meat grinders, for instance, than have ever been sold by it in a year heretofore. Other companies have set out to build up range sales, land big power "prospects," work out applications of electric heat—one cites the sale of baking and cooking units to restaurant and hotel kitchens—in short, to take hold of this problem in the spirit with which the nation has set to work to win the war.

MEETING THE DEPLETION OF THE STAFF

But it is at this point, of course, that the other horn of the dilemma must be met. What will he do whose staff has been reduced by loss of valuable men into the army? Many have met the urgency by employing

women either as direct substitutes or to relieve a bookkeeper, say, who can be turned into a salesman. No reports have been received of any company that has as yet begun to use women for reading meters, but many are known to be considering it. One company a year ago had nine men in the contract department. To-day all but two employed there are women, the service men having either joined the national forces or been needed more for other work that women could not do so readily. Another company expects to change to women collectors very soon and shift the men to other work. Its manager says, "We do not believe this will detract from the service, but on the other hand expect an actual benefit." And this manager counsels care in the selecting of employees in future to secure either men well below or over draft age or women of sufficient age and character to be settled in their tastes and habits and the kind to take real interest in their work and future progress with the company.

GROWING IMPORTANCE OF EMPLOYING WOMEN

So far the employment of women in the sales department has been general in appliance demonstrating, but many companies contemplate extending their activities to outside selling, though it will largely be experimental, they admit. Considerable confidence is expressed, however, based on actual experience in the bookkeeping, collection, credit, order and complaint departments. One man who has replaced thirty men with women in such capacities states that he has found it necessary to put on three women to care for each two men's work.

There seems to be no difficulty in securing women for this work. Several companies report applications on hand, though in Washington, D. C., it is almost impossible to secure any kind of help, since the government departments have been forced to offer such inducements to build up their fast-growing forces that the city has been swept almost clean of labor. So hard put to it has the local central station been that it has secured the services of the Boy Scouts to deliver bills after school. The boys will work in charge of a scoutmaster and in uniform—a touch of color which will not lack its value in publicity at the same time.

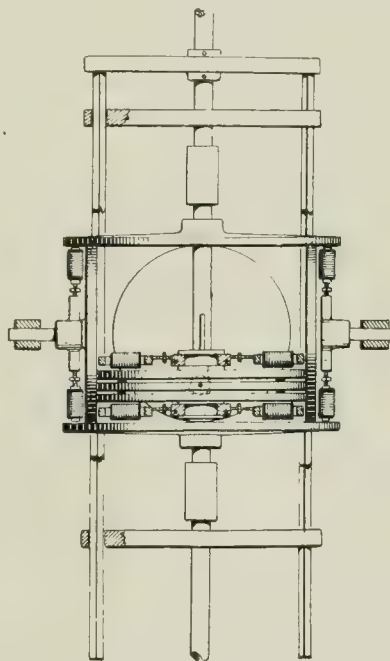
Then there is one more way to meet the emergency—one that several managers have cited as a most effective war measure and one that can easily be adopted. That is, off-peak, year-in-and-year-out business. One company reports an increased sales department that is doubling and tripling all former records for appliance sales. Another has by specializing on the kind of contracts that pay best cut down the cost of doing business quite materially. Another, with a smaller force, has bolstered up the "power to sell" until the department is producing 50 per cent more than before.

Also, in a large number of cases the basis of compensation has been changed from a straight salary to a bonus or commission plan for salesmen and collectors as a war measure to encourage greater sales and less delinquency, and other departments have been included through the fixing of a "bogie" of expense, the saving under which is to be divided on some basis to the interested employees. This has the simple purpose of imbuing the staff with the spirit of personal interest in this win-the-war effort, and it has proved a successful method.

In all, the problem resolves itself into saving wherever possible, particularly labor, and at the same time increasing service. A little paring here and a little saving there, a little more effort in this direction and a little more work in another, will undoubtedly accomplish the desired result.

Electromagnetic Friction Gear

An electromagnetic friction gear which has a differential interlocking arrangement allowing each wheel to turn at a speed proportionate to its respective distance from the driving disk has been patented by J. W. Murray of Moundsville, W. Va. The shaft to which the friction disks are keyed is connected to the driven shaft through a sleeve, permitting shaft, friction disks and electromagnets to be shifted with respect to the other disks making up the gear. This is accomplished by changing the radius of the disk at which they operate



ELECTROMAGNETIC FRICTION GEAR

through changing the relative speeds. As the friction wears the soft sleeve containing iron filings, the iron filings wear also, thus relieving the pressure from the magnet and at the same time maintaining a very short air gap.

A similar arrangement can be made using only two disks in contact with four disks. In this case there is a guider to support the magnets instead of rods. In each case, however, power is supplied by the shaft, on the end of which is a disk. This disk is forced against the four disks previously mentioned by magnets. The four disks are forced against the three frictions, differentially interlocked, by another set of similar electromagnets. The middle friction is keyed and is driven by the shaft as mentioned. The arrangement may be reversed—that is, the driving shaft may be the driven one and vice versa. Four disks are in contact with three frictions, giving twelve points in friction contact. The electromagnets are so located that the force supplied is equalized by the friction contact and none is brought to bear on a bearing.

CONVERTING A BREWERY INTO A REFRIGERATING PLANT

How the Steam Equipment of a Plant for Making Beer Was Utilized to Produce Ice and Cold Storage with Central Station Service

The Gottfried Brewing Company of Chicago, which until recently produced about 400 barrels of beer a day, made an arrangement whereby it consolidated its beer-producing business with that of another concern. This left the former brewing plant free to take up other business. Since the company had been in the ice-manufacturing business in a small way it was decided to expand operations in that time by operating the former brewery as an ice and cold-storage plant. The methods by which the company made use of much of its existing machinery are quite interesting, in view of the fact that brewers in states which have recently "gone dry" are casting about for some other profitable line of business in which their plants and property may be utilized.

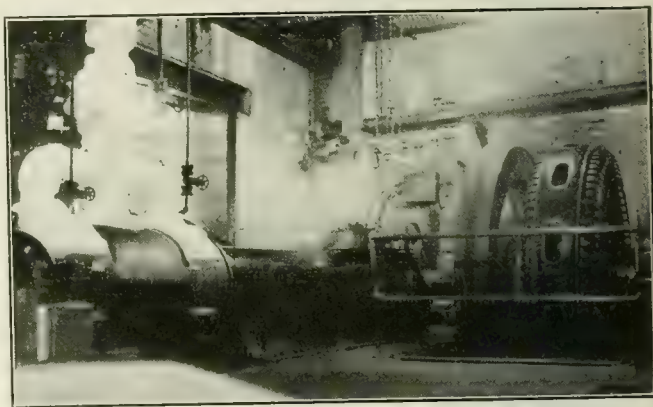
The steam plant in the brewery contained a battery of one 307-hp. and two 508-hp. boilers, furnishing steam for cooking and heating operations, as well as for operating machinery. The fact that steam was needed for these industrial heating processes prevented earlier purchase of central station service. With the need for these processes eliminated, the central station became immediately the most economical power source, in spite of the fact that the brewer's power plant machinery was comparatively new. The principal engine-room equipment consisted of two engine-driven generators and some old ammonia compressors. One engine was a 16-in. by 21-in. (46.6-cm. by 53.3-cm.) Lentz poppet-valve unit, rated at 250 hp. and operating at 200 r.p.m. This engine was operating at about 19 lb. (8.61 kg.) of steam per horsepower at full load. It was directly connected to a 200-kw., 240-volt, three-phase, 60-cycle General Electric alternator. The other generating unit consisted of a Lentz poppet-valve tandem-compound 13.5-in. by 23-in. by 21-in. (34.3-cm. by 58.4-cm. by 53.5 cm.) engine rated at 315 hp., directly connected to a Westinghouse 250-kva., 240-volt, three-phase, 60-cycle, 200-r.p.m. alternator. At full load it was developing a horsepower on about 13 lb. of steam. The 250-hp. unit had been installed in 1912, and the larger unit in 1913.

Broadly speaking, the change from steam to electric operation was accomplished by selling the boilers and the old compressors and converting the Lentz engines into compressors driven by the former alternators acting as synchronous motors. In addition to permitting the company to utilize much of its existing equipment, this method of changing also enabled it to begin active operations about one year sooner than it could have begun them if it had been forced to accept the commonly quoted deliveries on new equipment. The two engineering features which made the change feasible were the fact that the alternators could be converted into synchronous motors and the fact that high-speed compressors have now been developed for successful operation.

The change in the equipment was made by removing the steam cylinders bodily from the Lentz engines and replacing them with compressor cylinders. Both engines were fitted with compressor cylinders measuring 15 in. by 21 in. (38.1 cm. by 53.3 cm.). The stroke in each case, of course, remained the same, since no change

was made in the engine cranks or connecting rods. These compressor cylinders, when operating at rated speed of 200 r.p.m., will each have a rating of about 140 tons (127 t.) of refrigeration, which is the equivalent of about 90 tons (81.6 t.) of ice per day.

The changes in the electrical end were of somewhat more complicated character. The rotating fields were removed from the alternators and were fitted with "damper" windings to give a squirrel-cage effect at starting. For the 250-kva. Westinghouse machines half-voltage taps were brought out from a bank of three 200-kva., 12,000/220-volt, single-phase transformers served from the Commonwealth Edison system. These half-voltage taps and the full-voltage leads were connected to a three-pole, double-throw switch, so that 110 volts could be used for starting. Owing to the fact that the compressor cylinder is equipped with full-speed by-pass and that the flywheel is small, it is possible to start this machine with 110 volts and bring it near



ALTERNATOR OPERATING AS A SYNCHRONOUS MOTOR DRIVING
A COMPRESSOR MADE FROM A CONVERTED STEAM ENGINE

enough to synchronous speed so that the "throw-over" to the operating potential can be successfully made.

With the 200-kw. General Electric machine it was found that, on account of the larger engine flywheel, 110 volts would not be sufficient to start the compressor, even though it too is equipped with a full-speed by-pass. In order to determine what voltage was required to start it, arrangements were made to serve all 12,000-volt central station customers, except the Gottfried Brewing Company, temporarily from another direction. Then the potential on the brewing company's line was gradually raised at the Edison company's substation until it was learned that 150 volts would successfully accomplish the purpose. A compensator designed to give 150 volts at the machine terminals was therefore put in.

In addition to the overload and no-voltage release on the circuit breakers, the machine has been further protected against operating with one phase open by the installation of a new type of relay manufactured by the Associated Engineers' Company, Chicago. These relays are so connected that the opening of any phase at once trips the circuit breaker.

While the new compressors have not been connected on separate meters to give accurate data on their overall efficiency, indications are that the units will be able to produce refrigeration quite economically. The Gottfried Brewing Company is well pleased with their operation. The total connected load at the one-time brewery is now about 1000 hp.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

REMEDYING MOTOR-DRIVE TROUBLE IN RUBBER PLANT

Making a Synchronous Motor Work Satisfactorily After Poor Selection of Gearing Had Caused Trouble

In the plant of the Rubber Regeneration Company, Mishawaka, Ind., there was a rubber mill driven by a 450-hp., 60-cycle, 900-r.p.m., eight-pole synchronous motor. The driving pinion had sixteen teeth. When this machine was started instruments connected with the circuit showed that the load rose and fell in regular periods, increasing with each period until the circuit breaker would go out. It being impossible to operate the machine under those conditions, the synchronous motor manufacturer was called in. He diagnosed the trouble as a case of harmonic load building brought about by the fact that a sixteen-toothed pinion had been selected to run on a shaft driven by an eight-pole machine. The frequency of the motor and of the impulses to the driven machine being too nearly alike created a condition approximating resonance, and this being intensified by the irregularities on the pinion teeth caused the load to fluctuate and increase beyond bounds. The difficulty was finally solved by putting a small flywheel on the set to take up the load fluctuations.

SYNCHRONIZING WITH LAMPS

Demonstrations Indicate That Synchronizing Dark Is More Accurate Than Synchronizing Light

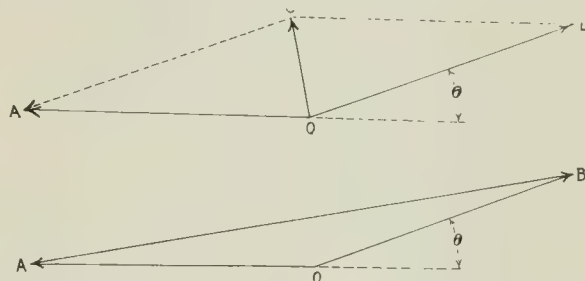
BY FRANK A. ROBBINS

The statement has often been made that synchronizing with lamps dark is not so accurate as synchronizing light, the reason given being that a lamp must have a considerable voltage impressed on it before it begins to glow and that a small reduction from normal voltage can be readily detected. In the writer's opinion the advocates of synchronizing light have evidently failed to consider the phase relations which are shown here-with by vector diagrams for the two cases.

In synchronizing dark the voltage across the lamps is the vector sum of the electromotive forces of the alternators. If OA is the electromotive force of one alternator and OB the electromotive force of the other, then OC is the voltage across the lamps (see Fig. 1). If the lamps are arranged for synchronizing light, the voltage across the lamps is the vector difference (not the vector sum) and may be represented by AB (see Fig. 2).

From Fig. 1 it may be noted that even for very small values of angle θ the line OC has considerable length. On the other hand, in Fig. 2 the angle θ must have considerable magnitude to cause AB to be appreciably shorter than OA plus OB .

Simple experiments show that the filament of a carbon lamp is barely luminous when 25 per cent of normal voltage is impressed on the lamp, and the filament of a tungsten lamp is barely luminous at 8 per cent of normal voltage. These values are for a well-lighted room. If the room is dark, the figures would be lower. With a carbon lamp there may be a decrease from normal voltage of about 3 per cent before the eye can detect it positively; 6 per cent is necessary with a tungsten lamp.



FIGS. 1 AND 2—VECTOR RELATIONS OF GENERATOR VOLTAGES AND POTENTIAL ACROSS LAMPS WHEN SYNCHRONIZING

Therefore if carbon lamps are used to synchronize dark, the smallest value of θ (Fig. 1) which may be detected may be found by letting OA and OB equal 100 units each and OC equal 2×25 units (since there would be two lamps in series). In this case the smallest angle would be 29 deg. If OC equals 2×8 units, the smallest angle that can be detected, using tungsten lamps, is $9\frac{1}{2}$ deg.

If carbon lamps are used to synchronize light, the smallest value of θ (Fig. 2) which may be detected may be found by letting OA and OB equal 100 units each and AB equal $2(100 - 3)$, in which case the angle would be 28 deg. If AB equals $2(100 - 6)$, the smallest angle that may be detected, using tungsten lamps, is 42 deg.

When the load on the system is not changing rapidly it is possible to get the machines so nearly in step that the lamps pass through a regularly recurring cycle. This makes it possible to split the dark period, which helps materially in synchronizing by the dark method.

To check the relative advantages of the two methods two machines were synchronized many times by each method. The error in synchronizing was noted by the throw of one of the generator ammeters and also by the position of a synchroscope needle at the instant of closing the switch. It was found that synchronizing dark is somewhat more accurate than synchronizing light when carbon lamps are used and decidedly more accurate when tungsten lamps are used. With the light method carbon lamps are best; with the dark, tungsten.

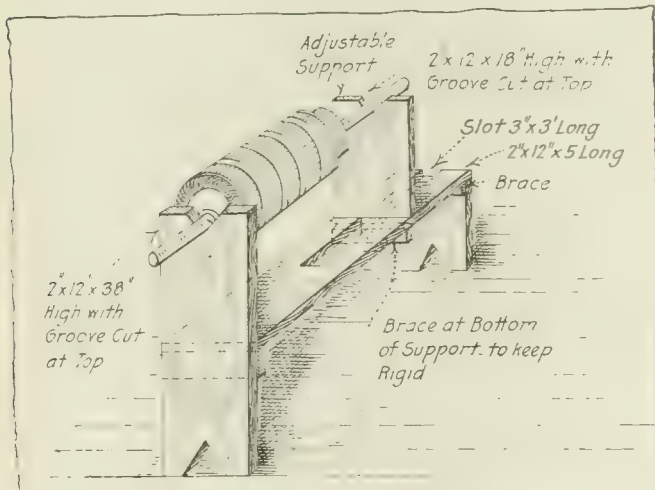
The method of synchronizing dark is opposed by some on the ground that the lamp might burn out during the process of synchronizing, thereby deceiving the operator, with serious results. This objection may be almost eliminated by putting two sets of lamps in parallel and so close together that they may be watched at once.

STAND DESIGNED FOR REWINDING ARMATURES

Rack Has One Adjustable Support Which Can Be Moved to Accommodate Armatures of Various Sizes

BY FRANK HUSKINSON

In the accompanying illustration is shown the detail of an armature stand that can be easily made and which will accommodate armatures ranging in length from



THE ADJUSTABLE SUPPORT PERMITS ACCOMMODATING ARMATURES OF DIFFERENT LENGTHS

2 ft. to 5 ft. (0.6 to 1.5 m.). One support is adjustable, being provided with a tongue which slides in a slot in the bench top. This support is self-sustaining as the lower part of the tongue is provided with a cross-piece which prevents the support toppling in case there is any thrust in the direction of the armature shaft. The material used in the stand consists of well-seasoned and planed lumber put together with lag-screws, bolts or nails as desired.

IRON PIPE AS MATERIAL FOR STATION BUSBARS

Experience Shows that for High-Tension Stations It Is Unnecessary to Use Expensive Copper Tubing to Obtain Successful Operation

For the last eighteen months the Central Illinois Public Service Company, Mattoon, Ill., has been using 0.5-in. (1.27-cm.) iron pipe in its indoor 33,000-volt substation for buses and drops to transformers and oil switches. Prior to this time the company had used 0.5-in. (1.27-cm.) copper tubing of iron-pipe size. When the price of copper increased, however, until it cost approximately 50 cents a foot (16.4 cents a meter), while iron pipe cost approximately 5.75 cents a foot (1.9 cents a meter), it was decided that it would be possible to use iron pipe.

While the iron pipe cannot be bent into the desired shapes quite so easily as copper tubing, it can be made to answer the purpose very nicely and can be bent if sufficient care is taken. The chief difficulty in bending the pipe comes from the fact that it tends to break at the seams. In order to give the iron pipe the appearance of a finished job and to permit the pipe to be more easily cleaned, it has been painted with a bronze

paint. This not only improves the appearance of the substation interior but also enables the station operator to clean the bus work with less trouble.

Up to the present time all of the iron-pipe installations on the lines of the Central Illinois Public Service Company have been in stations of comparatively small ratings. The largest of any of these stations consists of three 200-kva. transformers connected in delta. It has been the company's experience with installations up to that capacity, according to A. W. Mann, assistant electrical engineer, that iron pipe can be used with entire success on the 33,000-volt side of transformers.

METHOD OF PREVENTION OF CONCURRENT PEAKS

Large Ammeter Visible to Operators in Woodworking Plant Reduces Interruptions Caused by Overloading Motors

BY D. R. SHEARER

Sometimes a manufacturing plant will be found in which the connected motor load is greatly in excess of the plant generating capacity. When such a condition exists there is a possibility that the machinery may be subject to a concurrent peak which will stall the prime movers or in some other way mitigate against normal production. The voltage may drop to a point where the low-voltage releases trip out, thus stopping all the motors and introducing serious delays.

A case of this kind was called to the writer's attention some time ago in a woodworking plant operating a number of machines each subject to peak loads on heavy cuts. It was exceedingly difficult to get the operators to understand the seriousness of allowing a peak to occur on several machines at the same time, and such a condition actually occurred once or twice each day. Each time this happened the manufacturer lost several dollars, so it was determined if possible to obviate the trouble. The blame could never be placed on any one man, and thus it was not feasible to get the desired result through discipline.

The trouble was corrected by placing a large ammeter in plain view of the operators of three of the largest machines. On the ammeter dial, which was printed in large figures and well illuminated, was placed a danger mark, and the operators were instructed never to allow the load to run the pointer above this mark. Since the entire motor load was indicated on this instrument, it was not subject to violent fluctuations, but remained very steady until several machines began to take heavy cuts at the same time, when the pointer gradually moved up toward the danger mark.

There was some fear that the use of this ammeter would curtail production, but this proved not to be the case. In fact, the production was increased, for not only were delays from overloads obviated but the load factor was improved. This is explained by the fact that the men could see when the load was dropping and so could increase the feeding proportionately.

It is possible that the use of an ammeter might be of considerable benefit even in those plants having abundant power by tending to better the load factor and consequently the production of all the machines. If a minimum point as well as a maximum were indicated on the dial and the entire plant load indicated on

the meter, it would appear that great gains in economy might be expected with attendant increase of production simply from the efforts of all the operators to keep the needle in its restricted space on the scale.

TESTING THE LOADS ON DISTRIBUTION TRANSFORMERS

Tests Are Made to Determine Total Load, Phase Balance and Location of Transformer with Regard to Its Load Center

A transformer testing outfit that consists of a split-type current transformer with two windings connected to a low reading ammeter with a 48-ft. (14.6-m.) duplex stage cord is used by the Portland Railway, Light & Power Company of Portland, Ore. Two scales, one for each winding, were calibrated with standard instruments. The low scale has a range of from 5 amp. to 40 amp. and the high scale from 45 amp. to 150 amp. A two-point dial switch mounted on the side of the current transformer is used for changing scales. The contact bar on this switch touches one button before leaving the other, so that in changing from one scale to the other the circuit is not opened.

All testing is done on the secondary side of the transformers, generally in the outside legs only, and in each direction from the transformer. In this way the total load on the transformer is obtained. The conditions of balance between the two sides of the line are shown and also how near the transformer is to its center of load.

In using this outfit it is, of course, necessary to test at night when the peak load is on. It has been found that during the winter months tests could be made over a period of three hours and still be very close to the peak. Two men with a Ford compose the testing crew. One of the men is a lineman, who climbs the pole and clamps the current transformer around the wires, and the other is a tester, who records the readings and directs the work. If the transformers are not too badly scattered, from ten to fifteen can be tested a night.

In addition to testing transformers, this outfit is frequently used to test motors and also to test the current in 2400-volt circuits to determine how the current in the three phases was balanced up and to determine the load on a branch circuit. This scheme was brought out by W. C. Heston and R. E. Thatcher at the recent annual meeting of the Northwest Electric Light and Power Association, Spokane, Wash.

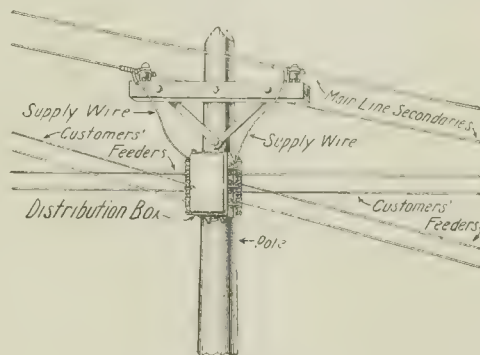
IMPROVING APPEARANCE OF DISTRIBUTION LINES

Illinois Company Is Using Panelboard in Cast-Iron Boxes in Order to Insure Construction of a Neater Character

In many cases electric service companies distribute energy for several residences from the same pole, four houses being easily served in such manner under average conditions. In thickly populated districts six, and sometimes eight or more, customers may be supplied from one pole.

Until recently there has been no appliance on the market from which these service wires could be distributed suitably, and the general practice was to use an

ordinary pole and cross-arm, as shown in the illustration. On distribution lines of this type it was necessary that the wires should be soldered and taped to the main line and that they should be extended from the pole in several different directions. The usual effect was that the taps were unsightly, and unless work was carefully handled the result was a conglomeration of cross-connected leads, difficult to maintain and incapable of giving satisfactory service. To disconnect a customer's service, when the meter was removed, it was



FOUR SERVICES RADIATING FROM ONE POLE

necessary to cut the service wire and fasten it to some rigid point temporarily. A reconnection necessitated sending a lineman to solder the joint again, which in itself usually added to the unsightliness of the work.

On the lines of the Canton (Ill.) Gas & Electric Company use has been made of a distribution box to give a neater and more satisfactory installation. The box, which is made by the Canton Specialty Company, is placed beneath the main-line cross-arm, and taps from the main line are connected to busbars mounted on a slate panel in the cast-iron box. The service leads are attached to the distribution racks on the side of the box, and enough wire is left on the end of the line to extend through a porcelain thimble to a lug connected with the busbars inside the box. This permits connections and disconnections to be made with a screwdriver, instead of with solder and tape, which not only decreases the time necessary for making connections but also enhances the appearance of the line.

REPLACING GLASS OIL GAGES

Brass Pipe with Small Opening Used to Eliminate Danger of Shut-down

Large generator bearings and other machine bearings made several years ago with exposed and unprotected gage glasses to show oil level constantly invite danger of shut-down owing to breakage of these gage glasses and consequently a burned-up bearing. There is little advantage in having an 8-in. or 10-in. (20.3-cm. or 25.4-cm.) glass to show the level of oil. A brass pipe having a small opening at one side of the proper oil level, with a short piece of gage glass cemented or puttied inside the pipe at the opening, is preferable. This will show the correct height of oil to be carried and will eliminate the danger of a cracked glass causing trouble. This idea was brought out by O. N. Wiswell of the Puget Sound Traction, Light & Power Company, Seattle, Wash., at the tenth annual meeting of the Northwest Electric Light and Power Association at Spokane.

CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

LIGHTING COMPANY STOPS PERIODIC LAMP RENEWALS

Study of Existing Conditions Showed that Only About 30 Per Cent of Customers Took Advantage of Periodic System Last Year

Another large company in the East, this time the Boston Edison company, has made a change in its free lamp-renewal policy. The Boston company has gone as far as to discontinue entirely the periodic deliveries and will now deliver only on request. Under the old system, which the company has gradually been discontinuing for some time, a lamp-delivery wagon called at regular intervals to renew worn-out units.

A careful study has been made of the old system, and the results showed what was felt to be a very unsatisfactory number of customers taking advantage thereof. The percentage of customers using the periodic system was found to run as low as 17 in some districts, and for the last year has averaged around 30 per cent for the entire territory covered by the system. It was found that the failure to make exchanges was owing partly to premises being closed, partly to indifference on the part of customers or their representatives. The accompanying waste in time, expense and labor was therefore very apparent.

For this reason the old method has given way to the new, which may work in one of three ways: (1) The customer may on presentation of the old lamps at any one of the company's stores or other places designated receive in exchange as before new lamps; (2) the customer may by telephoning or upon written order, definitely stating the number, size and type of lamps desired, receive the lamps by special automobile delivery service and the old lamps will be collected upon delivery of the new, or (3) if the orders are scattered or the places far away, the new lamps will be sent by special delivery or parcel post, in which case the old lamps will be collected later by the company.

The special delivery service has been in vogue for the last four years or more in certain districts and has

the customers feel that they are having better and more direct attention than under the periodic system.

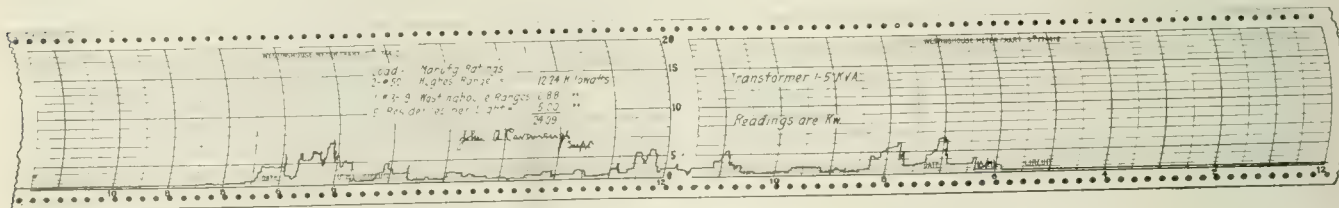
In making the change-over from the old to new system each customer served under the periodic system was notified by a circular letter how renewals could be made hereafter. With each letter there was inclosed an addressed post card for the customer's convenience and use in placing a written order for lamp renewals. There was also inclosed a folder descriptive of the different types and sizes of lamps furnished by the company to facilitate a customer in definitely stating his requirements. With each special delivery package the company incloses an addressed post card, as explained, for the customer's convenience in placing his next order.

DISTRIBUTION TRANSFORMER CARRIES LARGE RANGE LOAD

Five Residences, Including Three Cooking Installations, with a Total Connected Load of 24.09 Kw., Are Served from 5-Kw. Transformer

An investigation of the relation between the connected load and the demand, conducted by John A. Cavanaugh, superintendent of light and power for the Benton Harbor (Mich.) & St. Joe Railway & Light Company, shows that unexpectedly large residential loads may be safely connected to ordinary distribution transformers. At one point on the system of the company five residences are served from a single 5-kw. transformer. The total connected lighting load in the three residences amounts to 5 kw. In addition to this, three families of the five have electric ranges. Two of these are rated at 6.12 kw. each and one is rated at 6.85 kw. This makes a total connected load on the 5-kw. transformer of 24.09 kw.

A load curve taken on Wednesday, Aug. 29, by a graphic meter placed near this transformer is reproduced herewith. It represents the typical condition which exists during most days of the week on the cir-



GRAPHIC INSTRUMENT CHART COVERING A PERIOD OF TWENTY-FOUR HOURS

been found to be generally satisfactory. Under this system a lamp renewal order might stand from a minimum of one day to a maximum of six days, making an average of three to four days before delivery.

The experience of the company shows that under the special delivery system the effective calls average about 80 per cent, and consequently it is of the opinion that

cuit. On the day when this chart was taken a special inquiry was made to be sure that all families were actually cooking on that day. As may be seen from the chart, the peak load on the circuit is somewhat less than 7.5 kw. While this throws 50 per cent overload on the transformer, the duration of the overload is usually less than fifteen minutes except in the evening.

when the transformer carries an overload ranging from 10 per cent to 50 per cent for about forty-five minutes. A study of the load curve indicates clearly the difference in the habits of the families, which leads to the high diversity factor.

AN ANALYSIS OF CENTRAL STATION SELLING POLICY

Specialty Manufacturer Presents Arguments for Aggressive Appliance Campaigns and Is Answered by Utility Sales Manager

Walter E. Ott, district sales manager for the Eureka Cleaner Company, in a paper presented before the commercial men of the Ohio Electric Light Association at Cincinnati, Oct. 10, divided central station selling policies into three groups for analysis. The first group—stations which operate no appliance department—were characterized as thorns in the side of specialty manufacturers. Their lack of direct activity and the apparent apathy of local contractor-dealers deprive the manufacturers of the volume of output they desire in that particular city. New Haven, Bridgeport, Springfield, Mass., Omaha, St. Paul and Dayton were cited as cities in this class which by reason of the central station's inactivity in appliance sales have fewer appliances on their lines than other cities of the same size. People must be made to desire specialties, the speaker argued; therefore electrical appliance sales must be actively promoted.

The second group of stations considered were those which do sell appliances from their stores but do not conduct campaigns featuring goods of some particular manufacturer. Mr. Ott's analysis of this type of company's business is as follows:

The situation arising is that salesmen of the competitive manufacturers who have their goods on display in the appliance department oftentimes place the central station management in a regrettable position.

We will say that the salesman in the appliance room has just had a talk with a prospective purchaser of a vacuum cleaner. He has shown the various makes on display, yet has favored no particular one, admitting to the customer that they are all good, and, as a matter of fact, stating that one is as good as another. Inasmuch as the salesman has not favored any particular one, the customer is generally "up a tree" as to which is to be preferred. We will say that two particular makes are sent out for trial by the customer, which is a case that often happens. Here the salesmen for the competitive manufacturers enter in, and in a few moments one salesman quickly convinces the customer that his cleaner is so far superior to the other that there is no comparison, and for his efforts he is given the order.

The situation resulting is that the customer comes to the conclusion that very little reliance can be placed in the salesman on the floor of the appliance room, and that in reality there was absolutely no truth in his remark that one was as good as the other.

This policy of not favoring any particular manufacturer in so far as his merchandise is concerned, even though such articles may be far superior both in quality and workmanship to a competitive manufacturer's goods, naturally handicaps the manager of the appliance department in his efforts to increase his appliance business, for the most forceful manner of bringing electrical appliances before the public attention is by what I would call the feature idea. It is solid, logical argument that convinces the public you have something to offer it which is worth while considering before investing in appliances sold by competitive dealers.

From this standpoint it certainly seems advisable for ap-

pliance managers to investigate the fields of different electrical devices and, after adopting or accepting particular makes as the best that can be had at the money, to place them before the public and put behind them all the push and energy that the central stations command.

Giving the public logical argument which becomes all the more forceful and convincing as the salesman hammers strongly on the merits of the article the customer is interested in produces a natural tendency for the prospective purchaser to buy more quickly and to feel better satisfied with his purchase. Moreover, that purchaser in talking to friends causes the argument started by the salesman to keep on the move, and more returns naturally come to the coffers of the appliance department.

The third group of companies to which Mr. Ott referred includes those which by aggressive sales methods endeavor to operate a wide-awake appliance department at a profit in the face of competition. He mentions as examples the Consolidated Gas, Electric Light & Power Company of Baltimore and the Toledo (Ohio) Railways & Light Company. Their policy Mr. Ott heartily indorsed as follows:

Central stations should support and encourage aggressive selling policies. Appliance department managers should profit by the results obtained with the working out of definite selling schemes as illustrated by these two central stations. I urge that they proceed to build up definite sales organizations in the field. I further urge them to resort to catchy and attractive window displays to vary the advertising and make it effective. The latter, to become effective, must be got up bearing in mind that electrical appliances are specialties and not staple goods. To hire and discharge men, as well as to have them resign of their own accord, is expensive. Therefore encourage good men and pay them better. Arrange a scale of commissions for the men in the field; handle honest merchandise, offering it at the most attractive prices; school your salesmen in the respective merits of various articles, and above all things in how to close sales. If central stations with their prestige and capital as a basis will only combine with these initiative, aggression and specialty business principles, I feel that they will see their appliance business grow by leaps and bounds."

AN OPPOSITE POINT OF VIEW

George E. Miller, sales manager of the Cleveland (Ohio) Electric Illuminating Company, in discussing Mr. Ott's paper, said his company had tried selling appliances and had given it up, preferring to devote its energies to the manufacture and sale of electricity and to permit contractor-dealers to do the merchandising business. "Nothing could induce us to change back to the old plan," said Mr. Miller. "We are working in harmony with the electrical merchants and are getting their good will. Moreover, there are now six stores in Cleveland which are carrying stocks larger than we should carry if we were in the retail appliance and wiring business. These firms really have 150 sales representatives that are working for us. This gives an outlet for a greater volume of goods than the company could move. The quality of all electrical goods sold may not be so high as it would be if all were sold from a central source, but the majority of appliances on the market to-day are of fairly high quality."

Mr. Miller also pointed out the manner in which a central station's merchandising activities are likely to be reflected upon the company to its disadvantage. The electric light company when it has a franchise to make and sell electricity possesses a monopoly in the community. If it then enters into the merchandising business, it becomes a competitor of the merchants who have sanctioned the monopoly. Furthermore, if the company conducts cut-price campaigns and de-

ferred-payment sales, the merchants will begin to realize that it is using the strong position its huge capital affords in a kind of competition which they themselves cannot meet on limited capital.

Merchants who compete with the company will naturally deem this unfair, and if they are clear thinkers will attempt to revoke the monopoly privileges which make the unfair competition possible. Mr. Miller concluded by asserting that he had heard merchants seriously discussing this phase of central station merchandising activities, and advised central stations to take this growing sentiment into account.

ADVERTISING SERVICE AT
FAIRS AND EXHIBITIONS

Miniature Mechanical Map of System Recommended
as Effective Method by Utility in Small
Indiana Community

The Indiana Railways & Light Company, Kokomo, Ind., a city of 17,000 or more inhabitants, at Kokomo's fourth annual industrial exposition, filled its booth with a mechanical map 7 ft. wide by 11 ft. long (2.1 m. by 3.3 m.). The miniature cars, nine in number, were moved by means of a motor-driven mechanical device beneath the map, so that the cars traveled from Frankfort on the left to Kokomo at the center, to Marion on the right and then back again, representing the travel of the company's interurban trolley cars. The miniature lamps with poles, lines, etc., connected to a battery circuit represented the company's transmission and distribution system into the neighboring towns.

The purpose of the display was to show the extent of the company's system and at the same time to advertise its railway, power and lighting service. On a



MAP OF LIGHTING, POWER AND RAILWAY SYSTEM OF AN
INDIANA COMPANY

small chart at the rear of the exhibit were given the names of the towns on the company's lines, together with the number of customers in each, the amount of industrial horsepower connected and the number of passengers hauled on the railway system. The total attendance at the exhibit was between 50,000 and 55,000. O. M. Booher, manager of the commercial de-

partment of the Kokomo company, recommends this plan of advertising for any company which takes a booth at a state fair, county fair or local industrial exhibition, being of the opinion that the results derived are equal if not superior to those that could be obtained by any other kind of exhibit.

CUSTOMER'S METER TAG
FOR CONTINUOUS RECORD

Method Whereby Readings for Four Years Can Be
Kept as Insurance Against Loss of
Records by Utility

Following a fire which destroyed all of the records of a neighbor company, the Bloomington & Normal (Ill.) Railway & Light Company worked out a plan to keep

Meter No.

BLOOMINGTON & NORMAL RY. & LIGHT CO.

BLOOMINGTON, ILLINOIS

YOUR METER READS,

DATE	INDEX	DATE	INDEX
1917		1918	
Jan.		Jan.	
Feb.		Feb.	
Mch.		Mch.	
Apr.		Apr.	
May		May	
June		June	
July		July	
Aug.		Aug.	
Sept.		Sept.	
Oct.		Oct.	
Nov.		Nov.	
Dec.		Dec.	

CONVENIENT TAG FOR CUSTOMERS' METERS, SHOWING READINGS FOR FOUR YEARS

from ever getting in the same predicament. The scheme consists of keeping on each customer's meter a tag as shown, bearing the meter number and having space on each side for monthly readings for two years. A complete record of monthly readings over a period of four years is thus contained on this tag. The scheme has the further advantage of permitting the customer to check up his bills at any time he doubts the accuracy of the company's bills. With this plan in effect there is a duplicate record of customer's energy consumption in the company's office and on the customer's premises, and destruction of the office records could therefore occasion no loss of revenue.

The fire in the premises of the neighbor company which set the Bloomington company thinking caused a loss of revenue of \$5,000, and the company was fortunate that the sum it lost was no larger. In view of this fact the Bloomington company believes the cost of a single tag for each meter to be a low insurance premium against entire loss of its energy sales records, with all the confusion and inevitable loss of income that such a loss must necessarily entail upon any public service company undergoing it.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

APPROXIMATING THE CURRENT RATINGS IN D.-C. BALANCERS

Notes and Formulas Which Provide Information Designed to Facilitate Handling Estimates for This Type of Machine

IN THE Sept. 28 issue of the London *Electrical Review* there is an article which gives information on approximating the maximum current rating of each machine composing a three-wire balancer set where the balancing unit is also required to act as prime mover to a pair of booster dynamos. When the boosters of a balancer-booster set are to give an output calling for a motoring current exceeding the out-of-balance current in the middle wire, both machines forming the balancing unit will operate as motors and will take between them all the current called for by such conditions from the busbars, the motor connected across the heavily loaded side of the system taking half the difference between the middle wire and booster-motoring currents, and the other balancer machine taking half the sum of the mid-wire and booster-motoring currents.

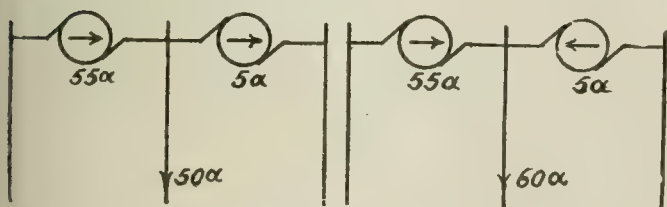
When the out-of-balance amperes in the middle wire exceed the booster driving current, the balancer machine on the more heavily loaded side will act as a generating unit, giving a current rather less than half the difference between the out-of-balance and booster-motoring currents, and the other balancer machine will work as a motor, taking rather more than half the sum of the out-of-balance amperes and the driving current called for by the boosters.

The two machines forming the balancing unit will, of course, as in the case of the plain balancer arrangements, be identical, each being liable to act in its maximum current capacity, according to the specified conditions of out-of-balance and booster loads.

Neglecting balancer difficulty, the current values are—

$$C_n = (C_b + C_m)/2,$$

$$C_o = (C_b - C_m)/2, \text{ or } (C_m - C_b)/2.$$



FIGS. 1 AND 2—CONDITION OF CURRENTS AS REFERRED TO IN THE TEXT OF THE ARTICLE

These are actual values when C_b is greater than C_m , under which conditions both sides of the balancer are motoring, but when C_m is greater than C_b , the actual current values are:

$$C_n = (100C_m + C_bE)/(100 + E),$$

$$C_o = (C_m - C_b)E/(100 + E),$$

when—

C_n = amperes in balancer machine on normally loaded side of neutral wire;

C_o = amperes in balancer on overloaded side of neutral wire;

C_b = motoring amperes in balancer absorbed by booster load;

C_m = out-of-balance amperes in neutral wire, and

E = efficiency of balancer $(100C_o/C_n - C_b)$.

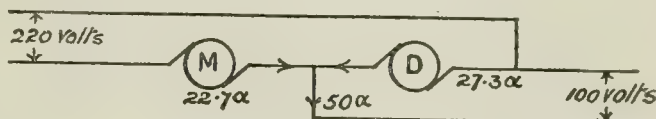


FIG. 3—BALANCER PRINCIPLE AS EMPLOYED IN MOTOR-GENERATOR VOLTAGE REDUCER SET

The value of C_b is, of course, $W_b/E_bE_mV_m/0.0001$, when:

W_b = watts output of boosters;

E_b = per cent booster efficiency;

E_m = per cent balancer motor efficiency, and

V_m = voltage across balancer motor,

and may be taken as approximately 5 amp. to 6 amp. per kilowatt of booster output when the voltage either way of the middle wire is, say, 220; thus the motoring current in a balancer working across a 440-volt, three-wire system will be for a booster load of 10 kw. about 50 amp. to 60 amp.

When the middle-wire and booster-motoring currents are respectively, say, 50 amp. and 60 amp., the currents in the balancer will be as shown in Fig. 1, and, neglecting efficiency, the same current values exist with an out-of-balance of 60 amp. and a booster-motoring current of 50 amp., the machine on the side carrying the out-of-balance load in this case acting as a dynamo, as shown in Fig. 2.

When the balancer principle is employed in motor-generator or auto-converter voltage reducer sets, as shown in the diagram in Fig. 3, in which system of connection the secondary current is the sum of the motor and generator amperes, the input current through the motor from the high-voltage side will be:

$C_m - 100 C_s V_d V_p E_c$, or $100 C_s V_d / (100 V_d + V_m E)$, and the amperes given to the secondary circuit by the generator will be:

$C_d = C_s (1 - 100 V_d V_p E_c)$, or $C_s V_m E / (100 V_d + V_m E)$, when—

C_m = amperes in motor;

C_d = amperes in dynamo;

V_m = volts across motor;

V_d = volts across dynamo;

V_p = primary supply voltage $(V_m + V_d)$;

C_s = secondary current $(C_m + C_d)$;

E = combined machine efficiency $(100C_d V_d C_m V_m)$, and

E_c = conversion efficiency $(100C_s V_d / C_m V_p)$.

Neglecting efficiency, it will be seen that the current

through the motor equals $C_s V_d / V_p$ and that the dynamo current is $C_s V_m / V_p$; thus, in the case of a motor-generator working off a 220-volt supply and giving out 50 amp. at 100 volts, the machine currents will be as shown in Fig. 3. And if a combined machine efficiency of 70 per cent is assumed, the motor current will be:

$$\frac{100 \times 50 \times 100}{(100 \times 100) + (120 \times 70)} = 27.2 \text{ amp.}$$

and the dynamo current will be:

$$\frac{50 \times 120 \times 70}{(100 \times 100) + (120 \times 70)} = 22.8 \text{ amp.}$$

It will be found that the actual commercial efficiency—i.e., the efficiency of conversion—works out in the example taken as 83½ per cent.

The balancer system of connection of course offers an advantage only when the voltage reduction ratio is a low one (the advantage being that smaller machines may be used than with the ordinary arrangement of motor-generator having independent high and low voltage circuits), as on the higher ratios of voltage the conversion efficiency is low and the current supplied through the motor to the secondary circuit is too small to be of any value.

Generation, Transmission and Distribution

Modernization of Stuart Street Plant, Manchester.—Owing to the unusual growth of industrial load in Manchester, England, and the necessity of increased fuel economy the Stuart Street plant has been remodeled extensively. The reciprocating engines are giving way to turbines rated as high as 25,000 kw., larger and more modern boilers combined with economizers are being substituted for the old ones, additional coal-handling equipment is being provided, the condensing facilities are being amplified, and the switch gear and busbars are being remodeled. Four of the boilers ordered for this plant are rated at 100,000 lb. (45,359 kg.) per hour, probably the largest contemplated in England, and are single-ended and fitted with both forced and induced draft. Each will have 16 sq. ft. (1.5 sq.m.) of grate area, 14,000 sq. ft. (1288 sq.m.) of heating surface, 7500 sq. ft. (697 sq.m.) of economizer surface, and 5145 sq. ft. (48.3 sq.m.) of superheater surface. Jet condensers are being used for some of the units, but owing to the scarcity of cooling water, surface condensers with cooling towers and tank storage are being used for the others. These will be supplemented by new natural and fan draft towers. Large-capacity switches are being installed throughout and the busbars are being sectionalized with reactors.—*London Engineering*, Sept. 7, 1917.

Installations, Systems and Appliances

Dissimilar Transformers in Delta.—J. B. GIBBS.—Formulas giving division of current between banked transformers having different characteristics.—*Electric Journal*, September, 1917.

Mercury Rectifiers for Large Outputs.—S. M. POWELL.—Description of iron-clad rectifier and comments on the operations of several commercial installations of this type of equipment.—*London Elec. Review*, Aug. 31, 1917.

Electric Furnace for Brass Melting.—T. F. BAILY.—Description of a resistance-type furnace for melting brass and bronze. The furnace is of the non-crucible

type and operates on the true resistance principle. The resistance element is contained in a circular trough made of a refractory material similar to carborundum fire sand. In this refractory trough the resistance material, composed of broken carbon, is placed, forming contact with the electrodes, which are placed diametrically opposite each other with their ends protruding into the circular trough. The control of the current, and hence of the furnace temperature and melting capacity, is by means of suitable voltage taps brought out from the secondary of a special transformer supplied with each furnace. Running tests were given of melting bronze and brass, with mechanical tests of the cartridge brass produced and numerous analyses showing the uniformity of the metal at the beginning and end of the cast. The electrical power required shows favorable comparison of melting costs with crucible or open-flame melting furnaces, the average being 450 kw.-hr. per short ton of bearing bronze (495 per metric ton), and 311 kw.-hr. per short ton of cartridge brass (342 per metric ton).—*Met. and Chem. Eng'g*, Oct. 15, 1917, report of meeting of A. E. S.

Electrophysics and Magnetism

Pure Alloys for Magnetic Purposes.—TRYGVE D. YENSEN.—Reasons why pure iron and iron containing elements which do not separate its crystals from each other have great magnetic permeability and low hysteresis losses. Ordinary and vacuum electric furnaces for making the alloys at temperatures up to 1800 deg. C. were also described; also annealing furnaces for heat treatment of the alloys produced.—*Met. and Chem. Eng'g*, Oct. 15, 1917, report of meeting of A. E. S.

Electrochemistry and Batteries

Electrochemical Gasoline.—LOUIS B. CHERRY.—Description of experiments to make gasoline synthetically by electrochemical or electrothermal means. It was predicted that aromatic hydrocarbons such as benzol and toluol (which are in such great demand at present for the manufacture of dyes and explosives) will be made by some modification of the process described.—*Met. and Chem. Eng'g*, Oct. 15, 1917, report of meeting of A. E. S.

Electrolytic Method of Obtaining Solid Iodine from Solution.—L. PISARSHEVSKI and S. TJELNI.—In this article the authors give a description of certain preliminary attempts to devise a method of separating iodine electrically from solutions containing iodides, bromides and chlorides. Lead electrodes or a lead anode and a carbon cathode give good results. The lead anode becomes coated with a thin layer of lead iodide, which prevents further combination with the iodine, the latter being deposited in a crystalline crust to remove.—Abstracted from *Transactions of Russian Phys. Chem. Soc.*, J. 47, 1915, in *Science Abstracts*, Section A, Aug. 30, 1917.

Lithium in Storage Batteries.—L. C. TURNOCK.—Description of an investigation made to determine the magnitude of the effect of various additions of lithium hydrate to the potassium hydrate electrolyte of the Edison storage battery. Comparative tests of capacity of Edison storage batteries were made with 0, 10, 20, 30, 40 and 50 grams per liter of lithium hydrate added to the usual 21 per cent caustic potash electrolyte. Test runs showed increased capacity up to 12

per cent with the largest amount of lithium hydrate, in spite of the fact that the addition increased the electrical resistance of the electrolyte 21 per cent.—*Met. and Chem. Eng'g*, Oct. 15, 1917, report of meeting of A. E. S.

Units, Measurements and Instruments

Cross-Current Predeterminations from Crank-Effort Diagrams.—LOUIS ILLMER.—On the basis of principles discussed in this paper, it was concluded that when two alternators are thrown into parallel the resulting cross-current flow, as measured by means of ammeters, will be largely independent of the wheel weight used, except in so far as this weight may influence the character of the regulation rendered by the governor. The difficulty that may be involved in the use of a light flywheel resides in the detrimental secondary effects

that may arise. When the ratio of $\beta_o/\beta_x \left(= \sqrt{\frac{s_o}{\pi k} s_a} \right)$

(where k is a coefficient depending on the impulses per revolution and s_a/s_o is the ratio of cross-current pull to

ing coils and like devices may be able to exert upon the cumulative armature oscillations. The purpose of the present investigation was simply to find the most favorable inherent conditions when operating without compensating adjuncts of any kind. The formulas given are further conditioned upon identical constructive characteristics for all the paralleled engine and generator units. Any important difference in this respect may involve a considerable increase in the minimum expected cross-current flow as fixed by the given formulas. Finally, attention is called to the need of properly selecting the coefficient of speed fluctuation for the engine governor. The extent to which the primary speed coefficient may be increased by the cumulative displacements arising in paralleled engine units is indicated by the ratio of s_x/s_o . The governor characteristics should be such that this increased "factor of irregularity" will not throw the governor gear into resonant oscillation with the cumulative wheel period. The use of additional wheel weight is able to effect an important change in the period of the cumulative wheel swing, and this in turn may make it far easier to meet the governing requirements. On the whole, therefore, it may be concluded that owing to the beneficial secondary effects the most satisfactory results in the parallel operation of reciprocating engine units are to be attained by the use of reasonably heavy flywheels, as prescribed. In the foregoing discussion α_o = mean angular displacement lead of the armature as measured in electrical radians; α_x = angular displacement shift of the armature as measured with respect to mean lead position α_o ; $s_x = \alpha_x R$ = arc length in feet, corresponding to the armature-displacement shift angle α_x , and s_o = the maximum linear displacement or amplitude of oscillation (in feet).—*Journal of A. S. M. E.*, October, 1917.

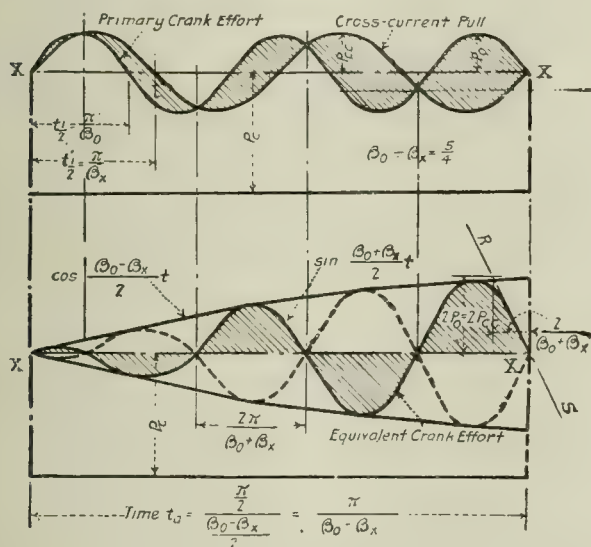


FIG. 4—CONDITIONS LIABLE TO EXIST WITH LIGHT FLYWHEELS THAT CAUSE EXCESSIVE CROSS-CURRENTS

mean crankpin force) is less than $7/2$, as is likely to be the case when using a light wheel, the oscillatory peak movement indicated in Fig. 4 becomes about twice as large as would be produced by the use of a heavy wheel. This difference in maximum angular displacement shift may become so marked that the armature working with a relatively light wheel may be thrown far over into the negative or motor position. Such excessive shift in the armature displacement may readily create serious electrical disturbance, for should the angle α_x plus α_o at any time exceed $\pi/2$ electrical radians, i.e., one-half pole pitch, the parallel generators would immediately fall out of step. The best results in parallel operation may therefore be expected when the ratio β_o/β_x is kept as high as 6 or possibly 8. This condition is more readily complied with in the smaller short-stroke engines running at a relatively high speed. However, in order to avoid excessively heavy wheels for the long-stroke, slow-speed engines, it is found advisable to keep the wheel weight in a constant relation to the engine output. The foregoing deductions do not take into account any beneficial effects which dampen-

Telegraphy, Telephony and Signals

Contribution of French Engineers to Long-Distance Telephony with Underground Cables.—DEVAUX-CHARBONNEL.—An account of the work of Vaschy and Barbat in furthering long-distance telephony, in which it is contended that as far back as 1886 Vaschy had recognized the important rôle of self-induction in telephonic transmission and that some years later Barbat championed and experimented with the methods known to-day by the names of Krarup and Pupin. A letter written by Pupin to the Academy of Sciences at the time when the academy awarded him the Hébert prize is quoted in which the writer makes a graceful acknowledgment of the inspiration he had received from "French science and particularly from the classic experiments of Lagrange, Fourier and Vaschy."—*Revue Gén. de l'Elec.*, Aug. 25, 1917.

Miscellaneous

Electric Transporters at Munition Factory.—An article giving perspective, elevational and sectional views of two large transporters or cranes used at one of the national projectile factories in England for handling incoming material and outgoing projectiles. They operate over 100,000 sq. ft. (9290 sq. m.) of area at a very high rate of speed. Each crane has a span of 90 ft. (27.4 m.) and an overhang at each end of 45 ft. (13.7 m.). Three motors are employed—one for hoisting and the others for transverse and longitudinal travel.—*London Engineering*, Sept. 7, 1917.

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

WATER-POWER DEVELOPMENT NEEDED IN THE SOUTHEAST

**At Convention of the Southeastern Section of the
N. E. L. A. in Birmingham, Ala., Legislation
by Congress Is Urged**

The fifth annual convention of the Southeastern Section of the National Electric Light Association was held at the Tutwiler Hotel, Birmingham, Ala., on Wednesday and Thursday of this week. Much interest was manifested in the papers presented, and it was the general opinion of those present that, with the coal situation as acute as it now is in the Southeastern section of the country and with water-power developments loaded to capacity, further water-power development is necessary. The hope was expressed that at the coming session the Congress will enact remedial legislation.

In his presidential address W. E. Mitchell, Alabama Power Company, told of the phenomenal growth of the South industrially and of the rapid increase in water-power development even in districts where coal is comparatively cheap.

PAPERS AND DISCUSSION

The first paper of the Wednesday session was read by W. H. Onken, Jr., editor of the *ELECTRICAL WORLD*, New York. It is printed in abstract on another page of this issue. The portions treating of the coal situation and of the necessity for further water-power development were discussed freely. It was pointed out that coal mines which previously refused to consider secondary service rates are now glad to accept primary service rates. Isolated plants, because of coal shortage, are also seeking central station service. The general seriousness of the coal situation was accentuated, and many managers attended the convention for the sole purpose of ascertaining how other companies are preparing to meet the emergency.

Two other papers were read at the Wednesday session—one on "Safety," by T. K. Selden, American Telephone & Telegraph Company, and another, the "National Safety Code," by P. A. Tillery, Carolina Power & Light Company, Raleigh, N. C. After this the meeting adjourned so that the delegates might see the Liberty Day parade.

Papers presented on Thursday were as follows: "Methods of Handling Customers' Accounts," by H. S. Strong, Birmingham Railway, Light & Power Company; "Effect on Cost of Service of Varying Cost of Fuel, Labor and Supplies," by D. H. Cronheim, Alabama Power Company; "Selling the Electrical Idea," by H. W. Alexander, Society for Electrical Development; "Some Operation and Distribution Problems," by J. O. Harden, Georgia Railway & Power Company; "Selling Securities to Consumers," by C. T. Naumberg, Henry L. Doherty & Company; "Development of the

Induction Watt-hour Meter," by M. C. Rypinkhi and S. A. Berger, Westinghouse Electric & Manufacturing Company, and "Standardization of Transformers and the Economic Results Obtained from the Installation of Potential Regulators," by L. W. Carnagy, General Electric Company.

A theater party was given on Wednesday evening, and trips to manufacturing plants in Birmingham were made on Thursday. On Friday a special train and boat took the convention to the Warrior River plant of the Alabama Power Company.

PUBLIC SERVICE ASSOCIATION OF KANSAS IN CONVENTION

**Twentieth Annual Meeting Is Held at Salina—
Commercial and Operating Problems and
Fuel Shortage Discussed**

The twentieth annual convention of the Kansas Public Service Association was held at Salina, Kan., on Oct. 19 and 20. Meetings were held in the city hall. In spite of low total registration some really constructive work was done through the establishment of working committees. The organization has come to be one made up almost entirely of those interested in the generation and use of electricity. Affiliation with the National Electric Light Association appears to be the next logical step, and a committee, practically with power to act, was appointed to consider further the details of such an affiliation. The convention placed itself on record as favoring this move provided the committee should find it feasible. The local committee, with M. L. Derge of the Salina Light, Power & Gas Company, generously provided entertainment.

FRIDAY'S SESSIONS

The convention was welcomed to Salina on Oct. 19 by P. A. Brown, member of the City Council, who commented upon the need of closer co-operation between public service corporations and city administrations. In response, C. L. Brown of Abilene emphasized the fact that those responsible for the corporations were not unmindful of the need for this mutual understanding and that the up-to-date corporation was willing to meet the city more than half way.

Some time was devoted to a report of the committee on affiliation, H. W. Magruder of Liberal, chairman, to the end that the committee, consisting of H. W. Magruder, P. B. Harbaugh and W. W. Austin, was continued with instructions to report directly to the executive committee for action should this move of affiliation with the National Electric Light Association prove practical.

P. Loyd Lewis, Wagner Electric Company, Kansas City, was on the program for "Just Talk," but his address, directed to the salesmen at the convention, was

something more in that he outlined clearly and enterprisingly the functions of the traveling representative as first a business ambassador, next an arbitrator between the customer and the house, then an educator in carrying information from one customer to another, and finally a salesman whose duty it is not only to close contracts for goods already in demand, but to create sales opportunities.

In the discussion the sales representatives, headed by Mr. Cohn, Wesco Supply Company, pointed out that salesmen were not doing their share in obtaining attendance at conventions. Messrs. Reid, Obermeyer and Cohn were appointed a committee to remedy the condition, and it was voted that the nominating committee should nominate at least one vice-president from the salesmen members.

The afternoon session was opened by a talk on "Selling the Idea" rather than the specific equipment by Mr. Harper of the Western Electric Company, another talk of special interest to the sales fraternity.

A. J. Spizzy of Abilene reported for the committee on uniform accounts. The Kansas Public Utilities Commission asked the association to send representatives to discuss it. Mr. Spizzy reported that uniform accounting would be required in the near future and pointed out its advantages. The utilities commission wishes the co-operation of the association. The convention was in favor of uniform accounting and appointed Messrs. Spizzy, Brown and Derge a committee to which companies may go for aid in introducing the system finally prescribed.

R. G. Lafite of Eureka called attention to the critical fuel situation. The convention adopted a resolution calling the attention of Governor Capper and the State fuel administrator, Senator Carey, to the necessity of distributing fuel to electric stations, and appointed a committee, with Mr. Lafite as chairman, to discuss ways and means of insuring an adequate fuel supply to the central stations in the State.

At the evening session the convention was addressed by Harry W. Alexander, publicity manager Society for Electrical Development, New York, on "Winning the Public to Your Side." Mr. Alexander called attention to the following agencies: humanizing the corporation, courtesy, good service, presenting statistics of the industry, investor-customer ownership, explanation of what Wall Street really is, less tendency to hide good deeds, the part politics plays, paid publicity, and free publicity.

SATURDAY'S SESSIONS

On Saturday Prof. C. E. Reid, Manhattan, presented a paper on "The Determination of the Various Losses in Transmission Lines and Distribution Circuits." He presented statistics on typical small transmission lines and distribution systems and explained the method of analyzing total losses to determine the amount that each element makes in the total. While the full-load efficiency of individual elements may be very high, the sum total losses on an all-day basis with unfavorable load conditions may amount to as much as 50 per cent of the energy generated. The need for careful engineering in the layout of these systems was emphasized. Professor Reid favors the establishment of municipally owned transmission lines where conditions are such as at all to warrant their installation, but he

cautions both central station managers and municipalities that losses should be taken into careful account before fixing rates for energy.

Prof. George C. Shaad, Lawrence, pointed out that cities have often been disappointed in the financial outcome of transmission lines, and the further introduction of such lines has been retarded somewhat. This has been due to the fact that municipalities have been led to believe that not to exceed 10 per cent of the energy will be lost in transmission, but when the net result of large transformers, small load and poor load factor is considered what looked like a fair financial return has been changed to actual loss. Education of the public, public utilities commissions, station managers, and even electrical engineers, on the nature and extent of distribution losses is needed.

ROUND TABLE DISCUSSIONS

The program provided for a series of "round table discussions" as follows:

"Electric Cooking in Kansas." C. L. Dunn, Salina, outlined what was being accomplished along this line and a short discussion followed.

"Should We at This Time Increase or Decrease Our Efforts to Take on New Business?" W. A. Wadsworth, Wichita, spoke briefly on this subject to the effect that only where a load would tax unduly the ability of the plant to obtain the machinery to take care of it should the efforts to secure new business be curtailed.

"What Is Being Done to Offset Increased Kilowatt-hour Costs?" C. L. Brown, Abilene, outlined the introduction of many fuel-saving devices which, with ordinary prices for fuel, have not always been considered as worth while installing, but which may now be used to very considerable advantage.

"To What Extent Is Iron Wire Being Used for Transmission Purposes, and with What Results?" Prof. F. E. Johnson answered for Kansas by saying that of the 1300 miles of transmission lines in the State about 325 miles is of iron wire, and that it is being used for voltages all the way from 2300 volts to 66,000 volts. Some lightly loaded lines are having trouble because of the excessive charging current and other systems have attempted to transmit more power than the lines were really designed for. Complete and careful tests over a wide range of operating conditions are urgently needed in this class of line.

"What Permanent Effect Will the War Have on Central Station Loads?" L. O. Ripley, Wichita, predicted continued increase in such loads because the central station is the logical source of power for manufacturing plants. In the present stress such plants are turning to the central station, and they are not likely to give up this service.

The technical part of the program was closed with a paper on the subject "The Electrical Range and Its Possibilities for Increasing Central Station Service," by C. A. Meier, Westinghouse Electric & Manufacturing Company.

Officers were elected as follows: President, J. D. Nicholson, Newton; secretary, W. W. Austin; executive committee, C. L. Brown, H. W. Magruder, L. S. Small and Walter Gudy. Oct. 17, 18 and 19, 1918, and Kansas City, Kan., were selected as the time and place of the next meeting.

SIGN LIGHTING DISCUSSED BY NEW ENGLAND COMPANIES

Desiring to Do Their Part in Supporting the War,
Many Are Unconvinced that Sign Curtailment Is Economy Worth While

The discontinuance of electric sign service by owners of such equipment is a live topic of discussion at present in the New England States. The fuel committee of the Massachusetts Committee of Public Safety, of which James J. Storrow of Boston is chairman, has informally suggested to various business associations that the present shortage of coal calls for every possible economy in the use of fuel; that New England consumes 40,000,000 tons of coal annually and will be 6,600,000 tons short by Jan. 1 unless the utmost is done to relieve the situation, and that by cutting out electric signs a saving will be effected along most important lines. A representative of the ELECTRICAL WORLD called at the committee's office in the State House on Monday to investigate the matter further after having been in touch with a number of important central stations to ascertain their attitude upon the sign question.

The fuel committee makes no claim that the saving in coal from the shutting down of electric signs would amount to any substantial percentage of the annual consumption of the public utilities concerned, but it holds that even if the saving should amount to but a barge load or two for all New England it would be worth while. The difficulties of the coal situation in New England at present are very serious. Although solid trains of fuel are being brought in, an entire train is able to transport little more than one or two equivalent barge loads at a time. Strong appeals are being made to the federal authorities at Washington to secure the shipment of more coal into New England, and it is felt that the use of electric signs should be discontinued as evidence that everything feasible is being done to conserve the existing supply. Beyond this, the committee is of the opinion that the householder and other private users of fuel will be encouraged toward greater economy if electric signs are cut out of service, and that the psychological effect of dark signs will be such as to bring home to the average citizen the reality of the war economies advocated and the necessity for the utmost co-operation.

Some of the larger central stations in New England have discontinued electric signs of their own in accordance with the suggestions of the committee, but there has been a general feeling among the companies that it is not their province to ask customers to cut out their signs. The Edison Electric Illuminating Company of Boston has discontinued the service of all but two of the company's signs on its lines. One of these is the illuminated tower sign on the company's main office in Boylston Street, Boston. The other sign, which has been greatly reduced in brilliancy, is the famous "clock" sign advertising Edison service near the intersection of Boylston Street and Massachusetts Avenue, in the Back Bay district of Boston. On the latter only the clock dial and essential words calling attention to the company's name and service have been retained in operation. All the co-operative development signs supplied with energy by the company in the suburban towns outside Boston, some twelve or fifteen in number, have been cut out of circuit. The company has also

ceased to supply energy on its advertising account to real estate dealers and electrical contractors. The company takes the position, however, that it has no right to ask its customers to discontinue their electric sign service. It has furnished the fuel committee with a list of every electric sign user on its lines and, while regretting the loss of revenue which curtailment of sign service involves, is co-operating as outlined above with the conservation movement. In the October issue of *Edison Life*, the company's official publication for employees, there appeared an editorial emphasizing the point that in Boston, with about 3300 signs in public use, only about 0.7 per cent of the annual coal consumption of the company is represented by this service. The writer of the editorial emphasized the need of cheerfulness in street illumination in these depressing times and held that only the stern necessity of military protection should require the relinquishment of the electric sign.

The Narragansett Electric Lighting Company, Providence, R. I., is of the opinion that a lasting injury will be done the electric sign business by present curtailment. It is believed in Providence that the fuel saving would be so small as to be lost in the station coal consumption records, and very recently a large inter-chimney electric sign erected by the company for its own service at its generating station in Providence has been placed in operation. The Cumberland County Power & Light Company of Portland, Me., is about to issue a notification to its customers that protracted coal shortage may at some future date require curtailed sign service, but so far it has not been necessary to take any steps in this direction. At Springfield, Mass., the United Electric Light Company has considered no curtailment as yet and believes in keeping the service going as normally on the ground that the actual fuel saving is too small to warrant the drastic action of cutting signs out of service or the other unwelcome, and from the company's viewpoint unnecessary, course of asking customers to suspend their sign operation.

The Worcester (Mass.) Electric Light Company has taken no steps looking toward sign reductions and has just installed and placed in operation a sign at the new offices of the company on Foster Street. The inter-stack sign of the company at its Webster Street station is operating as usual. The executive opinion at Worcester coincides with that at Providence, and the small proportion of yearly energy devoted to sign service is advanced as a sufficient reason for non-curtailement.

The Edison Electric Illuminating Company of Brockton, Mass., one of the Stone & Webster central stations, has seen no need of curtailing sign service as yet, and the movement toward this end is looked upon as controlled by the utmost good intentions but influenced by an undue anxiety as to the effect of signs upon the coal pile. Various companies managed in Massachusetts by Charles H. Tenney & Company of Boston (in Salem, Fitchburg, Haverhill and Malden) have discontinued the use of company signs and ceased the supply of energy to the various board of trade signs in the districts served. On all the properties managed by this organization inside and outside New England the total fuel requirement of the electric signs in service on the lines is less than 300 tons per year. The management of this group of utilities is more favorably inclined toward window and outline lighting than to electric

sign service, and the commercial departments have not attempted to develop sign business to so large a volume of yearly revenue as would otherwise have been the case with these companies.

In sum, the feeling of the New England central stations with which the ELECTRICAL WORLD has been in direct touch during the last few days on this question is that, while every company desires to do its part in supporting the war and is glad in that connection to cut out fuel waste, a good many utilities remain unconvinced that the curtailment of sign service represents any worth-while progress in that direction. It was pointed out by one central station man that the actual effect of cutting down the sign load during off-peak hours might in some cases be adverse to station economy, resulting in a higher rate of fuel consumption per kilowatt-hour than if the load had been retained. There is a general opinion that it is therefore no part of a central station's duty to discourage the use of signs by its customers under present conditions.

THE DEVELOPMENTS IN THE COAL SITUATION

**Dr. Garfield Expresses the Belief That Patriotism in
the Use of Coal Will Provide All That
Is Necessary**

Dr. H. A. Garfield, United States fuel administrator, expresses the opinion that if all the people will show the same patriotism in the use of coal which the miners and mine operators are showing in its production, there will be enough coal this year for all war purposes and in addition all that is necessary for domestic industries and for keeping the people warm will be forthcoming.

Reports to the ELECTRICAL WORLD from some sections have failed thus far to confirm rumors of discontinuance of operation of central station companies because of coal shortage, although all indications show that considerable anxiety is felt in many quarters.

Washington reports say that searching investigation will be made by the fuel administrator to determine whether coal hoarding has taken place on a large scale in New York.

It is announced officially that Dr. Garfield will handle the coal problems of each state only through the state administrators. He will return to them all correspondence addressed to him pertaining to conditions in their territory. But in rare cases it will be possible for local bodies or individuals to exercise the right of appeal to the authorities at Washington.

As indicating the difficulties of the present situation, the New England Coal & Coke Company, Boston, has advertised to customers and other steam coal users that earlier in the year, long before any price restriction was made on coal, it contracted for several hundred thousand tons of bituminous coal varying in price from \$2.77 to \$3.75 per net ton at the mines, subject to any increase in mining rates. "We bought this coal to supply the demands for spot coal and also to be in a position to serve our contract customers in the event of a shortage in our regular coal receipts," the company says.

The federal fuel administrator at Washington, through orders appearing on Oct. 8, does not allow the company to sell this coal at more than \$2 per net ton

at the mines, although it cost on an average \$3.08 per net ton at the mines. The company would be willing, if the government allowed, to sell the coal on the basis of cost at the mines plus the profit allowed by the government of 15 cents per net ton. Among the applicants for coal during two days were included a railway company, an electric lighting company and several gas companies, whose urgent needs could have been filled with this coal at a price satisfactory to all parties, but the company regretfully declined the business on account of the price restriction from Washington.

Homer H. Johnson, newly appointed Ohio coal administrator, who has been investigating the reason for coal shortage, declares that there can be no improvement in the supply for any purpose until a modification is made in the priority order, under which the greater part of the State's production is being sent to the Northwest by way of the Great Lakes.

Mr. Johnson has asked the federal coal administrator so to modify the order that the railroads may use a certain percentage of their cars to ship coal to Ohio points where it is needed and thus keep homes and industries, which includes public utilities, supplied. The railroads were notified to furnish cars for 20 per cent of the coal mined on Oct. 16 to be distributed in Ohio, but so far as can be learned by the correspondent of the ELECTRICAL WORLD in Cleveland very little of that coal has been delivered yet. Reports indicate that the operators did not receive the cars and that the attempt to secure coal in that way practically failed.

Little comment has been made in Cleveland on the report that the government might order all electric sign and other extra use of energy discontinued in order to conserve coal.

The Louisville & Nashville Railroad has been confiscating much of the coal shipped from mines on its lines, its supplies having been practically exhausted during the two months' strike in southeastern Kentucky. Mayor O'Neill of Augusta, Ky., has given orders to a committee to commandeer for the city any coal that may be seized passing through the city so that the municipal lighting plant may have fuel. All over the section similar plants are operating on a hand-to-mouth basis and finding it difficult to get coal. All of the operators state that they are sold ahead for more than two months and have prepared form letters explaining the situation to the increasingly numerous pleading letters which are being received. Although the strike in the southeastern Kentucky field has been over for two weeks, the production has not yet reached much more than 40 per cent of normal.

MILWAUKEE COMPANY INCREASES APPROVED

**Wisconsin Railroad Commission Gives Authority for
Higher Rates for Steam Heating and Elec-
tricity for Large Consumers**

A petition of the Milwaukee Railway & Light Company for authority to increase rates for steam heat and electrical energy to large consumers has been granted by the Wisconsin Railroad Commission. It is stated that the increases average about 22 per cent. They are based directly on increased cost of operation due to higher cost of coal and labor.

FEW CHANGES MADE IN THE NATIONAL ELECTRICAL CODE

Several New Committees Appointed to Take Up
Important Subjects—Chairman Cabot Resigns
—Next Meeting to Be Held in 1920

Very few important changes were made in the National Electrical Code by the electrical committee of the National Fire Protection Association at its twenty-first annual meeting on Oct. 23 and 24 at New York City. The meeting was shorter than usual, lasting only one day and a half, but was well attended. About 150 were present. Chairman Cabot, who has presided for about twenty-five years, announced his resignation at the end of the meeting. A vote of appreciation and gratitude for his able leadership during these many years was given. A successor to Chairman Cabot has not yet been named.

RECOMMENDATIONS OF ELECTRICAL COMMITTEE

Five recommendations were proposed by the electrical committee: (1) That a committee of five be appointed to consider the use of lead-covered cables for extensions in fireproof buildings; (2) that a special committee of five be appointed to draw up additions to the code to take care of apparatus under 50 volts; (3) that a committee of five have power to re-edit sections of the code to eliminate class D; (4) that the next edition of the code be known as the 1918 edition, to be ready by Jan. 1, 1918, and that the next meeting be held in 1920; (5) that a committee of five be appointed to be known as the "new system and devices committee." The latter committee will investigate all new systems and devices, referring them to the Underwriters' Laboratories, which will make the necessary tests and investigations and refer them back to the committee. The above recommendations are to be carried out.

WIRING OF POWER STATIONS AND SUBSTATIONS

Recommendations in the report of the committee on the wiring of power and substations were accepted almost as presented. The new paragraph on the subject of isolating lightning arresters, which formerly read "on circuits of over 7500 volts," was changed to "all arresters." Several changes were made on recommendation of the committee on induction motors. In Section c of Rule 8 the first sentence of the second paragraph suggested was changed to the following: "Except for auto-starters, the switch called for in the preceding paragraph may be omitted where the motor starter disconnects all wires of the circuit. Where auto-starters are used a switch must be provided on the supply side of each auto-starter. Where the starter, when in the running position, automatically opens under overload it may serve also as a circuit breaker." Several other minor changes were made in this report.

The report of the committee on circuit breakers was withdrawn.

Several changes were made in suggestions made by the committee on cabinets. Under the rule on outlet-junction and flush-switch boxes, Section a was finally amended to read as follows: "Junction or pull boxes having not more than 150 cu. in. [2400 cu. cm.] contents, outlet boxes and flush switch boxes must be of

pressed steel not less than 0.078 in. [1.98 mm.] (No. 14 U. S. sheet metal gage), or of cast metal having wall thickness not less than $\frac{1}{8}$ in. [3.2 mm.]."

Recommendations offered by the committee on transformers were accepted, as was the report of the committee on electric signs.

GROUNDING COMMITTEE REPORT

The committee on grounding presented a supplementary report dated Oct. 17, 1917. This was adopted after several changes. In the rule on wires, an amendment was agreed to, reading as follows: "Metal conduit containing service wires must be grounded, as provided in Rule 15A, except under the following conditions: (1) Conduits containing no conductors of circuits except 150 volts to ground may be left ungrounded if insulated from the ground and from the metal conductors, metal raceways or armored cable systems within the building and from all other work on or in the building. (2) Conduits containing conductors of circuits exceeding 150 volts to ground may be left ungrounded if insulated as above and also isolated or guarded."

A change was also made in the rule on fixtures, under the subject of grounding, so that it would read as follows: "Insulating joints and canopy insulators may be omitted in the following cases: (1) Straight electric fixtures in which all wires have an approved rubber insulation not less than $\frac{3}{64}$ in. [1.19 mm.] in thickness, metallically connected in a permanent and effective manner to metal conduit, armored cable or metal molding system or to gas piping, provided such gas piping is grounded in the manner described for conduit in Rule 15A, (2) straight electric fixtures in which all wires have an approved rubber insulation not less than $\frac{3}{64}$ in. [1.19 mm.] in thickness, connected to knob and tube, wooden molding or open work, except on metal ceilings or on plaster walls or ceilings containing metal lathing; (3) straight electric fixtures in which all wires have an approved rubber insulation $\frac{3}{64}$ in. [1.19 mm.] in thickness which are permanently and effectively grounded to a separate ground wire not more than No. 14 B. & S. gage; (4) combination fixtures in which all wires are of approved rubber insulation not less than $\frac{3}{64}$ in. [1.19 mm.] in thickness and where gas piping is grounded, as in Section 1 above." The present rules are to stand until 1919, when the foregoing will take effect. This is in order to allow fixture manufacturers, especially those who make decorative types, to change fixtures to comply with the ruling.

This committee also recommends that as soon as practicable the rules be further revised with the idea that grounding may be extended to all utilization devices, including sockets, fixtures, receptacles and even portable devices; that all of these devices be so made in the future that the casing, shell or covering may be grounded when used with polarized circuits, and that manufacturers, jobbers, contractors and all interested be asked to co-operate in securing the above results with as little delay as possible. The committee further recommends that the Underwriters' Laboratories, Inc., be more severe in its specifications and tests on "approved ground clamps." The committee also recommends that ground clamps be made only of copper and not less than $\frac{1}{16}$ in. (1.6 mm.) in thickness, that no

iron or steel be used in any part of the clamp except that a steel clamping bolt may be used, and that the lug to which the wire is soldered or fastened by an approved connection be an integral part of the clamp.

FUSES, SWITCHES AND METER INSTALLATIONS

In the report of the committee on fuses, switches and meter installations, Rule 23 on automatic cut-outs (fuses and circuit breakers), Section a, caused considerable discussion and the wording was returned to the secretary for revision. The main idea in this section, it was decided, was that all meter installations be placed together to make a workmanlike arrangement and not be scattered over various parts of a building. In the rule on switches a paragraph was rearranged to read as follows: "Service switches must be arranged to cut off the entire current from all circuits and devices, including meters, except as provided in the following paragraph. Where service fuses and meter are combined in an approved single self-contained unit device having no exposed wiring or live parts and no parts not protected by the fuses, the switch may be so arranged or installed that it will not disconnect the meter from the supply line, provided it does disconnect all lines of the supplied house circuits."

The report of the committee on electric heaters was adopted as recommended.

SWITCHES AND CUT-OUTS

The report of the switch and cut-out committee was adopted with a few changes. Regarding the rule on refillable fuses a notice was read that the suit brought last March by the Economy Fuse & Manufacturing

TABLE 2—MINIMUM SPACING (IN.) FOR SWITCHES OTHER THAN ON SWITCHBOARDS

Ampere Rating	125-Volt., D.C. or A.C.		250-Volt., D.C. or A.C.	
	Opp. Pol.	Break	Opp. Pol.	Break
30	1 1/4	1	1 3/4	1 1/2
60	1 1/2	1 1/4	2 1/4	2
100	1 1/2	1 1/4	2 1/4	2
200 to 300.....	2 1/4	2	2 1/2	2 1/4
400 to 600.....	2 3/4	2 1/2	2 3/4	2 1/2
800 to 6000 inc....	3	2 3/4	3	2 3/4

Ampere Rating	250-Volt., D.C. or 500-Volt., A.C.		600-Volt., D.C. or A.C.	
	Opp. Pol.	Break	Opp. Pol.	Break
30	1 1/4	1 1/2	4	3 1/2
60	2 1/4	2	4	3 1/2
100	2 1/4	2	4 1/2	4
200 to 300.....	2 1/2	2 1/4	4 1/2	4
400 to 600.....	2 3/4	2 1/2	4 1/2	4
800 to 6000 inc....	3	2 3/4	4 1/2	4

Company of Chicago has been withdrawn. The committee reported: "In view of the misinterpretation placed on the report of the committee in the March bulletin regarding refillable fuses the committee desires to submit the following revised report: On evidence presented to or obtained by the committee, it does not recommend any changes in Rule 68d, but presents this report with the understanding that in order to obtain additional field experience, municipal and underwriters' inspection departments may permit a continuation or extension of the use of such refillable fuses as have, in their opinion, been shown to comply with tests and specifications for cartridge fuses and to be suitable for use."

Several minor changes were made in the classification and marking of switches with a rating of over

1000 amp. Table 2 on spacing was rearranged, as shown herewith. It was also added that switches above 1000 amp. should not be used for breaking the current but only as disconnecting switches.

In the report on cut-outs, Rule 67, slight changes were made and the recommendation was voted for.

MISCELLANEOUS SUGGESTIONS

Under the suggestions in miscellaneous items, the majority were returned with no action. Several important recommendations are given herewith. Under the rule on motors, a new paragraph was finally adopted to read as follows: "Alternating-current motors operating freight or passenger elevators or cranes, that are dependent on phase relation for the direction of rotation, must be protected by approved automatic circuit breakers (or reverse phase relay), operative in the event of any phase reversal that would cause a reversed motor rotation or in the event that the motor be connected in the line single-phase." In Section d of this same rule the first sentence of the suggested change in the second paragraph was taken out. In Section a of Rule 23, on automatic cut-outs, fuses and circuit breakers, the amended second paragraph was returned with no action. Several suggested changing this as in the 1913 code, but were not supported.

On the subject of interior conduits a committee with power to amend the ratio between conduit and wires was appointed to prepare a report for publication in the 1918 edition of the code. This committee consists of Messrs. Wynkoop, Peet and Forsyth.

On motors the amendment was made to read as follows: "Must each be provided with the name plate, giving maker, capacity in volts and amperes, and full-load speeds at interval duration, which operate safely, starting cold. Time interval given must be either 5, 10, 15, 30, 60 or 120 minutes, or continuous." This ruling does not apply to motors in railway use.

On the subject of switches an amendment was made as follows: "Must be supported at outlets where possible by 7/8-in. [2.25-cm.] blocks fastened between studs flush with the back of lath except where approved fittings or outlet boxes which will give proper support are used. When this cannot be done wooden-base blocks, not less than 3/4 in. [1.9 cm.] in thickness, securely screwed to lathing must be provided."

A new rule was added to the code to be known as 37A concerning electrically operated organs. This applies to the electrical control of the sounding apparatus and keyboards.

PUBLIC POLICY COMMITTEE CONSIDERS WAR PROBLEMS

Meeting in New York Is Devoted to Consideration of Questions Affecting the Industry in War Time

A meeting of the public policy committee of the National Electric Light Association was held in New York on Oct. 19. A general discussion of the war-time problems of the industry took place. This included discussion of the fuel situation in which the industry finds itself, the question of sign lighting, and similar problems created by the stress and the industrial requirements incident to the war.

JOVIANS IN WAR-TIME BUSINESS CONVENTION

Fifteenth Annual Convention in New York Devoted
Mainly to Business Sessions—Amendments
to the Constitution

With attendance and proceedings tempered by the war conditions, the Jovian Order held its fifteenth annual convention at the Hotel McAlpin, New York, on Oct. 22 and 23. In keeping with the times the convention was shorn of many of its usual entertainment features and to a large extent was a strict business gathering. The principal work done was the adoption of amendments to the constitution. In the main they are intended to make possible a campaign for bringing the non-Jovian electrical leagues within the fold and then to strengthen the relation between the parent organization and the various leagues.

The convention program was opened by a luncheon at the Hotel McAlpin given by the New York league to the visiting Jovians. James M. Wakeman, general manager of the Society for Electrical Development, presided as toastmaster. The Rev. Wallace Petty made a stirring patriotic address which aroused great enthusiasm.

The convention was called to order by Reigning Jupiter Henry L. Doherty, who asked Henry Harris of Pittsburgh to take the chair. Mr. Harris presided over the sessions as he has done for several years. Mercury Ell C. Bennett read a letter from Edward N. Hurley, chairman of the United States Shipping Board, to Mr. Doherty in acknowledgment of an invitation to address the convention. Mr. Hurley was unable to be present, but he expressed keen appreciation of the work of the Jovian Order and of the effectiveness of such co-operative measures in building up the great electrical industry.

Mr. Doherty, in lieu of a formal address, explained briefly the necessity for holding a business convention notwithstanding war conditions. He told his hearers that they would be surprised if they knew how many of their associates are serving the country not only through enlistment but through the sale of bonds and in other ways giving from 1 per cent to 100 per cent of their time.

ADDRESS OF MR. LIEB

At the opening session on Tuesday John W. Lieb, chairman of the National Committee on Gas and Electric Service, made an address outlining the work which that organization has done to assure co-operation of the utilities with the government in all matters relating to the prosecution of the war. Early in the course of this work, said Mr. Lieb, the question was raised as to whether the committee would be of assistance in solving the fuel problems of municipal plants as well as of privately owned plants. Mr. Lieb said that the position was taken that the committee was in existence primarily to render a patriotic service to the government, and in the pursuance of that purpose it would make no difference whether a utility was municipal or private.

Lynton T. Block, Utilities Indemnity and Fire Exchange of St. Louis, explained in detail the new insurance plan of the order.

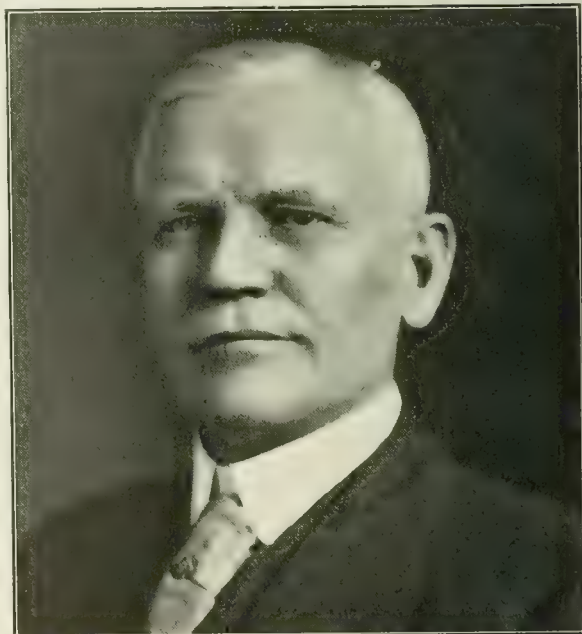
The amendments were adopted at the afternoon session with some changes made after discussion on the

floor. One of the principal contests was over the method of nomination and election of congressmen and statesmen. It was decided to substitute for the amendment offered in the report a provision permitting contests by candidates for whom petitions are presented twenty-four hours before the election. To induce non-Jovian leagues to charter and, as at present organized, to bring into the order rapidly their entire membership, the initiation fee to the Jovian Order is to be waived from Oct. 24, 1917, to Feb. 1, 1918; on and after the last-named date the initiation fee will be \$5, one-half to be retained by the local Jovian organization holding the initiation and the balance remitted to the central office.

The report of the committee on resolutions, of which Charles A. Newning was chairman, included the accompanying pronouncement concerning the war, which was adopted by a rising vote.

J. F. STRICKLAND, JUPITER

The report of the nominating committee, presented by W. N. Matthews, St. Louis, named the following, who were elected: J. F. Strickland, president Texas



JUPITER-ELECT STRICKLAND

Power & Light Company, Dallas, Tex., Jupiter; Ell C. Bennett, St. Louis, Mercury.

Mr. Strickland was born on a farm near Gadsden, Ala., and went to Texas as a young man. First a farmer and later in the mercantile business, he afterward entered the electrical industry through the purchase and control of the electric light plant at Waxahachie, Tex. In this enterprise Osce C. Goodwin and M. B. Templeton were connected with him. Later they extended operations and bought control of other companies in the same district. They acquired the Hillsboro Gas & Electric Company, the Cleburne Gas & Electric Company, the Bonham Gas & Electric Company and the Sherman Gas & Electric Company. When Mr. Strickland moved to Dallas the Dallas Securities Company was formed to hold control of the operating properties. Mr. Strickland and his associates built the Texas Traction Company, an interurban line extending between Dallas and Denison. Later they or-

ganized and built the Southern Traction Company, extending between Dallas and Corsicana and Dallas and Waco. In the latter part of last year the inter-urban properties were consolidated as the Texas Electric Company. When the Texas Power & Light Company was organized to take over the lighting properties of the Strickland-Goodwin syndicate it acquired also

JOVIAN PLEDGE TO WIN THE WAR

For the first time within the history of our order, it meets under the shadow of a great war in which our nation is engaged as one of the participants. It is, we believe, fitting and proper that we should define in unmistakable language the attitude of this great organization toward our nation in this great struggle.

For nearly three years our nation has been the target for abuse, insult and degradation at the hands of an unscrupulous power, blind with the lust of conquest by war and including our people in its path of destruction. Stinging under the lash of insults to our nation, we finally threw off our apathy and entered the great contest entirely from principles of humanity and for the preservation of the liberties that we have so long possessed. That our nation did right in entering this war we declare and affirm, and we further pledge the resources of our great order in men, money and influence to the support of our nation in waging this great conquest for liberty.

We ask and demand that our members, wherever located and however situated, give of their time, their money and their labor to our nation in this struggle. We must not only measure our patriotism in dollars, but we must give all that we possess in brains, energy and devotion toward this most sacred cause in which we are now engaged. This requires sacrifice upon our part, and we ask and request that every member make this sacrifice. The life of our order, the liberties of our people and the existence of our nation depend upon this sacrifice that we must make.

There is no place for the slacker in our membership. There is no excuse for shifting responsibilities, and we expect that every member will give all that he possesses that is good, if necessary, for the winning of this struggle. We stoutly affirm and maintain that we want no peace until that peace shall come stripped of the lust of power and blessed by the humanity of men one to another. In this national convention assembled, we pledge to our nation and its officers our lives, our means and our power to win this war for right.

We further request that this resolution be not only spread upon the minutes of our order but that a copy be sent to each league with a request that it be brought to the attention of every member, and, further, that a copy be sent to those in charge of our national defense, and that the pledge that we have made herein be kept with honor.

other properties and has been enlarged considerably. One of the recent principal activities of Mr. Strickland has been the acquisition of a franchise in connection with C. W. Hobson for the Dallas electric railway and electric properties.

Congressmen and statesmen elected were:

MEMBERS OF THE CONGRESS

First District—William R. Phipps, Brush Electric Company, Galveston, Tex.

Second District—Joseph Insull, General Electric Company, Pittsfield, Mass.

Third District—Harry W. Alexander, Society for Electrical Development, New York.

Fourth District—Arthur G. Pierce, Cutler-Hammer Manufacturing Company, Pittsburgh.

Fifth District—T. J. Creaghead, Louisville, Ky.

Sixth District—Julien Binford, Jr., Westinghouse Lamp Company, Atlanta, Ga.

Seventh District—W. R. Power, Consolidated Heat, Light & Power Company, Huntington, W. Va.

Eighth District—Galen Crow, Public Service Company of Oklahoma, Guthrie, Okla.

Ninth District—L. O. Ripley, Kansas Gas & Electric Company, Wichita, Kan.

Tenth District—Henry N. Remington, Central Illinois Light Company, Peoria, Ill.

Eleventh District—William T. Wallace, Idaho Power Company, Boise, Idaho.

Twelfth District—H. L. Woolfenden, Allis-Chalmers Company, Denver, Col.

Thirteenth District—J. N. Colkitt, John A. Roebling's Sons Company of California, Los Angeles, Cal.

STATESMEN

Arkansas—C. J. Griffith, Little Rock Railway & Electric Company, Little Rock.

Arizona, California, Nevada—Lewis E. Sperry, New York Insulated Wire Company, San Francisco.

Idaho—Ernest C. Kiersted, Idaho Power Company, Boise.

Illinois—L. C. Spake, McGraw-Hill Publishing Company, Chicago.

Indiana—Wallace O. Lee, Indianapolis Light, Heat & Power Company, Indianapolis.

Iowa—H. W. Garner, Des Moines Electric Company, Des Moines.

Kentucky—J. B. Riley, Westinghouse Lamp Company, Louisville.

Louisiana—W. A. Porteus, Western Union Telegraph Company, New Orleans.

Maryland—J. G. Livingston, Southern Electric Company, Baltimore.

Massachusetts—C. B. Burleigh, General Electric Company, Boston.

Minnesota, North Dakota, South Dakota—W. H. Vilett, Sterling Electric Company, Minneapolis.

Missouri—Fred Johnson, Wagner Electric Manufacturing Company, St. Louis.

New Jersey, Delaware—James Howlett, Elizabeth.

New Mexico—J. A. Shepard, Deming Ice & Electric Company, Deming.

New York—E. G. Hines, ELECTRICAL WORLD, New York.

Ohio—N. H. Boynton, Cleveland.

Oklahoma—Charles McCallum, Western Electric Company, Oklahoma City.

Oregon—A. S. Moody, Pacific States Electric Company, Portland.

Pennsylvania—George H. Criss, Pittsburgh.

Rhode Island—E. R. Davenport, Narragansett Electric Light Company, Providence.

South Carolina—W. W. Fuller, Isle of Palms Traction Company, Charleston.

Tennessee—C. J. R. Watson, Electric Supply Company, Memphis.

Texas—Hiram O. Clark, Houston Lighting & Power Company, Houston.

Utah—Charles H. Talmadge, Western Electric Company, Salt Lake City.

Vermont—E. E. Larrabee, Twin States Gas & Electric Company, Bennington.

Virginia—Guy E. Seiler, Virginia Railway & Power Company, Richmond.

Wisconsin—Carl Golin, Northwestern Storage Battery Company, Milwaukee.

Province of Alberta—Norman S. Richards, Northern Electric Company, Calgary.

Province of Manitoba—J. H. Schumacher, Schumacher-Gray Company, Ltd., Winnipeg.

Province of Quebec—E. N. Hyde, Northern Electric & Manufacturing Company, Montreal.

MR. DOHERTY ON SIGN LIGHTING

At the banquet which closed the convention on the evening of Oct. 23 talks were made by Sam A. Hobson, Frank E. Watts, W. N. Matthews, Henry L. Doherty and Dr. Talcott Williams, dean of the School of Journalism of Columbia University.

Mr. Doherty spoke of the movement to save coal by curtailing the utilization of energy for electric signs. Every war, Mr. Doherty declared, is more or less a problem in psychology. The present war is bound to be very largely one of psychology. The confidence, or lack of confidence, on the part of the various opponents may prove in the end to be the determining factor.

G. H. STICKNEY ADDRESSES CHICAGO SECTION, I. E. S.

War-Time Work of Illuminating Engineering Society and Recent Developments in Incandescent Lighting Are Summarized

Without stating specifically what the Illuminating Engineering Society is doing to assist the government, G. H. Stickney, president of the society and illuminating engineering assistant to the sales manager of the Edison Lamp Works of the General Electric Company, Harrison, N. J., gave the Chicago Section of the society on Oct. 18 a fixed impression that valuable service is being rendered. Before taking up his subject, "Recent Developments in Incandescent Lighting," Mr. Stickney expressed the opinion that factory-lighting codes which have been adopted and are being considered in several states would become the order of the day in every industrial state in the Union before many more years elapse.

Speaking of incandescent lamps, Mr. Stickney stated that one or two improvements had been made in the last year. In addition to the improvements, a number of changes have been made necessary by the war. The lamp companies' engineers have been faced by many problems brought about by the increasing prices of certain chemicals and the decreasing qualities of others. The speaker stated, however, that detailed discussion of the engineering problems which must be faced in lamp manufacture was not encouraged by the manufacturing companies' engineers on account of the fact that lamps may be said to be still in the development stages. The manufacturing companies' engineers, wishing to avoid all necessity of manufacturing special lamps, have thought it wise not to talk about lamp specifications.

One of the problems which lamp companies are facing on account of the war is the largely increased use of carbon lamps. About two years ago the carbon lamp was practically a dead letter. Of late, however, it has been coming back to a considerable extent. Just what the real cause is the speaker could not say, but he indicated that the difficulty might be attributed to the fact that the companies' educational program was not meeting with entire success.

Better store lighting, Mr. Stickney declared, is the keynote of all lamp work for the year. He expressed the belief that industrial lighting is lagging somewhat, although this is not particularly true of the Chicago territory. As the greatest development in industrial lighting in the year he pointed out the new type of unit which employs a silvered metal cap fitted tightly to the lamp bulb to reflect the rays against a dishpan-type reflector and entirely screen the filament from the eye.

On protective lighting it was difficult for the speaker to go into details on account of the fact that owners of most installations have requested secrecy. Protective lighting had been of three general types, post lighting, lighting from corners of buildings and floodlighting. In the latter the plan which arranges all the lamps to play in the same direction was particularly favored. As present trends in street lighting the speaker pointed out the use of single lamps instead of cluster standards, the movement toward standards of more ornamental design, most of which incidentally require that the lamp tip upward, and the use of stippled glass in connection with refractors to accomplish desirable distribution and

diffusion at the same time. Another trend which from the lamp manufacturers' standpoint is interesting is the use of more massive fixtures. It has been discovered that such fixtures will dissipate heat easily and permit the lamps which operate at high temperature to run cooler, even though the fixture be unventilated and the lamp could be operated in a ventilated fixture of less massive design.

Regarding colored lighting, the speaker indicated a belief that lamps of higher efficiency are creating a real demand for color modification. Light users can now afford color effects. The difficulty of getting certain materials because of the war is retarding development along this line. Mr. Stickney declared the carbon-dioxide lamp to be the most accurate medium for color matching. In such places as silk mills these lamps have no effective competitors. In other places, where the demand for a high degree of accuracy is less consistent, there are many types of color-matching units which will give adequate results.

Perhaps the most spectacular development has been in the field of projection. The moving-picture lamp has arrived, and while it is not suitable for the theaters of larger cities, it will displace arc-lighting equipment rated at as much as 35 amp. direct current or 60 amp. alternating current. The lamps are made in two sizes with ratings as follows: 30 amp., 25 volts, and 20 amp., 30 volts. The life of these lamps is 100 hours.

DISCUSSION

Prof. E. H. Freeman, who presided at the meeting, suggested the use of unidirectional floodlighting for one-way traffic streets. On broad thoroughfares the light from lamps on one side might be directed in one direction and that from those on the other side in the other direction. James R. Cravath urged the use of more stippled glass, but cautioned engineers to be on guard against glass of this type with edges which were too sharp and hence apt to accumulate dirt.

Mr. Stickney, in answering questions, stated that it was impossible to make automobile lamps conform more nearly to a standard dimension as regards the focal length. The reason is that glass cannot be worked to greater accuracy than $\frac{1}{8}$ in. (3.2 mm.). He also stated that he did not believe colored light of the future would be produced by lamps with colored bulbs, since it would be more economical to use colored screens of gelatine or glass. The possible exception may be in lamps of the more common color. The yellow-bulb lamp, he said, had been held up because of a disagreement as to just what yellow should be employed. He stated that he knew of no satisfactory dips for use on type C lamps.

Electric Distributing System for Charleston Government Plant

Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until 11 a. m. on Nov. 5, and then and there publicly opened, for an electric distributing system at the naval projectile plant, Charleston, W. Va. Drawings and specification No. 2657 may be obtained on application to the bureau or to the commandant of the navy yard or naval station named. F. R. Harris is chief of the Bureau of Yards and Docks.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Fall Meeting of Electric Power Club.—The fall meeting of the Electric Power Club will be held Nov. 12, 13 and 14 at Hot Springs, Va.

San Francisco Electrical Development and Jovian League.—At the Oct. 10 meeting of the league John F. Neylan, former chairman of the State Board of Control, spoke on "Facts and Figures on War Costs."

Chicago Section of the I. E. S.—G. H. Stickney, president of the Illuminating Engineering Society, addressed the Chicago Section of this society on the subject of "Recent Development in Incandescent Lighting" at the meeting held on Oct. 18.

"The Engineer at the Battle of Verdun."—Captain G. P. Capart of the French General Staff addressed the Schenectady Section of the American Institute of Electrical Engineers on the subject of "The Engineer at the Battle of Verdun" on Oct. 23.

The Electrical League of Cleveland.—Prof. J. L. Borgerhoff, present head of the foreign language department at the Women's College, Western Reserve University, addressed the Electrical League of Cleveland on the subject of "Belgium Before the War and Now" at a meeting held on Oct. 18.

Philadelphia Section of the Illuminating Engineering Society.—"Economies in the Operation of Large Lighting Installations" was the subject of a paper presented by Clarence L. Law and James E. Buckley at a meeting of the Philadelphia Section of the Illuminating Engineering Society held Oct. 19.

Jovian Electric League, Los Angeles.—James W. Gerard, former United States Ambassador to Germany, spoke at the Oct. 10 meeting of the Jovian Electric League on the "Urgency of Liberty Loan Subscriptions," and was followed by City Attorney Stephens, speaking on the same general topic. The annual election of officers was held at this meeting. Harry N. Sessions, of the Southern California Edison Company, was elected president.

Quarter Century Club of the General Electric Company.—The "Quarter Century Club" of the General Electric Company, composed of employees who have been with the company twenty-five years or more, recently met and donated \$1,750 as a "comfort fund" for the old Second, now the One Hundred and Fifth New York Regiment, of Schenectady and neighboring cities. This sum will form the nucleus of a fund to be placed in the hands of Col. J. W. Andrews and to be spent at his discretion for the aid

and comfort of the soldiers from this vicinity. A large percentage of these men are employees of the General Electric Company. At the conclusion of this business the members of the club, at dinner in the General Electric restaurant, devoted the evening to the second Liberty Loan, listening to addresses by President A. L. Rohrer and G. E. Emmons.

Philadelphia Section, Association of Iron and Steel Electrical Engineers.—The November meeting will be held Nov. 3 and will be known as the "General Ideas and Discussion" meeting. Every member has been requested to prepare a ten-minute paper on any subject pertaining to the application of electricity to the iron and steel and allied industries. It is suggested that papers be prepared, not only on technical subjects, but also on subjects such as apprentice systems, stock-room methods, cost systems, piece work, etc.

Chicago Engineering Societies' Meetings.—The tentative program of the Chicago Section of the A. I. E. E., with which is affiliated the electrical section of the Western Society of Engineers, has been arranged as follows: On Oct. 22 Lieut.-Col. L. D. Wildman was to speak on "The Engineering Problems of the Signal Corps"; Nov. 25, Bert H. Peck, "Engineering Data for the Determination of an Electric Rate Problem"; Dec. 27, joint luncheon meeting with Electric Club-Jovian League; Jan. 27, Thaddeus Baily, "Electric Furnaces"; Feb. 24, Professor White, University of Michigan, "Electrochemical Processes"; March 24, "Railway Electrification"; April 28, joint meeting with American Society of Mechanical Engineers; May 26, F. A. Vaughan on "Regulation of Street Series Lamps," at a joint meeting with the Illuminating Engineering Society.

New Jersey Utilities Association.—For the third annual convention of this association, meeting Oct. 26 and 27 at Atlantic City, N. J., this program was scheduled: "The Proper Relations Between Public Utilities and Public Utility Commissions," by Ralph E. Donges, president Board of Public Utility Commissioners of New Jersey; "The Problem of Higher Operating Costs and Commission Control of Rates," by Dr. Thomas Conway, Jr., professor of finance, University of Pennsylvania; "Public Utilities Doing Their Bit," by J. L. O'Toole, Newark, N. J.; "Interrelation of Various Obligations for Adequate Utility Facilities Under War Conditions," by George W. Fuller, consulting engineer, New York City, N. Y.; "The Financing of Public Utilities," by T. H. Dudley Perkins of Bioren & Company, bankers, Philadelphia; "The Binding Force of Term Contracts, with Special Relation to Public Utility Rates," by Ralph J. Baker, Harrisburg, Pa.; "The Valuation of Intangibles for Rate-Making Purposes," by Dr. F. Herbert Snow, chief engineer Public Service Commission of Pennsylvania; "Utility Troubles—Their Causes, Effects and Remedies," by W. H. Roth, Philadelphia.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Minimum Rate in Indiana Decision.—The Indiana Public Service Commission has handed down an order in the case of the Indiana Power & Water Company, which has its central station at Edwardsport, Ind., fixing new rates in many southern Indiana towns and cities. The order in general reduces primary rates to electric consumers at Petersburg, Dugger, Bloomfield, Worthington, Odon and Elnora, and provides a slight increase at Bicknell. The latter action places Bicknell rates on a par with those of the company at Vincennes, where operating costs are practically the same as at Bicknell. The commission's order raised the minimum monthly charge for small consumers at Bicknell from 50 cents to 75 cents; at Petersburg this charge was lowered to 85 cents from the former charges of \$1 to \$1.50; Dugger minimum charges were lowered to 85 cents; at Bloomfield, where there had been no minimum before, a minimum of 85 cents was established; at Worthington the minimum was increased to 85 cents; at Odon the minimum was made \$1, and at Elnora the minimum fixed was \$1 monthly. The small consumer primary rate readjustments, when applied generally, will result in average decreases of from 5 to 15 per cent, the commission announced. These schedules were accompanied with the promulgation of a uniform schedule of power rates. The company's territory is in the Indiana coal fields and the low power rates are promulgated to give an impetus to the movement to substitute electricity in the operation of the mines. The company operates in about twenty towns. The commission announced that it had established the minimum charges on a basis of the population of the towns served and their consumption of electricity and also, in a few instances, that the question of the accessibility of the towns to the distributing and generating center had been taken into consideration. The action of the commission in readjusting the rates had been taken with a view to help the company develop its business. In justification of the minimum lighting charges promulgated, the commission points to the contention of the company that it costs \$1.40 a month to serve each individual customer. The order shows that the patrons of the company in the various municipalities "stand receptive to improved service and rate reductions, but if they are to enjoy said benefits it is also incumbent on the comparatively few patrons adversely affected to bear the slight changes that are adjudged to be reasonable."

Preferred Stock Sold by Colorado Company.—The Colorado Power Company has sold to Denver bankers \$100,000 of 7 per cent cumulative preferred stock, which is being offered at par and dividends.

New Director of California Railway & Power Company.—Lyman P. Hammond of Bonbright & Company has been elected a director of the California Railway & Power Company, increasing the directorate to twelve members.

Station Operating Committee, O. E. L. A.—The station operating committee of the Ohio Electric Light Association, of which Henry B. Dates of Cleveland, Ohio, is chairman, will hold its open meetings as follows: Nov. 14, Columbus, Gibson Hotel; Jan. 18, Cleveland; March 13, Dayton; May 15, Toledo.

Private Energy Supplants Municipal Lighting.—The Village President of Fredonia, N. Y., has been authorized to contract with the Niagara & Erie Power Company for electric lighting for the streets, parks and public buildings. The contract will continue for five years. The municipal electric light plant will be discontinued.

Electric Furnace Activity in Northwest.—There are now eight electric furnaces in operation in the Puget Sound district of Washington, all engaged in the reduction of steel scrap. Two of these are of 3-ton capacity, the others being smaller. Several other electric-steel reduction works are in process of construction and more are contemplated. General interest in the electrical phases of the industry in that quarter is manifested.

Colorado Power Company Acquires Competitive System.—Acquisition of the business of the Gem Electric Company, successor to the Boston-Colorado Electric Company, operating as competitor of the Colorado Power Company in the Idaho Springs district, is reported by the Colorado Power Company. The Colorado Power Company acquired only that part of the distribution system which was necessary for carrying on the business. Lines duplicating the system already operated by the Colorado Power Company were removed.

Chicago in the War.—E. W. Lloyd, general contract agent of the Commonwealth Edison Company of Chicago, who is devoting his entire time to his duties as assistant secretary of the Illinois State Council of Defense, described the activities of the council at the weekly luncheon of the Electric Club-Jovian League on Oct. 11. He gave figures to show that so far the Chicago district, which includes the northern part of Illinois and a small portion of Wisconsin, has sent about 90,000 men to the war, contributed four times as many Red Cross members as were asked of it, contributed twice its quota to the Red Cross fund and oversubscribed its allotment of the first Liberty bonds by more than \$100,000,000. Mr. Lloyd said it nettled him a little to hear people say that Chicago is lagging in war activities.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Power Purchase in California.—The Sierra & San Francisco Power Company has filed with the California Railroad Commission a supplemental application for authority to pay out of the proceeds of the sale of \$1,000,000 first mortgage bonds hitherto authorized by the commission \$450,000 for the La Grange division of the Yosemite Power Company. The bonds were authorized in October, 1916, by the commission, to pay for additions and betterments. The Sierra and Yosemite companies have filed applications for the transfer of the property, which was approved.

Change in Control of Cuba Power Company.—Vice Consul George B. Starbuck, Cienfuegos, writes that all the interests of the Cienfuegos Electric & Power Company have been taken over by the Cienfuegos, Palmira & Cruces Electric Railway & Power Company. The purchasing company (until about a year and a half ago practically the property of an American) was organized under a charter of the State of Maine and is said now to be owned and controlled by H. Upmann & Company, Havana, Dr. Julio de la Torre, acting for Dr. Orestes Ferrara, also of Havana, and Cardona & Company of Cienfuegos.

Cities Service Directors Declare Increase in Stock Dividends.—The directors of the Cities Service Company on Oct. 17 declared not only the regular cash and stock quarterly dividends of 0.5 per cent on the common stock, payable Jan. 1, 1918, to stockholders of record Dec. 15, 1917, but also the Feb. 1 dividend. At this date the stockholders will receive a stock dividend of 0.75 per cent (9 per cent per annum), thereby increasing the disbursements in the form of stock by 3 per cent per annum, and as well the 0.5 per cent cash dividend. The regular 0.5 per cent cash dividend on the preferred stock was likewise declared.

Electricians Wanted in the Army.—The United States Army needs electricians and men of many other trades such as iron workers, automobile mechanics, etc., to serve in the army along the lines of their civilian occupations in this country and abroad. Enlistment is open to citizens of the United States or to those who have declared their intention of becoming citizens. They must be between the ages of eighteen and forty-five years and have no one depending on them for support. Men who can qualify for the above positions will be examined physically at recruiting headquarters, 357 Broadway, New York City. Military training is not required, nor are strictly military duties exacted except in emergencies.

Federal Government Needs Stenographers and Typewriters.—The United States Civil Service Commission announces that, owing to the present emergency and the urgent need for eligibles, examinations for stenographer and typewriter and stenographer or typewriter, for both men and women, will be held on each Tuesday until further notice, at a great many places a list of which may be obtained from the commission at Washington. Vacancies in the departmental service, Washington, D. C., will be filled from this examination. The usual entrance salary for this position ranges from \$900 to \$1,200 a year. These examinations have been modified. Full information in regard to the scope and character of the examination, including sample questions, is contained in Form 1424, "Information for Applicants for Stenographer and Typewriter Examinations."

Signal Corps Appeals for Lenses for Aircraft Cameras.—Citizens able to do so are asked to help the Signal Corps of the army get lenses enough for cameras for the fleet of observation airplanes now being built. German lenses can no longer be bought in the open market, and pending the development of a substitute by the Bureau of Standards, which is under way, hundreds are needed at once. Possessors of the following types are urged to notify the photographic division of the Signal Corps, United States Army, Mills Building Annex, Washington, D. C., of the price at which they are willing to sell: Tessar anastigmat lenses, made by Carl Zeiss, Jena, of a working aperture of F. 3.5 or F. 4.5, from 8¼ in. to 20 in. focal length; Bausch & Lomb Zeiss tessars, F. 4.5, from 8¼ in. to 20 in. focal length; Voigtlander Heliar anastigmat lenses, F. 4.5, 8¼ in. to 24 in. focal length.

Civil Service Examination for Laboratory Assistant.—The United States Civil Service Commission announces an open competitive examination for laboratory assistant, for men only, on Nov. 7 and 8, 1917. Vacancies at the United States Navy Yard, Washington, D. C., at entrance salaries ranging from \$3.28 to \$4.48 per diem, depending on qualifications of appointees, and in positions requiring similar qualifications will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer or promotion. It is especially desired to secure eligibles who are qualified to do laboratory work in the Model Basin, where ship models are tested for power and hydrodynamical investigations in connection with the resistance and propulsion of ships are carried out. The laboratory work will also include aerodynamical investigations carried on in the Wind Tunnel in testing models of aeroplanes, dirigibles and other aircraft. While previous experience in either of these two lines of work is desirable, such experience is not necessary, as applicants who have a good engineering education can qualify easily. Applicants should apply for Form 1312 to the Civil Service Commission, Washington, D. C.

Samuel Riebel, engineer at the power plant of the Commonwealth Electric Company, Summit, N. J., for fourteen years, has resigned.

Clarence E. Salisbury, assistant manager of the North Coast Power Company, Vancouver, Wash., has enlisted in the ordnance department of the army and has left for Eugene, Ore.

Sidney G. Vigo, who formerly had charge of the commercial work of the Middle West Utilities Company, Chicago, has been made assistant to the vice-president of the American Public Service Company, with headquarters at Dallas, Tex., in charge of operation, commercial and other departments of the company.

Maurice E. McCormick has resigned as assistant general manager of the Bangor Railway & Electric Company to become assistant general manager of the New Brunswick Power Company, St. John, N. B., Canada. Mr. McCormick had been connected with Bangor (Me.) property for twenty-three years, having worked up to the position he held at the time of his recent resignation.

Everett Morss, president of the Simplex Wire & Cable Company, Boston, has been appointed a member of the priority committee of the Council of National Defense. Mr. Morss is widely known in the electrical industry and has been connected with the Simplex company for thirty-two years. He is a graduate and member of the executive committee of the Massachusetts Institute of Technology.

Hugh L. Cooper, noted hydraulic engineer, New York City, who received a commission as major in the Engineering Corps of the United States Army, has reached France safely and is now engaged in active service. Mr. Cooper is vice-president and chief engineer of the Mississippi River Power Company and was chief engineer of the company's large low-head hydroelectric development at Keokuk, Iowa.

Louis D. Eckard, who for some months has been engaged as superintendent of construction of a copper mine in Alaska, has recently been appointed assistant general manager of the Alaskan Light, Heat & Power Company, with offices at Seattle. Mr. Eckard before going to Alaska was connected with the Philadelphia Electric Company in the distribution and station construction department.

Frederick Bedell, professor of applied electricity at Cornell University, has been serving on a government commission charged with establishing government schools in military aeronautics. Professor Bedell is widely known for his electrical engineering textbooks and for his research in alternating-current phenomena especially as affected by wave forms. Professor Bedell is managing editor of the *Physical Review* and has had a wide experience as a member of important commissions. At the last annual meeting of the American Institute of Electrical Engineers he was elected one of the vice-presidents of the Institute.

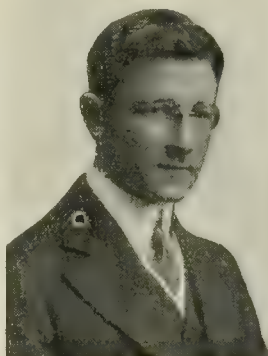
Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

M. H. Flexner, of the power division of the Commonwealth Edison Company, Chicago, has accepted a position with the Booth-Hall Company, manufacturer of electric furnaces in the same city.

Cloyd Hunt, who has been associated with the Minneapolis General Electric Company for several years, has been appointed manager of the newly created Southwestern division of the Northern States Power Company, with headquarters at Montevideo, Minn.

R. J. McClelland, chairman of the Hydroelectric Section of the National Electric Light Association and chief



R. J. M'CLELLAND

engineer of the Electric Bond & Share Company, is receiving congratulations on his marriage on Oct. 13 to Miss L. W. Hendrick of Washington, D. C. Mr. McClelland was born in Iowa in October, 1878. He went to Iowa University and later to Stanford University. He was graduated in 1905 with the degree of B.S. from Union College. Previous to that time he had several years of experience, including a year in the field with Stone & Webster on the Pacific Coast in hydroelectric and transmission construction. For a while he had charge of all of the electrical work on what was the first third-rail system on the Pacific Coast. This line was from Seattle to Tacoma and was for the Puget Sound Electric Company. Mr. McClelland spent some time on the west coast of Mexico in the electrification of old Spanish silver mines and on the light and power supply for Mazatlan. He also had previous experience in hydroelectric and transmission construction in Montana in 1900 on the old Madison River plants. In 1906 he acted for some months as general manager for the hydroelectric and transmission

system in and around Pocatello, Idaho. He joined the Electric Bond & Share Company in November, 1906, shortly after the formation of the company and has been connected with it ever since. He has for a number of years been chief engineer in charge of all extensions, improvements, expenditures, consultations and purchases. Mr. McClelland has taken an active interest in N. E. L. A. activities, and in 1916 he was elected chairman of the Hydroelectric Section, continuing through this year. Mr. McClelland has the added distinction of being a fellow in the Royal Geographical Society of London.

Guy W. Talbot, who was elected president of the Northwest Electric Light & Power Association at its tenth annual convention, recently held at Spokane, Wash., is president of the Pacific Power & Light Company, Portland, Ore. Mr. Talbot was born in Centerville, Mich., on Aug. 12, 1873, and was educated in the public schools of Des Moines, Iowa, and the College of Emporia. He entered railroad work in Des Moines in 1891, following that occupation until March, 1910. During that time he was successively traveling freight and passenger agent for the Des Moines, Northern & Western Railway, traveling freight agent for the Iowa Central Railway, general traveling freight agent for the same road, traffic manager for the Peoria & Pekin Terminal Railway, from which position he was promoted to be general manager and later to be vice-president, serving in the later capacity from 1900 to 1905; vice-president and general manager of the Astoria & Columbia River Railway Company and Corvallis & Eastern Railway Company in 1905, and from 1906 to 1910 vice-president and general manager of the Oregon Electric Railway Company. Since 1910 he has been president and director of the Pacific Power & Light Company, the Portland Gas & Coke Company and the Walla Walla Valley Railway Company, all with headquarters at Portland.

Obituary

George Vasmer Leverett, consulting counsel of the American Telephone & Telegraph Company, died at Boston, Mass., Oct. 18. He was born at Charlestown, Mass., about seventy-two years ago, was educated at Harvard University, and became associated with the Bell system in 1886. For some time he was general counsel of the company.

Guy E. Mitchell, general manager of the Westfield (Mass.) municipal gas and electric lighting department, died in Westfield Oct. 18. He was a native of Lowell, Mass., and was a mechanical engineering graduate of the Massachusetts Institute of Technology, class of 1891. His professional career included consulting work in New York City and electric railway development in association with the late R. D. Gillett of Westfield in the Berkshire district, and he was for a time general manager of the Alden Sampson Company, Pittsfield, Mass.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

ELECTRICAL EXPORTS FOR JULY SMALL IN VOLUME

Figures for the First Seven Months of the Current Year Reach a Total of \$32,682,738—New Listings Made Covering a Number of Products

During the month of July last exports of electrical goods amounted to \$3,827,345, as compared with \$2,995,857 for July of 1916. This figure, however, is somewhat less than that for some of the previous months in the current year. A considerable part of the falling off came in the larger apparatus of the power-house type and in motors, the export of which in July last was but little more in value than in July, 1916, when prices were lower.

Exports for the first seven months of the current year reached a total in value of \$32,682,738, in comparison with approximately \$20,000,000 for the first seven months of 1916. At this rate the exports for the year should reach almost \$60,000,000. However, on account of the growing lack of bottoms for purely commercial use owing to government requirements, it now seems doubtful if the exports of electrical goods from the United States will be much more than \$50,000,000. Even this figure will be a substantial increase over the figures for 1916.

The accompanying figures, which are furnished by the Bureau of Foreign and Domestic Commerce, show for July for the first time detailed figures for a number of products, namely, carbons; heating and cooking apparatus; magnetos, spark plugs, etc.; rheostats and controllers, and switches and accessories. It is largely for this reason that the value of miscellaneous electrical exports was not so great in July as in former months. The value of new items listed amounted in July to, roughly, \$600,000. In comparing, therefore, with previous months this figure should be added to \$1,323,150 for "all others" in order to arrive at the proper total.

Articles Exported	July		Seven Months Ended July	
	1916	1917	1916	1917
Batteries	\$149,512	\$290,312	\$1,012,490	\$2,394,714
Carbons		102,828		†102,828
Dynamos or generators	131,597	96,057	804,793	1,456,192
Fans	28,395	41,245	197,305	379,036
Heating and cooking apparatus		23,295		†23,295
Insulated wire and cables	370,378	357,953	2,091,846	4,327,928
Interior-wiring supplies, including fixtures	82,952	119,994	494,077	753,090
Arc lamps	803	1,962	10,292	11,736
Incandescent lamps:				
Carbon-filament lamps	3,738	23,349	60,282	113,306
Metal-filament lamps	165,132	198,630	872,527	1,629,628
Magnetos, spark plugs, etc.		269,941		†269,941
Meters and measuring instruments ...	46,486	68,630	449,268	626,320
Motors	411,474	411,687	2,736,786	3,699,864
Rheostats and controllers		14,201		†14,201
Switches and accessories		177,052		†177,052
Telegraph apparatus, including wireless..	23,839	14,100	84,602	404,909
Telephones	74,162	180,937	1,023,626	1,269,936
Transformers	62,699	112,022	591,065	854,679
All other	1,444,690	1,323,150	9,505,929	14,174,083
Total	\$2,995,857	\$3,827,345	\$19,934,888	\$32,682,738

†Figures cover period beginning July 1.

PROGRESS TOWARD PLUG STANDARDIZATION SLOW

Development Temporarily Blocked by Inability of Manufacturers to Reach Agreement on Questions of Design, Patents, Etc.

On account of the war policy of the National Electric Light Association's executive committee it has not been feasible to carry on the usual activities of many of the committees of the organization, and in the wiring field particularly concerted efforts toward standardization progress have been lacking. The manufacturers have been intensely busy on government and closely allied work, and for this reason the normal amount of development work has been obliged to suffer. The condition is common to other branches of the electrical industry as well as to that particularly concerned with the manufacture of wire.

In view of the emphasis laid upon conservation of materials and labor, however, it is regarded as unfortunate in some circles that so little real progress has been made during the last few months in the direction of standardizing plugs at the appliance end of the cord. Industrial electric heating devices are in great demand, and it needs little argument to show the advantages which would result from plug standardization on the manufacturing side. At present development along this line appears to be at least temporarily blocked by the inability of all the more representative manufacturers of wiring fittings to reach an agreement on questions of design, patents, etc. On the insurance side conditions are also unsatisfactory, owing to the slowness of the underwriting interests to grasp the importance of adopting a more liberal policy toward improvements of demonstrated worth.

When it is realized that changes in the National Electrical Code proposed as far back as 1914 and brought up for consideration this fall, assuming favorable action in the latter case, cannot go into effect until the code is revised in 1918, the burden of delay upon the electrical industry is indicated. The holding back of improvements far beyond a reasonable time for their application on an extended scale, under proper supervision, on the ground that new developments are *ipso facto* unsafe until otherwise demonstrated, is a very discouraging feature of the present wiring situation.

THE CONTRACTOR-JOBBER PROBLEM ON PACIFIC COAST

Question of Preferential Discount Over Industrial Buyers Now Receiving Considerable Attention from Both Branches of the Trade

A phase of the jobber-contractor problem which has been receiving much attention on the Pacific slope is the old question of preferential discounts.

Taking first the contractors' point of view, their complaint is that jobbers have formed the habit of selling at wholesale discount to large industrial firms and other companies that do their own electrical construction on plant extension, temporarily employing for this purpose such journeymen as are required, and thereby obviating the need of employing a contractor.

The contractors do not object to wholesale discounts on material or supplies for use in maintenance, but when it comes to material for extensions where actual construction work is required, the contractor feels that the jobber is unfair in making it convenient for the owner to do the con-

struction on the day-labor basis. Where the jobber must sell materials for work of this sort direct to owners, the contractor feels he is entitled to protective discounts. This would at least enable the contractor to figure on the work on an even competitive basis instead of under conditions operating to his disadvantage.

Contractors who have made the most strenuous complaints along this line have pointed out that in time to come, when it becomes a question of the elimination of one or the other in the jobber-contractor competition, the contractor can be expected to develop and broaden into the jobbers' field, and even effectively to replace him. The contractor believes it is much more likely that the contractor of the future will take over the jobbers' field than that the jobbers should take on enough of the present contractors' work to eliminate the latter.

To consider the matter from the jobbers' point of view is to face the fact that the men who place the large orders—that is, the big corporations—are unwilling to deal with the small men in the field. In fact, the largest consumers are now even trying to buy from the manufacturer and in some instances have done so at a higher rate than they would have had to pay if they had obtained their supplies from other sources. This circumstance indicates how strong the feeling is that by direct dealing the profits of middlemen are kept low.

If the jobbers took off all of their salesmen, they point out that orders would still come in automatically from larger consumers. Further, if the jobbers were effectively prevented from direct sale to the consumers, this would simply mean that such trade would be diverted to those few large contractor-dealer firms that are able to carry the large stock required. Even in some of the larger Pacific Coast cities, for example, this would mean that such trade would be limited to three or four of the larger contractor-dealers.

The jobbers point out further that there is yet work for the contractors to do in perfecting their own organization before reaching out into this larger field. They cite, for example, the present not infrequent occurrence of a worker quitting his contractor-employer to take on a contract on which he bid in direct competition with the firm by which he was previously employed. Finishing this contract, he returns and is accepted as an employee in good standing by the same firm which had previously employed him.

METAL MARKET SITUATION

Little Activity, with Growing Uneasiness in Copper on Part of Buyers and Dealers

The week showed almost no changes in the metal situation. Lead, under a quiet market, slumped down to 6½ cents and spelter became somewhat weaker. In copper the general situation is about the same except for a growing uneasiness on the part of consumers and dealers. Production reached such low levels during the summer months that it is felt that a shortage may ensue, and this feeling adds to the anxiety that has prevailed owing to the abnormal condition of the market.

NEW YORK METAL MARKET PRICES

	Oct. 16			Oct. 22		
	£	s	d	£	s	d
Copper:						
London, standard spot....	110	0	0	110	0	0
Prime Lake	Govt. price	23.50		Govt. price	23.50	
Electrolytic	Govt. price	23.50		Govt. price	23.50	
Casting	Govt. price	23.50		Govt. price	23.50	
Wire base	30.00	to	32.00*	30.00	to	32.00*
Lead, trust price.....		7.00			6.50	
Nickel, ingot		50.00			50.00	
Sheet zinc, f.o.b. smelter....		19.00			19.00	
Spelter, spot	8.17½	to	8.30	8.05	to	8.17½
Tin, Straits		61.12½			61.50	
Aluminum, 98 to 99 per cent..	35.00	to	37.00*	35.00	to	37.00*

OLD METALS

Heavy copper and wire.....	23.00	to	23.50	22.00	to	23.00
Brass, heavy	14.50	to	16.50	14.00	to	16.00
Brass, light	11.00	to	11.50	11.00	to	11.25
Lead, heavy	6.00	to	6.25	5.25	to	5.50
Zinc, old scrap	5.50	to	6.00	5.50	to	5.75

*Nominal.

THE WEEK IN TRADE

EXCEPT for the growing scarcity of incandescent lamps, there is a steady tone to the market. Prices are very steady except for glass products, which are advancing because of the fundamental conditions with the glass producers. Incandescent lamps are slated to advance, for the first time, on new contracts around the first of the year.

Collections seem to be holding up remarkably well, notwithstanding the new Liberty Loan, although credits are in a somewhat uncertain position.

Certain railroad embargoes have deterred shipments in some directions and with winter approaching this action can be expected more frequently. A severe winter might prove very embarrassing to the industry.

NEW YORK

For the first time in many months the building market has taken on a hopeful aspect. According to the Dow Service Daily Building Reports, big building financiers are now publicly stating their belief that the turn for the better has come.

There is no change in the electrical market, deliveries, demand and prices remaining the same. Wire and lamps are now very difficult to obtain. In the case of lamps it is understood on good authority that for the first time incandescent lamps will advance in price. This advance is set for the first of the year. For a long time this move has been under consideration, but always some economy in production or distribution has developed and postponed such action. Profits have not been so great as before the war, and in the case of some of the smaller manufacturers it is well known that a continuance of present prices would prove financially disastrous. Lamps have been the last of the principal electrical goods to advance in price.

Credits are receiving more and more attention, although collections have not yet begun to fall off seriously.

COLLECTIONS AND CREDITS.—With the current condition of pressure for goods in almost, if not quite, every line and backward deliveries, collections are reported in a very satisfactory state. The acceptance of orders is based very much on the reputation of the buyer's promptness in paying his bills. This discretionary power is being exercised firmly. Credits follow suit in being very firm.

WIRING DEVICES.—The demand in the domestic market is not so active and is "sliding off," as one of the largest distributors phrased it. For export, however, heavy sales are anticipated. Prices are at a peak and no increase is looked for, as the buying would not be stimulated were quotations lowered, the general situation being too uncertain. It is a day-to-day proposition so far as buying is concerned, and no one can tell what may happen to change the relative position of the seller and buyer toward each other. The volume of business is as large as, if not larger than, ever; the difference is only in the character and location of the purchaser. The awarding of a contract by the government to the J. G. White Engineering Corporation of New York City for the construction of a naval and military base in France, to cost upward of \$100,000,000, calls for a large quantity of wiring devices, and this opening evens up the general selling market. Briefly, the level of business in wiring devices is as high as ever, only the outlet is in a new and different direction.

VACUUM CLEANERS.—The scarcity of aluminum is still troubling manufacturers. The substitution of sheet steel, heavily coppered and nickered, for aluminum has already been made in a few factories, and others freely admit the probability of following the same practice.

RANGES.—One manufacturer reports that a type in which sheet aluminum has been essential for linings has been temporarily discontinued, because the metal in suitable sizes cannot be obtained.

CONDUIT.—Pipe in some sizes is fully twelve months back in deliveries, with very little figuring on the future in shipments. Labor shortage and troubles incident to wage demands are reported as the primary cause of the delays. Conduit pipe for interior wiring is in fair supply at firm prices, and deliveries are not so restricted, two and three weeks being promised on accepted orders. The discount in this market is quoted at 45 per cent, as against a comparatively recent announcement of 40 per cent.

SOCKETS.—A scarcity prevails in some quarters. One jobber with a special socket has orders on his books for at least 225,000 pieces which he is unable to deliver. Elsewhere shipments are being made to satisfy urgent demands at no further advances. Difficulty in readily obtaining porcelain, and even the small amount of copper necessary in the brass for socket manufacture, is holding up the filling of orders.

LAMPS.—With jobbers the existence of an acute situation regarding lamps is freely admitted. In one instance 200,000 lamps of all sizes and for every use could be shipped on orders if obtainable. On miniature lamps a delay of six months in delivery is reported elsewhere, with regular sizes six to eight weeks behind. One lamp order amounting to \$40,000, for delivery in thirty days, was promptly declined by a jobber, who declared his lamp business was so pressing that further orders were embarrassing. Small quantities are being shipped daily by jobbers, and were an order for 5000 lamps received for prompt shipment about 100 would be delivered. As it is, goods go out to customers on allotment. Rumors are abroad in the trade of an advance, ranging from 10 to 20 per cent, effective Jan. 1, 1918. This, however, it is understood, will not affect basis of present contracts.

WIRE.—Orders for wire are accepted and quotations are made by the manufacturer with the proviso that they are subject to obtaining copper from the producer. Manufacturers are not buying any more copper than the circumstances of imperative specifications call for. In some places wire is held to be "softer" in price, but no copper is to be had from the producers except at a premium over the official selling figure.

CHICAGO

Certain jobbers are beginning to realize that business is changing because of conditions brought about by the war. One of the chief changes is the fact that the central stations and contractor-dealers in certain territories are finding out more and more that they cannot order from hand to mouth, but must order in reasonable quantities if they expect to get delivery on their material. The tendency seems to be for the retailer to order more standard packages of merchandise, to cut down the number of items in his stock, but to buy a sufficient quantity of staple articles.

PRICES OF COPPER AND STEEL PRODUCTS.—Jobbers throughout the Central West know that manufacturers have bought stocks of materials for more than a year in advance and that price reductions cannot be expected immediately on products which contain copper and steel. The sales organizations and the jobbers are busily explaining this to the dealers, some of whom fail to grasp the situation.

CONSTRUCTION IN NORTHWEST.—Construction reports from the Northwest territory are far from good for the rest of this year. The opinion prevails that 1918 prices will be considerably reduced and that construction work which has long been delayed owing to the high prices can then be satisfactorily carried out. Electrical jobbers in the Northwest territory have a different view of this situation, and doubt is expressed if much construction work will be done even in 1918.

TIME-PAYMENT CAMPAIGNS.—Reports from distribution centers outside of Chicago, such as Kansas City, Minneapolis, St. Paul and Duluth, indicate that the Liberty Bond campaign has not interfered with time-payment appliance campaigns.

CONSTRUCTION IN THE SOUTHWEST.—Reports from Kansas City indicate that jobbers are expecting steadily increasing construction work.

BOSTON

The volume of business continues well sustained in the supply field. Prices are steady, with the exception of a softening tendency in lamp cord, resulting from the quotation of copper at a 34-cent base. Jobbers are well stocked in anticipation of the approaching season of holiday business. An opportunity is noted to start holiday business earlier than ever this year in the field of electrical Christmas gifts to be mailed to members of the American expeditionary forces abroad. Such gifts must be mailed not later than Nov. 15 to reach soldiers in France by Christmas morning, and the opinion is advanced that the time is ripe to develop such sales in the light equipment department during the coming three weeks. Battery lamps in particular should move rapidly in response to this opportunity. Jobbers report that shipments by manufacturers are on the whole improving, although railroad congestion and resulting embargoes are causing much local difficulty in maintaining stocks. Large government orders are being handled, notably in lamps, sockets and switches for the destroyer plant now under construction at Squantum, Mass. Jobbers are feeling a shortage of skilled labor and are actively engaged in training substitute employees to improve their service to the trade. Little building construction outside industrial work is now under way. Collections are somewhat better than within the last few weeks.

APPLIANCES.—Business is growing brisker in household appliance branches, the domestic labor problem being difficult at present. Prices are firm. Washing machines are enjoying a genuine boom; irons are moving freely, and despite the moderate weather, it is very difficult to maintain stocks of electric radiators. Vacuum cleaners are unusually active, but efforts to sell sewing-machine motors do not appear to be meeting with a very satisfactory response.

LAMPS.—Government and industrial orders are heavy. A new purchase form of contract permitting the manufacturer to raise prices is to go into effect Nov. 1. Manufacturers are trying to prevent hoarding and are closely scrutinizing large orders. Deliveries are somewhat slow, and although vigorous efforts are under way to increase production facilities, there seems to be no escape from a shortage this fall.

ELECTRIC SIGNS.—This branch of the trade is facing much uncertainty, in view of the request of the fuel committee (Massachusetts) that the use of signs be temporarily discontinued. Central station authorities question the practical savings resulting from this policy, but are co-operating by refraining from canvassing actively for sign business. The quasi-public authorities hold that the "killing" of signs will stimulate private economy, but the opinion is expressed in the trade that the psychological effect of continued good illumination is worth retaining. Company and free signs for town development are being cut out widely.

INDUSTRIAL ELECTRIC TRUCKS.—Inquiries are very numerous and the outlook was never better in this field. Many sales are being made, and if manufacturers can better deliveries they will reap a harvest.

ELECTRIC COAL LOADERS.—One New England manufacturer reports that he is practically oversold all the time and the demand for this labor-saving machinery is constantly increasing.

MOTORS.—Ordinary industrial business shows a decrease, but the demand for motors for government and related duty is increasing. Prices remain steady, and no further increases are in sight. Stocks are low and immediate deliveries of particular sizes are a matter of chance.

FIBER CONDUIT.—The demand is larger this fall than at this time in other years. Central station orders are being postponed to spring, but industrial and government orders are most active. Six carloads of this material have been ordered for service in connection with the new destroyer plant at Squantum.

ASBESTOS.—Deliveries of about one week can now be had on plain unsanded asbestos board, compared with about four weeks on sanded board. The volume of business is increasing on asbestos insulation of all classes.

ATLANTA

There does not seem to be so much activity this week as there was last. While underlying conditions remain strong and the volume of business steady, a slight lull is noted in the line of general supplies. This may be due to a reaction from strong government pressure on cantonment work in this section for the last few months. Then, too, the large water-power companies in some cases have contracted for industrial power up to their capacity and have reached the point where they will have to spend large sums for extensions and new plants at present prices or stand still and take the chance of securing lower labor and material prices later on. Opinions expressed along this line seem to indicate that the volume of business in general is bound to decrease if the large power companies cease to add more load. There is no appreciable evidence at this time, however, that the temporary lull this week is the reflection of the public utility situation.

The services of a number of electrical helpers have been discontinued at some of the cantonments, and while the more skilled men have been retained the addition of helpers to the industrial field has tended to make the labor situation more easy this week, permitting the completion of urgent jobs and the starting of some new ones. Building continues steady and the number of permits issued for residences and apartments shows no decrease.

TRANSFORMERS.—Considerable improvement is noted in the delivery of standard ratings up to 37.5 kva. In one instance the promise of shipment was brought down from twenty-four to fourteen weeks. Some betterment is also noted in the deliveries of semi-standard ratings. Although the shipment on the above ratings is looking much better, no encouragement is offered on standard or semi-standard ratings, 100 kva. to 300 kva. inclusive, unless a military necessity is shown. These capacities are proving very popular with the government, especially for cantonments.

ELECTRIC RETAIL SALES.—Dealers report an increasing activity this week in almost all household appliances and specialties. There is quite a demand for toasters and grills. Vacuum cleaners and electric washing machines are not going so fast as might be expected. Flatirons are beginning to move briskly. Electric ranges are doing very well considering the section and the class of labor. This line is showing a substantial increase over last year.

CREDITS AND COLLECTIONS.—The Southeastern jobbers are having a very prosperous year, owing to the heavy demand for all classes of supplies from industrial sources, not to mention lucrative government business. As a general rule nice profits and quick turnovers have been made which have given the jobbers more ready cash. This condition has reacted on manufacturers' collections to the extent that they are carrying less paper, the jobbers having reduced outstanding notes appreciably during the last few months. In fact, the jobbers are in better shape in this connection at present than they have been in a long time. On the other hand, some of the larger central stations are asking three to four months, with the privilege of renewal on unpaid balances at expiration.

SEATTLE

The week from the 15th to the 22d shows a marked decrease in business along most lines, particularly in sales to the mills, industrial plants and shipbuilding concerns, as compared with several weeks past. The largest decrease comes from the shipbuilding plants, which until to-day have been closed by strikes. There is a noticeable shortage in high-tension insulators, conduit, large rubber-covered wire, marine fittings, motors and high-wattage lamps which is causing considerable inconvenience. These shortages are expected to increase on account of poor freight conditions, which are daily growing worse. Car shortages in Oregon are serious, and no hope for immediate relief is held out. The labor situation is deplorable throughout the State.

Holiday orders in large amounts are being placed for all energy-consuming devices, particularly washing machines, ranges, vacuum cleaners, etc. Local dealers intend specializing in the sale of Christmas gifts along these staple lines. The last orders for the holiday trade will be placed by Nov.

1. Public utility companies in both the Washington and Oregon field engaging in the "Lighten the labor of the home" campaign report excellent results, including a volume of inquiries and satisfactory sales. Local dealers are doing a remunerative business as a result of the campaign.

Pick-up sales, including fixtures, wiring devices and lamps to the American Lake cantonment, and to the Puget Sound Navy Yard at Bremerton, swelled the volume of the week's activities. The navy yard particularly bought quite heavily.

MOTORS.—Dealers are unable to supply the demand for motors ordered by the lumber mills. Buying from the mills is increasing slowly with a daily reopening of plants which have been tied up with strikes.

WIRE AND POLE-LINE MATERIAL.—The sale of transmission wire and pole-line material to the Pacific Power & Light Corporation, serving the Puget Sound district, was the first sale of this nature of any consequence made recently. The material will be used in extensions in northern Skagit County. The local utility company is making minor improvements and extensions.

TRANSFORMERS, INSULATORS, ETC.—The Board of Public Works has opened bids for the year's supply of distribution and instrument transformers, insulators, etc., involving the expenditure of approximately \$100,000. The smaller contracts went to local firms, while the larger contract is held up for one week.

LAMPS.—The demand is increasing daily and a shortage is being experienced. Prices remain firm with shipments unsatisfactory.

FIXTURES.—Moving slowly, with ample stocks and prices the same.

PROJECTORS.—Floodlamps for guard purposes at mills, shipyards and industrial plants are in great demand. Stocks are ample and prices remain firm.

HEATING APPLIANCES.—The demand for heaters, toasters and percolators is increasing.

SAN FRANCISCO

The prolonged fair weather has permitted the successful harvesting of crops and the completion of construction and field operations generally. As a result of this collections are better than last month and business in general is good. There is a notable tendency on the part of the central stations to conserve financial resources, and to call in salesmen who work on the smaller and less profitable business. This is partly because as much business as can be easily handled can be secured now in industrial lines, and also because of the delayed deliveries and high cost of small transformers and materials used for small installations. This condition has affected electric range sales very materially. It is suggested that the range business has also been hurt by the objection made by central stations to preferential discounts and increase of prices because this has advertised the idea of excessive cost.

WIRE.—Stocks of wire are fair. Deliveries are slow, particularly on weatherproof.

WASHING MACHINES.—The demand for all labor-saving devices continues to be heavy, particularly for washing machines. Stocks are fair just now, but deliveries are slow on all motor-operated devices.

LAMPS.—The Pacific Coast lamp allotment is barely sufficient to supply the demand, and there is sale for all that can be secured. The demand is particularly heavy for type C in the 100-watt size.

CONTROLLERS, SWITCHES, ETC.—Controlling devices, safety switches and other items affected by the recently enacted California safety code continue to be in great demand. Stocks are low and deliveries very slow.

PROJECTORS.—The demand for projectors continues good, and stocks are fair.

TRANSFORMERS.—Deliveries are improving slightly on all sizes of transformers, and this is noted with satisfaction in several quarters, because of the other lines which the transformer shortage has interfered with. It is now hoped that the deliveries will catch up with the demand.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List, per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor

No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE PER 1000 FT.—NEW YORK

Single-Conductor

Less than coil.....	\$61.00 to \$71.00
Coil to 1000 ft.....	59.17 to 68.87

Twin-Conductor

Less than coil.....	\$105.00 to \$135.00
Coil to 1000 ft.....	70.00 to 130.95

DISCOUNT—CHICAGO

Single-Conductor

Less than coil.....	+10%
Coil to 1000 ft.....	-10%

Twin-Conductor

Less than coil.....	+10%
Coil to 1000 ft.....	-10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	+10%
1/5 to std. pkg.....	20%
Std. pkg.....	34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+20% to 12%
1/5 to std. pkg.....	List to 20%
Std. pkg.....	30% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 30.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28	.29

BATTERIES, DRY—Continued CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 30.....	.35	.35
50 to barrel.....	.31 to .3175	.32 to .3275
Barrel lots.....	.28 to .2875	.29 to .2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. Per Coil	List, Per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip.....	\$75.00 \$69.75
3/8-in. double strip.....	75.00 72.00
1/2-in. single strip.....	100.00 93.00
1/2-in. double strip.....	100.00 96.00

NET PER 1000 FT.—CHICAGO

Less Than Coil	Coil to 100 Ft.
3/8-in. single strip.....	\$75.00 \$63.75
3/8-in. double strip.....	78.75 71.25
1/2-in. single strip.....	100.00 85.00
1/2-in. double strip.....	105.00 85.00-95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
3/4.....	.15	2.....	.55
1.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—.....	\$55.00	\$24.50
1/4-in.—.....	60.00	27.00
		23.50

NET PER 1000 FT.—Chicago

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—.....	\$36.67-\$55.00	\$27.50
1/4-in.—.....	\$40.00-\$60.00	\$30.00
		\$25.20-\$27.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List Elbows, List

1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.60
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.....	6% 8%
2500 to 5000 lb.....	9% 11%
(For galvanized deduct six points from above discounts.)	

DISCOUNT—CHICAGO

1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.....	3.8% 5.8%
2500-5000 lb.....	6.8% 8.8%
(For galvanized deduct six points from above discounts.)	

FLATIRONS

NEW YORK

List price.....	\$5.00
Discount.....	30%

CHICAGO

List.....	\$5.00 to \$6.00
Discount.....	25%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK.

	Per 100 Net
Less than 1/5 std. pkg.	\$5.75
1/5 to std. pkg.	4.50
Standard package, 500. List, each,	\$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500. List, each,	\$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B	100	\$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulbs, 3 1/4 in., frosted:		
15-watt—G	25	.50
25-watt—G	25	.50
40-watt—G	25	.50
Round bulbs, 3 3/4 in., frosted:		
60-watt—G	30	.72
Round bulbs, 4 3/8 in., frosted:		
100-watt—G	35	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$33.98
Coil to 1000 ft.	25.82

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$36.56 to \$36.88
Coil to 1000 ft.	27.42 to 27.66

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	\$20.00 to \$29.00
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CHICAGO

Net per 100	\$14.58 to \$38.35
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OUTLET BOXES

Nos.	List, per 100
101—A, A1 1/2, 4 S.C., 6200, 320	\$30.00
102—B.A., 6200 S.E., 300, A.X., 1 1/2, 4 S.	30.00
103—C.A., 9, 4R, B 1 1/2	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list..	25%	20%
\$10.00 to \$50.00 list..	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list..	40%	35%
\$10.00 to \$50.00 list..	50%	45%

PIPE FITTINGS**DISCOUNT—NEW YORK**

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$38.00
1/5 to std. pkg.	\$19.00
Standard package, 2200	List per 1000, \$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80 to \$20.54
1/5 to std. pkg.	13.00 to 19.24
Standard package, 2200	List per 1000, \$20.

PORCELAIN KNOBS**NEW YORK**

	Std. Pkg.	List
Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
	5 1/2 N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg.	\$29.00	\$30.75
1/5 to std. pkg.	15.60	24.20

CHICAGO

	Std. Pkg.	List
Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
	5 1/2 N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg.	\$11.85 to \$18.00	\$20.75 to \$30.75
1/5 to std. pkg.	9.00 to 11.10	16.30 to 24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/2-in. cap key and push sockets	500	\$0.33
1/2-in. cap keyless socket	500	.30
1/2-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:				
30-amp. S. R. S. T.				\$0.80
60-amp. S. P. S. T.				1.20
100-amp. S. P. S. T.				2.25
200-amp. S. P. S. T.				3.48
300-amp. S. P. S. T.				5.34
30-amp. D. P. S. T.				1.20
60-amp. D. P. S. T.				1.78
100-amp. D. P. S. T.				3.38
200-amp. D. P. S. T.				5.20
300-amp. D. P. S. T.				8.00
30-amp. 3 P. S. T.				1.80
60-amp. 3 P. S. T.				2.68
100-amp. 3 P. S. T.				5.08
200-amp. 3 P. S. T.				7.80
300-amp. 3 P. S. T.				12.00

Low Grade:				
30-amp. S. P. S. T.				0.42
60-amp. S. P. S. T.				0.74
100-amp. S. P. S. T.				1.50
200-amp. S. P. S. T.				2.70
30-amp. D. P. S. T.				0.68
60-amp. D. P. S. T.				1.22
100-amp. D. P. S. T.				2.50
200-amp. D. P. S. T.				4.50
30-amp. 3 P. S. T.				1.02
60-amp. 3 P. S. T.				1.84
100-amp. 3 P. S. T.				3.76
200-amp. 3 P. S. T.				6.76

DISCOUNT—NEW YORK

Less than \$10 list.	+5% to 5%
\$10 to \$25 list.	11% to 16%
\$25 to \$50 list.	14% to 24%

DISCOUNT—CHICAGO

Less than \$10 list.	+5% to 5%
\$10 to \$25 list.	11% to 16%
\$25 to \$50 list.	14% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to net
1/5 to std. pkg.	Net to 15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

	List, Each
Union and Similar—	
No. 155	\$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list.	List	..
\$2.00 to \$10.00 list.	20%	..
\$10.00 to \$50.00 list.	30%	..

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list.	25% to 50%	15% to 40%
\$2.00 to \$10.00 list.	25% to 50%	20% to 40%
\$10.00 to \$50.00 list.	25% to 64%	20% to 52%

TOASTERS, UPRIGHT**NEW YORK**

List price	\$6.00
Discount	30%

CHICAGO

List price	\$4.50 to \$5.00
Discount	25% to 30%

WIRE, ANNUNCIATOR**NET PRICE—NEW YORK**

No. 18, less than full spools.	\$0.49
No. 18, full spools.	0.45

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	\$0.65 to \$0.6585
No. 18, full spools.	0.55 to 0.5585

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

Price per 1000 Ft. Net			
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
11	\$18.00	\$14.00	\$11.25
12	27.09	23.22	19.35
10	37.80	32.40	27.00
8	53.34	45.72	38.10
6	84.42	72.36	60.30

CHICAGO

Price per 1000 Ft. Net			
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	\$18.00	\$16.00	\$14.00
12	27.79-28.63	23.82-24.54	19.85-22.50
10	34.44-38.78	30.47-31.57	27.70-28.70
8	48.84	43.13-44.77	39.20-40.70
6	68.25-70.80	62.05-64.00	55.85-57.60

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$37.25
25 to 50 lb.	36.25
50 to 100 lb.	35.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	\$40.35 to \$42.00
25 to 50 lb.	39.35 to 41.00
50 to 100 lb.	28.35 to 40.00

NEW APPARATUS AND APPLIANCES

*A Record of Latest Developments and Improvements in Manufacturers' Products
Used in the Electrical Field*

Single and Three-Phase Electric Furnaces

The Snyder electric furnace was developed particularly for converting steel scrap into high-grade castings in an efficient, rapid and simple manner. These furnaces are now built in either single-phase or three-phase types. In the single-phase furnace only one elec-



THE TILTING ROOF IS A FEATURE OF THIS FURNACE

trode is used, and in the three-phase furnace two relatively small electrodes are used with the third connection through the bottom contact to the bath.

These furnaces are particularly characterized, it is said, by the use of higher voltages with consequently smaller currents, longer arcs and the Snyder system of reactance control. The smaller currents resulting from the higher voltages decrease the necessary size of electrodes, make the matter of handling electrodes simpler, decrease the heat loss due to electrode heat conductivity, and make possible the tilting roof feature by which the furnace can be charged through the top and the necessity of side doors is obviated.

Another important feature of the high-voltage, long-arc furnace with reactance control, it is pointed out, is the diminished surge effect upon power lines, due to the fact that small changes in the arc length have very little effect in percentage.

The tilting-roof feature not only enables the furnace to be recharged in from one to five minutes but saves in the cost of labor and roofs, and with the accompanying doorless feature results in the rapid deoxidization of the metal. This exclusion of oxygen during melting effects a further important saving in the electrodes. On account of the compactness of the furnace and the smallness of heat losses the kilowatt input during the refining period following the melting is cut down to a minimum.

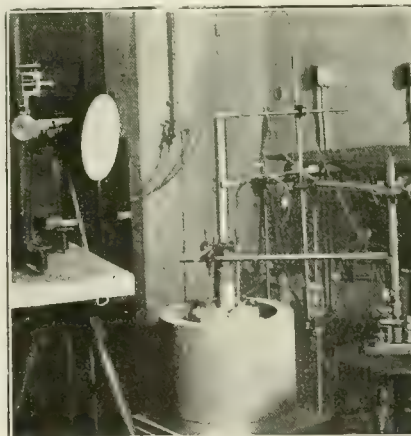
These furnaces are built in three types, those under 1 ton (0.9-t.) ca-

capacity being mounted on trunnions and tipped forward for pouring by hand-wheels. A furnace of 1-ton capacity is built in what is known as the heavy type, which is especially adapted for heavy shank ladling, the position of the spout remaining fixed while the furnace is tilted about a given point. Furnaces of more than 1-ton capacity are mounted on rockers for pouring.

These furnaces are made by the Industrial Electric Furnace Company of Chicago.

Tin Pyrometer

A tin pyrometer for measuring temperatures above the thermocouple range with the use of a direct insertion pyrometer has been developed by the Pyroelectric Instrument Company of Trenton, N. J. The tin is contained in a graphite bulb and expands through a graphite capillary tube. In this way the metal is subject to a reducing atmosphere, which tends to maintain a bright surface and keep the metal pure



FOR MEASURING HIGH TEMPERATURES

and free from dross. The expansion of the graphite is almost negligible in comparison with that of the tin. The tin does not appreciably evaporate until a temperature of presumably 2000 deg. C. is reached so that no difficulty in change of calibration is encountered.

A steel tube containing an insulated contact is lowered down to the capillary tube until it makes a contact with the surface of the tin and thus completes a circuit through an electric buzzer or sounder. The height of the tin is indicated by the position of the upper end of the steel tube which holds a pointer that moves beside a scale. Since the contact is insulated in quartz, which has an inappreciable thermal expansion, the inaccuracy is negligible.

Induction-Motor Control Panels

Where it is desired to combine in one unit the complete control equipment for wound-rotor induction motors, a neat, safe and convenient means either for starting or for speed variation is provided by type RF control panels, manufactured by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. By their use motors are provided with complete protection from injury due to overloads, failure of voltage and improper starting, it is claimed. Panels are suited to all applications where drum controllers may be employed. Each outfit consists of a pipe-mounting slate panel on which are mounted an oil circuit breaker for the primary circuit, a drum controller for the secondary circuit, and when desired one or more meters mounted on the panel. The resistors that are used with these panels are separately mounted.

One of the most interesting features of these panels is an interlock between the oil circuit breaker and the drum controller which renders it impossible for the operator to start the motor without all the resistance in the secondary.

Electric Heater

An electric heater, the top, base and legs of which are made of cast iron, highly nickel-plated, is being offered to the trade by the Allmur Manufacturing Company of Marion, Ind. The drum or body of the heater is of polished sheet steel. The heater is equipped with a patented removable unit which is rated at 600 watts. It is



EQUIPPED WITH A REMOVABLE UNIT

furnished complete with 10 ft. (3.05 m.) of asbestos heater cord and separable attachment plug. This stove stands 14 in. (35.8 cm.) high, diameter of base is 10 in. (25.4 cm.), diameter of the top 9 in. (22.8 cm.), and diameter of the drum, 8 in. (20.0 cm.).

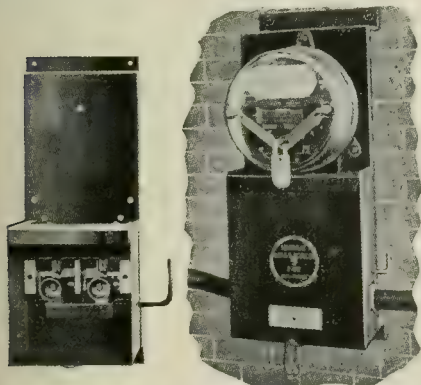
Water Purifier

An electric water purifier that sterilizes water by electrolysis has been developed by the American Utilities Company of St. Joseph, Mich. This device operates on 110-volt alternating-current and direct-current circuits. It has a capacity of purifying 5 gal. (15 l.) of water at one time. The device is equipped with 6 ft. (1.8 m.) of insulated cord and a two-piece attachment plug. With each purifier is furnished a special 2-gal. (7.5-l.) sanitary glass container in which to purify the water, equipped with a non-corrosive faucet for drawing off the purified water above the sediment.

Protective Service and Meter Equipment

The Metropolitan Engineering Company, 35 Vestry Street, New York City, has developed the protective service and meter equipment shown in the accompanying illustration. The manufacturers point out that the benefits resulting from the use of these equipments include tamper-proof and fool-proof features, safeguarding of revenue, continuity of service, prevention of unauthorized interference, safety to life, elimination of fire hazard, uniformity of service equipment, accessibility for tests and repairs, and economy of installation expenses.

This protective device was designed to accommodate all of the modern single-phase watt-hour meters, both two-wire and three-wire, 110 volts and 220 volts, in capacities up to 30 amp. The device is made of wrought steel and designed so that the service switch and service fuses are inclosed with the meter terminals in a sealable service cabinet. The switch is externally operated, permitting of opening or closing the circuit, but offering positive protection against tampering at all times. The service cabinet, all joints



INTERIOR AND EXTERIOR VIEW OF SERVICE BOX

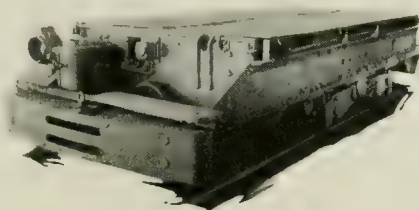
of which are electrically welded, is combined with a metallic mounting board having room at the top for mounting the watt-hour meter. Ample space is provided in the service cabinet for wiring, and several knock-outs are provided for conduit on either side and

bottom of the cabinet to accommodate the incoming and outgoing service and house wires.

Storage-Battery Locomotive

Single-motor drive, which reduces the number of working parts and bearings and at the same time gives a quicker starting torque with simple and efficient control, is one of the advantages claimed for the storage-battery locomotive shown herewith. Specially designed bearings in "radial housings" are used, which give extreme flexibility, insuring the best operation on bad tracks, as with this feature each wheel is in close contact at all times with the rails and consequently gives greater hauling power to the locomotive. A chain drive is used between jack-shaft and axles from which have been eliminated the bad features of the ordinary chain drive. It is provided with special means for easy adjustment, thus enabling a constant tension on the chain to be maintained at all times. All bearings on axles and jack-shafts are self-aligning ball or roller type, thereby giving the greatest efficiency between the motor and rails.

Charging equipment of heavy-duty



LOCOMOTIVE FOR MINE SERVICE

type with automatic features adapted for mine service makes the charging of the storage battery simple and reliable, and does away with the possibility of abusing the battery through excessive use or overcharging, it is said.

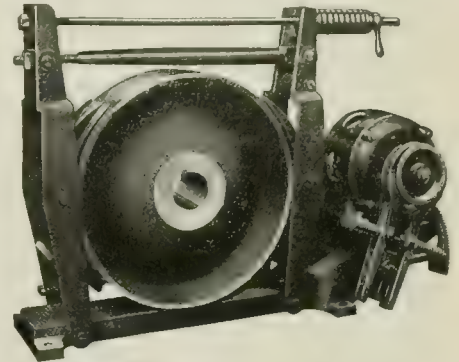
This locomotive is made by the Iron-ton Engine Company of Ironton, Ohio.

Motor-Operated Brakes

Types RS and M are the terms designating an alternating-current, motor-operated brake and a direct-current, magnet-operated brake respectively, recently developed by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis. The alternating-current brake with motor operation has been generally found to be more suitable than one depending on solenoid or magnet operation because of the inherent characteristics of alternating-current solenoids being unsuitable for braking service. The motor-operated brake is silent in releasing, in applying and while held released. A high-torque squirrel-cage motor is employed, geared to a toothed sector, which is linked to the arms carrying the brake-shoes. When power is applied the motor revolves until the brake is released. It then stalls and maintains the brake in the released position until power is cut

off. These brakes are made in sizes ranging from 8 in. to 30 in. (20.3 cm. to 76 cm.), with ratings as high as 250 hp.

The direct-current magnet or solenoid brake is similarly constructed, but has a magnet in place of a motor, the direct-current magnet being suited for



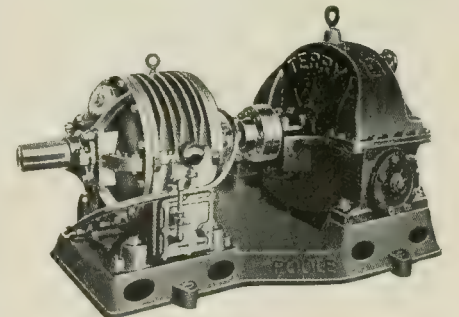
BRAKE IS SILENT IN RELEASING

brake operation. Six standard sizes range from 8 in. to 27 in. (20.3 cm. to 68.6 cm.), with horsepower ratings like the motor-operated type RS brake mentioned. Brakes of this construction are particularly suited for severe service, it is said.

Turbo - Gear for Mill Installations

In many mill installations, especially for line-shaft drives, it is very desirable to have the driving and driven shafts in the same straight line. This construction results in a great saving in floor space as well as permitting a more convenient and better grouping of the units. An interesting application of this character is shown in the accompanying illustration, which shows two 100-hp. turbo-gears direct-connected to motor-driven line shafts, the speed reduction in each case being 730 to 122 r.p.m.

It is pointed out that the gears and motors are mounted on base plates set upon concrete pillars. This brings the gear shaft and line shaft directly in alignment. As the turbo-gear requires



METHOD OF APPLYING GEAR

no subsequent attention or adjustment after being properly installed, it is feasible to mount the gear in the most convenient position. The turbo-gear is manufactured by the Poole Engineering & Machine Company, Woodberry, Baltimore, Md.

Trade Notes

EDWARD C. SOMMER, secretary and treasurer of the Sommer Lighting Fixture Company of New York City, died Sept. 7.

THE GARFIELD MANUFACTURING COMPANY, Garfield, N. J., is the new name of what was formerly the Hemming Manufacturing Company.

THE STANDARD STAMPING COMPANY, Huntington, W. Va., is now occupying its new "daylight" factory. The company was formerly at Marysville, Ohio.

THE WARD LEONARD ELECTRIC COMPANY, Mount Vernon, N. Y., is now represented in Detroit, Mich., by the Electrical Specialties Company, 69 State Street.

W. H. BRAMMAN, formerly with the American Carbon & Battery Company, has become associated with the Walter A. Zelnicker Supply Company, St. Louis, Mo., as assistant to the president.

A. H. BANNISTER has been appointed sales manager of the Western Electric Company at Minneapolis, Minn., effective Oct. 9. He formerly occupied the same position with the company at Omaha, Neb., this place being taken by M. A. Buehler.

THE DOMESTIC ENGINEERING COMPANY, Dayton, Ohio, has worked out a new plan of Delco apprenticeship, which is now in operation. It is approved as much better and more efficient than the former system, giving the apprentices broader and more thorough training.

THE LINDSTROM, SMITH COMPANY, Chicago, has opened an office and warehouse in New York City. S. T. Honey, formerly with the Central Electrical Supplies Company, is in charge. All orders originating in Eastern territory have been placed with the new branch since Oct. 1.

THE AMERICAN APPLIANCE COMPANY, New York City, has purchased the controlling interests of the Metalite Company, Inc. To commemorate this event the Appliance Company gave a dinner at the Hotel McAlpin on the evening of Oct. 4. About thirty guests were present, including leading lamp manufacturers and the managers and sales force of both companies.

THE CONDENSITE COMPANY OF AMERICA, Bloomfield, N. J., in order to facilitate work being done for the government, has formulated conditions under which shipments of its products will be given preference by transportation companies. They are accompanied by the assurance of the Council of National Defense to the same effect.

THE PAGE STEEL & WIRE COMPANY, Monessen, Pa., and Adrian, Mich., is now the corporate name of what was formerly the Page Woven Wire Fence Company. It has opened a branch office at 644 Union Arcade, Pittsburgh, Pa., of which E. C. Sattley will be general manager. Correspondence for the various departments, however, should be addressed as heretofore.

BURWELL S. CUTLER, Buffalo, N. Y., was confirmed as chief of the Bureau of Foreign and Domestic Commerce, Department of Commerce, by the Senate prior to adjournment. Mr. Cutler, who is well known in manufacturing circles in western New York, came into the bureau six months ago to assist in putting the organization on a thoroughly business basis. He was made first assistant chief, but since the resignation of Dr. E. E. Pratt has been acting chief.

THE INDIANA RUBBER & INSULATED WIRE COMPANY, Jonesboro, Ind., has presented all employees who have been in its service for one year or more with a life insurance policy written by the Metropolitan Life Insurance Company, New York. The amount of the policy is in accordance with the number of years of service and will be increased yearly as each employee grows older in the service. The total amount of protection will amount to approximately \$250,000, the expense of which will be paid by the Indiana company.

THE ROBBINS & MYERS COMPANY'S employees on Sept. 22 received their first bonus payments. The total amount of money represented in the distributed checks runs well up into the thousands. Out of approximately 2251 factory employees of the Springfield (Ohio) plant, 1302 received bonus checks, while 464 were handed checks for 3 per cent bonuses for perfect attendance. Any of the last named who continue their perfect records will draw 4 per cent the second month and then 5 per cent attendance bonuses will be paid monthly. The next service checks will come along Dec. 25, for the quarter immediately preceding.

THE NORTHWESTERN ELECTRIC EQUIPMENT COMPANY, St. Paul, Minn., will open for business a new division sales office and warehouse at Duluth, Minn., on Nov. 1. The building has ample dock and railroad facilities. A. M. Baldwin, Jr., will assume charge as district sales manager.

Trade Publications

ROPE TRAMWAY SYSTEM.—Book No. 343, descriptive of "Rope Tramway Systems," has been published by the Link-Belt Company of Chicago.

CARTRIDGE FUSES.—Daum refillable cartridge fuses for electric light and power are described in a bulletin prepared by A. F. Daum of Pittsburgh, Pa.

INSULATING BRICK.—Nonpareil insulating brick for boiler settings is described in a leaflet prepared by the Armstrong Cork & Insulation Company of Pittsburgh, Pa.

PORTABLE RADIATOR.—The Simplex Electric Heating Company of Cambridge, Mass., has issued a leaflet descriptive of its electric portable radiator for lamp socket use.

GAS ENGINES.—The Bruce-MacBeth Engine Company, 2111 Center Street, N. W., Cleveland, Ohio, has prepared bulletin No. 156, descriptive of its multiple-cylinder gas engine.

EXPANDED METALS.—The Consolidated Expanded Metal Companies of Bradock, Pa., is distributing a report from the Underwriters' Laboratories, Inc., on its "Steelcrete" mesh for guards.

PUMPS.—The Worthington Pump & Machinery Corporation, 115 Broadway, New York City, has prepared bulletin No. W-308, descriptive of its Worthington duplex piston pattern pumps for general service.

WIND POWER.—The Economy Power Appliance Company of Tomah, Wis., has prepared a booklet descriptive of its wind power machine for light, power and heat for the home, farm, factory and municipality.

LIGHTING FIXTURES.—The "four-in-one light" is illustrated and described in a book prepared by L. Plant & Company, 432 434 East Twenty-third Street, New York City. These fixtures are said to be dust-proof and bug-proof.

SAND AND GRAVEL WASHERY.—The Link-Belt Company of Chicago is distributing folder No. 340, descriptive of its Link-Belt sand and gravel washery installation at the plant of the Raritan Ridge Clay Company, Metuchen, N. J.

STOVES.—The Standard Electric Stove Company of Toledo, Ohio, is distributing a folder descriptive of its electric stoves. This folder describes an electrotape plate which this company is furnishing for central station companies to use on light bills.

COLORED LACQUERS.—The Moller & Schumann Company, Marcy and Flushing Avenues, Brooklyn, N. Y., has prepared bulletin No. 2, descriptive of its colored lacquers, air-drying and baking types. These lacquers are for use on manufactures of tin, polish, nickel, aluminum, zinc, etc.

STORAGE BATTERIES.—The Chloride accumulator and the Tudor accumulator and parts and accessories are illustrated and described in a bulletin prepared by the Electric Storage Battery Company of Philadelphia, Pa. This company has also prepared a price list section that is issued in connection with the catalog.

GALVANOMETERS.—The Pyroelectric Instrument Company of Trenton, N. J., has prepared circular No. 7, descriptive of its Northrup alternating-current galvanometer. This bulletin also describes the Brooks variable self and mutual inductor, Bureau of Standards type. This company has also prepared circular No. 6, descriptive of its Compton quadrant electrometers for measurements of very small currents or electrostatic potentials.

MEASUREMENT OF HIGHER TEMPERATURE.—"Production and Measurements of the Higher Temperatures" is the title of a bulletin now being distributed by the Pyroelectric Instrument Company, 148 East State Street, Trenton, N. J. This booklet also furnishes information and general comments on temperatures and a description of the Northrup-Ajax high-frequency induction furnace, the Northrup tin pyrometer, the Northrup pyrovolter, alternating-current galvanometer, Bureau of Standards type of variable self and mutual inductor and the Compton quadrant electrometer. All of this apparatus is made by the Pyroelectric Instrument Company.

New Incorporations

THE LIMA (OHIO) STORAGE BATTERY COMPANY has been incorporated with a capital stock of \$5,000 by H. W. L. Kidder, F. I. Bayley and E. R. Fletcher.

H. F. BARDWELL has been appointed New York district manager for the Vanadium-Alloys Steel Company of Pittsburgh and Latrobe, Pa., with offices at 30 Church Street, New York City.

THE COSMOPOLITAN GAS & ELECTRIC SUPPLY COMPANY of New York, N. Y., has been incorporated with a capital stock of \$10,000 by D. and S. Swartz and W. Schlessinger, 280 Bowery, New York, N. Y.

THE HERCULES STORAGE BATTERY COMPANY of West New York, N. J., has been chartered with a capital stock of \$20,000 to manufacture storage batteries. The incorporators are: Alfred J. Ellis, Robert G. Wiencke and M. Wiencke.

THE KANSAS CITY LIGHT COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$750,000. The incorporators are: C. L. Rimplinger, F. A. Armstrong and C. M. Egner of Wilmington, Del.

THE GENERAL APPLIANCE COMPANY OF AMERICA, of Jersey City, has been incorporated by William Fitzgerald, Maxmilian Weil and Henry Solbel. The company is capitalized at \$50,000 and proposes to manufacture and deal in telephone accessories.

THE PORTLAND (TENN.) ELECTRIC COMPANY has been incorporated with a capital stock of \$10,000 to construct and operate an electric plant in Portland. The incorporators are: R. D. Moore, W. C. Skaggs, George W. Moore, W. C. Austin and George G. Moore.

E. ROTHSCCHILD, INC., of New York, N. Y., has filed articles of incorporation with a capital stock of \$10,000 to manufacture private control and watchman's electric clocks. The incorporators are: A. L. Stock, E. and H. J. Rothschild, 277 West Fourth Street, New York, N. Y.

THE CUMANA LIGHT & POWER COMPANY of Cumana, Venezuela, has been chartered with a capital stock of \$50,000 by Arthur W. Britton, Joseph F. Curtin and Samuel B. Howard of New York, N. Y. The company proposes to acquire and operate light and water plants in the city of Cumana.

THE HYGRADE MACHINERY & EQUIPMENT COMPANY of Newark, N. J., has been chartered with a capital stock of \$100,000 to manufacture electrical equipment and appliances. The incorporators are: Frederick A. Holt, Thomas J. Graves and Harry A. Amerta, 22 North Eleventh Street, Newark, N. J.

THE VERO (FLA.) UTILITIES COMPANY has been incorporated with a capital stock of \$20,000 for the purpose of owning and operating power, ice and cold-storage plants, docks, autos and all public utilities. The officers are: C. G. Redstone, president; O. Roach, vice-president; Joseph Hill, secretary and treasurer.

THE AUTOMATIC TROLLEY LOCK COMPANY of the Bronx, New York, N. Y., has been chartered by H. D. Junge, 951 Grant Avenue; L. F. Roggenstein, 1060 Clay Avenue; and J. M. Ruhl, 2426 University Avenue, the Bronx. The company is capitalized at \$100,000 and proposes to buy patent rights and manufacture equipments for railroads, trolley cars, autos, etc.

THE NICHOLAS SABO COMPANY of New York, N. Y., has been incorporated with a capital stock of \$25,000 by N. Sabo, 407 Central Park West, New York, N. Y.; H. Wasserman, 32 Meserole Street, Brooklyn, N. Y., and L. W. Bowen, 46 Manhattan Street, New York, N. Y. The company proposes to manufacture lamp houses for use in connection with moving picture or stereopticon machines.

THE MOTOR STARTER CORPORATION has filed articles of incorporation with the Secretary of State with a capital stock of \$2,000,000. This company was formed to take over the patents of Henry K. Stewart, one of the founders of the Stewart-Warner Speedometer Corporation, and it will also take over the Stewart plant at Long Island City. The company will manufacture not only self-starters but other electrical equipment for automobiles. Among the directors are: Samuel McRoberts, Charles V. Rich, Eric F. Swenson, S. Magnus Swenson and Frank A. Vanderlip.

New England States

DAMARISCOTTA, ME.—The Public Utilities Commission has authorized the Lincoln County Power Company, successor to the Portland Power & Development Company, to execute a mortgage amounting to \$500,000 on its property and to issue \$108,000 in bonds, \$12,400 in preferred stock and \$100,000 in common stock, to be used in payment of properties of the Twin Village Water Company of Damariscotta and the Lincoln County Power Company, which are to be consolidated under the name of the latter. Arrangements have also been made by the Lincoln company for the purchase of the property and franchises of the Boothbay Harbor (Me.) Electric Light & Power Company, which has a distribution system only, taking electricity from the Lincoln County Power Company. The company is also planning to build an electric generating station at Bristol Mills with transmission lines to its present plant at Damariscotta Mills and to a point connecting with the present system at Boothbay Harbor. The cost of the Bristol Mills development is estimated at \$98,000, and the purchase price of the Boothbay Harbor distributing system is placed at \$117,000. Additions and improvements are being made to its present plant at a cost of about \$12,200.

GUILFORD, ME.—The Public Utilities Commission has granted the Piscataquis Woolen Company permission to sell its property, franchises, etc., in Guilford to the Penobscot Bay Electric Company for \$8,000.

NORRIDGEWOCK, ME.—The Central Maine Power Company of Augusta, it is reported, has purchased the Bomazee Rips power at Norridgewock and also the flowage rights at the grist mill here. The old power house near the M. W. Savage property, from where the power for the electric railway between Norridgewock and Madison was once supplied, is again being equipped with machinery and will be added to the trunk line.

CLAREMONT, N. H.—Rapid progress is being made by the Claremont Power Company in the construction of its new substation at Claremont, which will increase its output by 2000 kw. The company has increased the size of its transmission lines to the substation of the Monadnock Mills and is planning for the installation of additional transformers to double the load.

BURLINGTON, VT.—The Municipal Electric Light Department has decided to close down the municipal electric generating plant and purchase energy from the Burlington Light & Power Company. The electric plant will be held.

BOSTON, MASS.—The Edison Electric Illuminating Company of Boston has applied to the Commission on Waterways and Public Lands for permission to lay cables in Neponset River between Commercial Point and Squantum in the cities of Boston and Quincy.

BOSTON, MASS.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 29, for construction of pitch and gravel roof over the boiler room, central power plant building 108, at navy yard, Boston, Mass. Specification (No. 2629) may be obtained upon application to the above bureau or to the commandant of navy yard named.

CAMBRIDGE, MASS.—The committees on wires and lamps has granted the Cambridge Electric Light Company permission to erect and maintain poles in Mount Vernon, Irving, Pilgrim and Second Streets, Putnam Avenue, Berkshire Street, Kendal Square, Huron Avenue, Trowbridge, Elm Street, Gorham Street, Hancock Street, Lechmere Square and Camelia Avenue. The company was also granted permission to install additional cables in conduits in several streets and avenues.

CHICOPPEE, MASS.—The Electric Light Commission has recommended that street-lighting system be improved in the main street in Fairview by changing the 50-cp. lamps for 100-cp. lamps.

FALL RIVER, MASS.—The State Gas and Electric Light Commission has authorized the Fall River Electric Light Company to take by eminent domain the land in Fall River, Swansea, Somerset, Seekonk and Rehoboth for the erection of the proposed high-tension transmission system to the Rhode Island line. Locations for the extension have been granted by the town of Rehoboth, but the towns of Swansea, Somerset and Seekonk have withheld their action until the decision of the commission.

FLORENCE, MASS.—A two-story addition is being erected to the power house of the Northampton plant of the Nonotuck Silk Company in Florence.

MALDEN, MASS.—The Council has given

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

its approval of a five-year street-lighting contract with the Malden Electric Company which provides for an entire revision of the street-lighting system throughout the city. Luminous arc lamps mounted on ornamental iron poles will be placed on Pleasant Street from Malden Square to Summer Street. Arc lamps of high candle-power will be erected in Maplewood, Linden, Suffolk and Oak Grove Squares and luminous arc lamps will replace all lamps now in use.

WEST SPRINGFIELD, MASS.—The Board of Selectmen has granted the Turners Falls (Mass.) Power Company a franchise to extend its transmission lines through the town. The Turners Falls company and the Agawam Electric Company now have the joint contract to extend their transmission lines through Sykes Avenue to Westfield.

HARTFORD, CONN.—The Hartford Electric Light Company is building an addition, 100 ft., to its power plant at Dutch Point. Two new boilers of 1250 hp. each are being installed and also a 10,000-kw. steam turbine, increasing the output of the plant to 36,000 kw.

Middle Atlantic States

BATAVIA, N. Y.—The Genesee Light & Power Company has begun work on the erection of an electric transmission line to transmit energy to Pembroke and Corfu. Electricity will be supplied to residents along the line.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company has been granted an extension of one year to its street-lighting contract by the City Council, to become effective Jan. 1, 1918.

BROOKLYN, N. Y.—An agreement has been reached between the officials of Queens, representatives of large manufacturing interests of Long Island City and the officials of the Brooklyn Rapid Transit Company regarding the proposed extension of the transit company's car lines into Long Island City.

BROOKLYN, N. Y.—Bids will be received by the New York Municipal Railway Corporation, 85 Clinton Street, Brooklyn, until Nov. 1 for the installation of lighting, heating and train-announcing systems for stations on the Culver Line, Brooklyn. Plans and further information may be obtained on application to the office of the chief engineer, Room 602, 85 Clinton Street.

BUFFALO, N. Y.—The New York Central Railroad Company is constructing a power plant at Curtiss and Clarke streets, to cost about \$30,000.

BUFFALO, N. Y.—The Curtiss Aeroplane Corporation is building a steel test house, to cost about \$28,000, at its Elmwood Avenue plant, and also a power house. A testing room is also being erected at its Austin Street plant, at a cost of about \$10,000.

CLYMER, N. Y.—The Clymer Power Corporation has petitioned the Public Service Commission for permission to construct an electric-light plant in Clymer and for an approval of franchise granted by the town.

DEER HARBOR, SHELTER ISLAND, N. Y.—The Public Service Corporation has granted the village of Deer Harbor permission to install and operate a municipal electric-light plant. The village will purchase the property of the Island Realty Company and will make improvements to the plant involving an expenditure of about \$7,000.

DOLGEVILLE, N. Y.—A conduit is being installed from the warehouse of the Daniel Green Felt Shoe Company on Main Street to factory No. 2 on Elm Street, which will carry electric wires, steam pipes, etc., between the two buildings. This, it is said, is part of the plan by which the company proposes to utilize its water power opportunities in the East Canada Creek to operate all of its factories in Dolgeville. A large generator, it is understood, will be installed for that purpose.

EARLVILLE, N. Y.—The Public Service Commission has granted the Earlville Electric Light Company permission to issue \$7,000 in bonds at 90.

JORDAN, N. Y.—The capital stock of the Jordan Electric Light & Power Company has been increased from \$25,000 to \$35,000,

the proceeds to be used for expansion of its system.

LONG ISLAND CITY, N. Y.—The New York & Queens Electric Company, it is reported, contemplates extensions and improvements to its plant. The company recently acquired a site, about 25 ft. by 225 ft., on Mill Street.

NEW YORK, N. Y.—The New York Edison Company is planning to enlarge its employees' building, located along the East River, between Thirty-eighth and Thirty-ninth streets.

NEW YORK, N. Y.—The Board of Aldermen is considering an ordinance providing for the erection of ornamental lamp posts within stoop lines and on sidewalks near the curb in front of places of business and apartment houses.

NEW YORK, N. Y.—Plans are being prepared by McKenzie, Voorhees & Gmelin, 1123 Broadway, New York for the construction of a new telephone exchange building at 227 East Thirtieth Street for the New York Telephone Company, to cost about \$500,000.

NIAGARA FALLS, N. Y.—Plans are being prepared by the Kellogg Products Company for the construction of a new power house in Stephenson Street.

NIAGARA FALLS, N. Y.—The Niagara Falls Gas & Electric Light Company has petitioned the Public Service Commission for permission to issue \$300,000 in bonds for the purpose of building a new gas plant and extensions to mains in various parts of the city.

SARATOGA SPRINGS, N. Y.—The Adirondack Electric Power Corporation of Glens Falls has been awarded a new contract for street-lighting for a period of four years. Under the terms of the new contract the city will receive a much better service for the same amount of money it now pays.

TROY, N. Y.—The general committee in charge of the construction of the new county tuberculosis hospital has authorized a contract with the Wynthskill Hydro-Electric Power Company of West Sand Lake to furnish electricity for lamps and motors for the new hospital.

UTICA, N. Y.—Contract has been awarded by the Mutual Box Company to the John F. Hughes Construction Company, 211 Post Street, for the construction of an addition to its power house in Erie Street, to cost about \$5,000.

ATLANTIC CITY, N. J.—Plans are being prepared by Addison H. Savery of Atlantic City for a new brick and concrete power house for the Haddon Hall Hotel.

ATLANTIC CITY, N. J.—The Board of Utility Commissioners has granted the Atlantic City Electric Company permission to issue \$58,000 in bonds for extensions, improvements, etc.

CAMDEN, N. J.—Preparations are being made by the West Jersey & Seashore Railroad Company for the immediate installation of an electric-signaling system at its Bellevue Avenue station at Hammoncton.

CAMDEN, N. J.—Plans have been approved by the City Council for furnishing telephone service to Petty Island in the Delaware River. Telephone poles will be erected in Van Buren and Twenty-ninth Streets, submarine cable will be laid, and a landing for the cable provided for.

HIGHTSTOWN, N. J.—Permission has been granted by the Board of Public Utility Commissioners to the Electric Light & Power Company of Hightstown to issue \$36,000 in bonds, to provide for extensions and improvements to its system.

NEWARK, N. J.—Plans are being prepared for the erection of a new boiler room addition, 50 ft. by 70 ft., for the Titan Storage Battery Company, 4 Lister Avenue, to cost about \$4,100.

NEWARK, N. J.—Bids, it is understood, will soon be called for by the Board of Freeholders for new electrical equipment to be installed in the new laundry addition at the County Hospital at Overbrook.

NEWTON, N. J.—Contract has been awarded by the Sussex Print Works, 33 Liberty Street, for the construction of a new power house, 50 ft. by 50 ft., on Sparta Avenue, to the William L. Platt Construction Company, United Bank Building, Paterson.

PERTH AMBOY, N. J.—Plans have been prepared by the American Smelting & Refining Company, 120 Broadway, New York, N. Y., for the construction of a new power house, 60 ft. by 70 ft., one story, at its local plant.

RAMSEY, N. J.—The Borough Council has entered into a contract with the Rockland Electric Company for lighting the streets of the borough for a period of five years.

TRENTON, N. J.—Plans are being prepared for the construction of a new pumping station for the John A. Roebbing's Company in Canal Street.

TRENTON, N. J.—Plans have been filed and contract awarded for the erection of a new power house, 40 ft. by 50 ft., for the Luzerne Rubber Company, to cost about \$5,000. Newton K. Bugbee of Trenton has the contract.

CORNWELLS, PA.—Plans have been filed by the Badenhouse Boiler Company for the construction of a new power house, about 40 ft. by 80 ft. Contract has been awarded to A. R. Raff, 1635 Thompson Street, for erection of the building at about \$10,000.

ERIE, PA.—Plans have been prepared by Day & Zimmerman, engineers, 611 Chestnut Street, Philadelphia, for a new power plant at the works of the Erie Forge Company at Fifteenth and Cascade Streets.

HARRISBURG, PA.—The City Council is considering the installation of a new electric-lighting system at Riverside.

HUGHESVILLE, PA.—The Citizens' Electric Light & Power Company has petitioned the Public Service Commission for permission to issue \$10,000 in bonds for improvements, etc., to its system.

NEW CASTLE, PA.—The New Castle Electric Company has petitioned the Public Service Commission to issue \$20,000 in bonds for extensions and improvements to its system.

PHILADELPHIA, PA.—William Steele & Sons, 30 South Fifteenth Street, has been awarded a contract for the construction of an addition to the power plant of H. O. Wilbur at Third and New Streets.

PHILADELPHIA, PA.—Plans are being prepared for alterations and additions to the power house at Sixth Street and Columbia for the Henry Sheip Manufacturing Company. Day & Zimmerman are engineers.

PHILADELPHIA, PA.—A power plant will be erected at the corner of Coinly and Minor Streets for the Quaker City Rubber Company, at a cost of about \$5,000. Barclay, White & Company have the contract for the building.

PHILADELPHIA, PA.—The contract for the construction of the power house to be erected at Thirty-fourth and Pine Streets for the Philadelphia General Hospital has been awarded to the Standard Construction Company at \$238,600. Philip H. Johnson is architect.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 5, for construction of marine barracks, including electrical work, heating, etc., at the navy yard, Philadelphia, Pa. Drawings and specifications (No. 2555) may be obtained upon application to the above bureau or to the commandant of the navy yard named.

POTTSVILLE, PA.—Work has begun on the installation of the ornamental lighting system in the business district.

READING, PA.—The Philadelphia & Reading Railway Company has awarded a contract to the Metropolitan Edison Electric Company of Reading for furnishing electricity (1000 hp.) to its local locomotive and car shops. It is proposed to supply this service direct from the West Reading power plant, which will necessitate an extension of the 13,000-volt transmission line, which now terminates at the works of the Carpenter Steel Company.

SHARON, PA.—The Shenango Valley Electric Light Company has applied to the Public Service Commission for permission to issue \$40,000 in bonds for extensions, improvements, etc., to its system.

WILMINGTON, DEL.—The Electric Hose & Rubber Company, Twenty-first and Dure Streets, Wilmington, is contemplating extensions and improvements to its plant involving an expenditure of about \$20,000. C. D. Garretson is general manager.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company is contemplating the construction of a substation at Falls Road and Pacific Avenue, Woodberry, to furnish electricity to the proposed plant, to be erected nearby, by the Poole Engineering Company. The station will cost about \$2,000 and will be equipped with transformers and converters.

BEL AIR, MD.—Plans are being prepared by the Chesapeake & Potomac Telephone Company of Baltimore for the erection of an exchange building at Bel Air. McKenzie, Voorhees & Gmelin, 1123 Broadway, New York, N. Y., are architects.

CRISFIELD, MD.—The Maryland Utilities Company, recently incorporated with a capital stock of \$100,000, proposes to operate an electric-light and power plant in Crisfield. Albert Emanuel, Louis A. Pettit,

Jr., and L. Paul Ewell are among the incorporators.

SHARPTOWN, MD.—The construction of an electric railway from Sharptown to either Delmar or Salisbury, 11 and 15 miles respectively, is reported to be under consideration. The Board of Trade of Sharptown may give further information.

HUNTINGTON, W. VA.—Steps have been taken for the installation of an ornamental street-lighting system in the business district. John E. Norvell is chairman of the Chamber of Commerce committee on electric service.

NEWPORT NEWS, VA.—Subcontracts, it is reported, have been awarded by James Stewart & Company, 30 Church Street, New York, N. Y., general contractor, for the construction of an office and drafting room for the Newport News Shipbuilding & Drydock Company as follows: To Horn & Brannen Manufacturing Company of Philadelphia, Pa., for electrical fixtures to the W. G. Cornell Company of Washington, D. C., for the installation of electric wiring and fixtures, conduit and wiring, and to the Luminous Unit Company of St. Louis, Mo., for electrical fixtures. The cost of the building, it is reported, is estimated at \$600,000.

NORFOLK, VA.—The Virginia Railway & Power Company has awarded a contract to J. H. Pierce of Norfolk for the construction of a substation, 20 ft. by 25 ft., one story.

NORFOLK, VA.—The Virginia Railway & Power Company has awarded a contract to J. H. Pierce, Law Building, for the construction of a new substation on Forty-seventh Street.

North Central States

DETROIT, MICH.—The Burroughs Adding Machine Company is erecting a new two-story, brick and steel power house at its plant at Third and York Avenues. Albert Kahn is architect.

MUSKEGON, MICH.—The West Michigan Steel Foundry Company contemplates the installation of a 3-ton Booth-Hall electric steel furnace. Electricity to operate the furnace will be supplied by the Consumers' Power Company.

MUSKEGON, MICH.—The Muskegon Light & Traction Company has filed its acceptance with the city of the proposed 30-year franchise recently adopted by the City Council, which will be submitted to the voters at the spring election.

TRAVERSE CITY, MICH.—The Boardman River dam and spillway in Traverse City, owned by the Boardman River Electric Light & Power Company, which was recently destroyed by fire, will be rebuilt at once. W. S. Cook is manager.

CINCINNATI, OHIO.—Estimates submitted to the Court House Commission by Rankin, Kellogg & Crane, architects, for lighting fixtures for the new court house place the cost at between \$80,000 and \$90,000. The commission will receive offers from manufacturers, also, to equip the court house with lighting fixtures for \$80,000. The manufacturers will be allowed to submit individual designs.

CINCINNATI, OHIO.—The Union Gas & Electric Company has been awarded the contract for installing and maintaining boulevard lamps on the following streets: On Race Street, from Fourth to Twelfth; Vine Street, from Fourth to McMicken; Eight Street, from Elm to Broadway, and Pike Street, from Fourth to Pearl. The Board of Control has adopted the single-lamp standards where boulevard lamps are used. The present contract is for \$60 per lamp. Work is to begin within 60 days.

CLEVELAND, OHIO.—Contracts amounting to more than \$150,000 have been approved by the City Board of Control, which include an expenditure of \$67,000 for a concrete foundation for the extension to the municipal electric-light plant.

CLEVELAND, OHIO.—Specifications, it is understood, will soon be issued for machine shop, foundry, forging, sheet metal, woodworking and electrical equipment for the manual training department of the Lakewood schools (Cleveland), amounting to about \$100,000.

COLUMBUS, OHIO.—The Automatic Circuit Breaker Company, 153 North High Street, is remodeling a building at Sixth Street and Wesley Avenue, which will be equipped to manufacture an electrical specialty.

DAYTON, OHIO.—The Duriron Castings Company is planning to install a Booth-Hall electric furnace of ¼-ton capacity for manufacturing its special non-corrosive duriron. Energy will be secured from the Dayton Power & Light Company.

LOVELAND, OHIO.—The property of the Loveland Light & Water Company has been

acquired by the Columbia Gas & Electric interests. The new owners will continue to operate the plant for some time, but eventually electricity to operate the local system will be supplied from the new generating station now being built on the river front at Cincinnati.

PIQUA, OHIO.—An ordinance providing for the installation of an ornamental street-lighting system on Wayne Street, from the Pennsylvania Railroad north to Ash Street and on Ash Street from Wayne Street to Main Street, has been passed by the Council.

LA GRANGE, KY.—The Kentucky Utilities Company of Lexington is erecting an electric transmission line to La Grange, where it was lately granted a franchise. The company has taken over the plant of S. R. Schaff & Company and will furnish a 24-hour service as soon as the line is completed.

LOUISVILLE, KY.—Two new boilers of 500 hp. will be placed in the new boiler house being erected by the Henry Vogt Machine Company to replace those now in use.

LOUISVILLE, KY.—The Embury Box Company is planning to install woodworking and box-making machinery in its factory, recently purchased at \$50,000. The new plant will be equipped with electrically driven machinery.

GREENSBURG, IND.—The contract for the erection of 28 lamp posts around the public square for the new cluster lamps has been awarded to Allen Brothers.

GILLESPIE, ILL.—Plans are being considered by the Southern Illinois Light & Power Company for the erection of a new plant in Gillespie to meet the increasing demand for electrical service in this city and surrounding towns. The construction of an ice plant in connection with the electric plant is also proposed if sufficient patronage is assured. J. J. Frey, 104 East Second Street, Hillsboro, is president.

JOLIET, ILL.—The installation of a new ornamental lighting system in Chicago and Jefferson Streets has practically been decided upon by the City Council. The city also contemplates taking over the maintenance of the lamps.

WAYNESVILLE, ILL.—The National Telephone & Electric Company is planning to install 7000 ft. of underground cable and a new magneto system in Waynesville. The company was recently granted a 25-year franchise in this city.

LANCASTER, WIS.—The Mid-Continental Utilities Company, which owns and operates electric service stations in Boscobel, Fennimore, Galena, Lancaster, McGregor and other towns, is planning to erect an electric transmission line from Boscobel through Wauzeka and Woodman to Prairie du Chien and thence into Iowa, where it will connect with other towns.

MILWAUKEE, WIS.—Plans have been completed for the installation of new electric lamps on Auditorium Square and the thoroughfares leading thereto, also the entire length of Wisconsin Street. Work on the construction of the system will begin at once.

WABENO, WIS.—Plans are being prepared by the G. W. Jones Lumber Company for the construction of a new planing mill, including a 150-hp. steam generating plant, equipped with a 150-hp. Corliss engine, to be erected in connection with sawmill at Wabeno. The cost is estimated at \$40,000.

WAUPACA, WIS.—The Jorgenson Manufacturing Company, recently incorporated with a capital stock of \$70,000, has taken a lease, with the option of purchase, on the factory and water power of the Waupaca Felting Mills. The company is buying machinery and equipment for the manufacture of gas engine primers, carburetors and other automobile accessories. J. P. Jorgenson is president.

MONTEVIDEO, MINN.—The Northern States Power Company is contemplating the construction of a two-story building, 25 ft. by 40 ft., in Montevideo.

FORT DODGE, IOWA.—The Fort Dodge Gas & Electric Company has been granted a new 25-year electric franchise in Fort Dodge.

SAC CITY, IOWA.—The City Council has engaged G. J. Long of Webster City, engineer, to take charge of the engineering work in connection with the construction of the proposed municipal electric-light plant, to cost about \$60,000.

SPILLVILLE, IOWA.—The local electric-lighting system, owned by the Spillville Electric Light Company, has been purchased by Andrew Latimer of Calmar. Mr. Latimer was recently granted a franchise by the Board of County Supervisors to erect electric transmission lines to Spillville, Fort Atkinson and Festina. Energy to operate the new line will be supplied from Clermont.

KANSAS CITY, MO.—The City Council has voted to call an election on Jan. 8, 1918, to vote on the proposal to issue \$700,000 in bonds to establish the first unit of a municipal electric-light plant.

ST. JOSEPH, MO.—The St. Joseph Railway, Light, Heat & Power Company has submitted a new proposition to the City Council offering to furnish electricity for maintaining the entire street-lighting system of the city at the rate of 1½ cents per kw.-hour for the arc lamps and boulevard lamps and \$37.50 per standard for the ornamental lighting system. This is a renewal of the proposal made last winter by the company when there was an agitation to vote bonds to construct a new municipal electric-light plant.

ST. LOUIS, MO.—Steps have been taken by business men on Jefferson Avenue, from Park to Russell Avenue, for the installation of an ornamental lighting system on that thoroughfare.

GARRISON, N. D.—The installation of an electric-lighting plant is under consideration.

MADDOCK, N. D.—Bids will be received until Nov. 5 for the sale of \$7,000 in bonds for an electric-lighting plant in Maddock.

DELL RAPIDS, S. D.—The Northern States Power Company is contemplating the erection of an electric service line from Dell Rapids out about 8 miles.

BANCROFT, NEB.—Bids will be received by the city of Bancroft until Nov. 9 for the installation of a complete electric system, to cost about \$27,000. The Electric Development Company, 803-4 Frances Building, Sioux City, Iowa, is engineer. For details see Searchlight Department.

BLOOMINGTON, NEB.—The installation of an electric generator in the water-works station to be driven by an engine already installed to furnish electricity for lighting the town in emergencies is under consideration by the Town Board.

OMAHA, NEB.—A permit has been granted the Omaha & Council Bluffs Street Railway Company for the construction of a one-story power house on Randolph Street, between Drake Street and the river, to cost \$15,000. William Baumeister has the contract for the building.

ARMA, KAN.—The Kansas Gas & Electric Company of Wichita has been granted a 20-year franchise to erect and operate an electric distributing system on certain streets and alleys in Arma.

CHANUTE, KAN.—The municipal electric plant is now carrying about 40 per cent overload. In order to give good service it will be necessary to enlarge the plant.

NORTON, KAN.—A new engine, costing about \$12,000, will soon be installed in the municipal electric-light plant.

Southern States

LAWNDALE, N. C.—Plans are being considered by the Piedmont Hosiery Company, recently incorporated, for the installation of electrical equipment.

WALHALLA, S. C.—The Hetrick Hosiery Mills, it is reported, is considering equipping its local plant for electrical operation throughout.

CLERMONT, GA.—The Chestatee Railway Company, recently incorporated with a capital stock of \$150,000, contemplates the construction of a railway from Clermont to the mines of the Chestatee Pyrites & Chemical Company, a distance of about 9¼ miles. The incorporators are: N. P. Pratt of Decatur, J. Palmer of Pratt and others.

EASTMAN, GA.—The Georgia & Southern Utilities Company is installing a new 300-hp. engine in plant here. A new generator will soon be installed. Work is progressing on the erection of a new distributing system in the town.

GENEVA, FLA.—The Osceola Cypress Company is contemplating the installation of an electric plant in connection with its proposed mills to saw and plane lumber and manufacture lathes and shingles. E. L. Hunter is president.

LEBANON, TENN.—Bonds to the amount of \$25,000 have been voted for the installation of improvements and extensions to the municipal electric-light plant and waterworks system.

NASHVILLE, TENN.—The contract for the construction of the library building, 80 ft. by 170 ft., three stories, including electric elevator, vault and mechanical plant in basement, to be erected on the college campus, has been awarded by the Peabody College to the Foster-Creighton Company of Nashville; lighting, heating and plumbing contract was awarded to the Standard Engineering Company of Nashville. The cost of the building is estimated at \$150,-

000. R. W. Selvidge is superintendent of construction for the college.

MONTGOMERY, ALA.—The Montgomery (Ala.) Light & Traction Company will begin work at once on the construction of its proposed extension to Camp Sheridan; also double-tracking its street-car line to Pickett Springs.

STUTTGART, ARK.—The City Council, we are informed, has refused to grant S. R. Morgan of Little Rock a franchise to supply electricity in Stuttgart. The Stuttgart Public Service Company, controlled by the Arkansas Light & Power Company of Pine Bluff, furnishes electrical service here.

EUFULA, OKLA.—Plans have been completed for improvements to the water-works system for which bids will soon be asked. The plans provide for a new power house, boiler, pumps, etc. J. L. Lowe is engineer.

TULSA, OKLA.—The Fortier Electric Manufacturing Company, it is reported, will purchase machinery to equip a plant to manufacture time switches, electric washing machines and other devices. U. D. Fortier is manager.

DENNISON, TEX.—Plans are being considered for the installation of an ornamental lighting system on Main Street for a distance of six blocks.

GOOSE CREEK, TEX.—The installation of an electric-light plant in Goose Creek is under consideration. N. L. Nelson of Sour Lake, it is reported, is interested in the project.

Pacific and Mountain States

SEATTLE, WASH.—Sites at Everett and on Lake Washington are being considered by the Sound Paper Company of Seattle on which it will erect a paper mill with a daily capacity of 400 tons, at a cost of about \$6,000,000. The construction of a hydroelectric plant, to cost about \$3,000,000, is included in the project.

SEATTLE, WASH.—The city of Seattle has filed a notice with the United States government of an appropriation of a power site in one of the national reserves within 100 miles of Seattle, where a large hydroelectric project will be developed. This means that the city has abandoned the plan of buying a site already developed, for which bids have been called, but the date of opening was postponed several times and it was finally announced that it has been abandoned. J. D. Ross is superintendent of lighting.

TACOMA, WASH.—Hamilton F. Gronen, commissioner of light and water, has been authorized to purchase electrical devices, such as heaters, ranges, water heaters, etc., at a cost of about \$12,000. He will also soon ask for bids for 50,000 lb. of copper wire, to cost about \$15,000.

EL CERRITO, CAL.—The Board of Trustees of the city of Cerrito has authorized the installation of 20 arc lamps to be erected in various parts of the city. The service will be supplied by the Western States Gas & Electric Company of Richmond.

HOT SPRINGS, CAL.—The installation of an electric-light and power plant in Hot Springs has been completed.

MANTECA, CAL.—The Sjerra & San Francisco Power Company is erecting a small substation at the local refinery of the Spreckels Sugar Company, to be used exclusively for operating the plant.

MOJAVE, CAL.—At an election held recently the proposal to form a lighting district in Mojave was carried. Bids will be received by the Board of Supervisors until Nov. 5 for the installation of a lighting system here.

OKDALE, CAL.—Preparations are being made by the Sierra & San Francisco Power Company of San Francisco for the construction of reservoirs in the mountains above Okdale, and in enlarging its existing ditches and storage dams, which will involve an expenditure of about \$5,000,000. The proposed work consists of the enlargement of the Philadelphia ditch to permit a greater flow of water and the construction of the upper Strawberry dam, which will cost about \$2,225,000 and will take about three years to build. This dam will impound 80,000 acre-ft. of water. After that the Donne's Flat Reservoir, to impound 55,000 acre-ft. of water, will be built, which will cost several millions of dollars. The plans also provide for remodeling of the 9-mile flume at Sand Bar, just above the Stanislaus plant, which will cost about \$1,500,000 and will double the capacity of the power plant.

PLACENTIA, CAL.—An election has been called by the Board of Supervisors to vote on the proposal to create the Placentia lighting district.

RICHMOND, CAL.—The Western States

Gas & Electric Company has received an application from the newly incorporated city of El Cerrito to furnish an electric street-lighting service.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company has been awarded contracts by the Board of Supervisors for furnishing electricity for lighting the Imperial Beach, Normal Heights and Fallbrook lighting districts.

SAN FRANCISCO, CAL.—The Pacific Telephone & Telegraph Company has filed a petition with the State Railroad Commission asking for permission to operate in Marysville, Yuba County, El Paso de Robles, San Luis Obispo County, Stockton, San Joaquin County, and Watsonville, Santa Cruz County.

STANISLAUS, CAL.—The Sierras & San Francisco Power Company of San Francisco is reported to be considering an extension to its local plant, at a cost of about \$1,000,000. The plans provide for doubling the present output of the power station.

STOCKTON, CAL.—An application has been filed by the Western States Gas & Electric Company with the State Water Commission asking permission to appropriate 5000 acre-ft. from Medley Lake and 7000 acre-ft. from Echo Lake, both in El Dorado County, and 8000 acre-ft. from Twin Lakes in Alpine County, for the purpose of developing 2500 hp. at the hydroelectric plant of the American River Electric Company for a period of seven months in the year.

BOISE, IDAHO.—The City Council has authorized an issue of \$1,800 in bonds for the Harrison Boulevard lighting district.

HAILEY, IDAHO.—An election will be held on Nov. 15 to vote on the proposal to issue \$90,000 in bonds for the installation of a municipal electric-light plant in Hailey.

BUTTE, MONT.—In a report to the Mayor and City Council the city electrician recommends the complete reorganization of the city lighting system. The city is still using the same style of lamps in the residence section that was in use 15 years ago. He also recommends that the city secure an estimate for maintenance on 400-cp. 15-amp. Mazda lamps from the Montana Power Company, to be operated on the company's lines, and that the city purchase 470 Mazda pendant lamps, to replace the old-style carbon lamps now in use. New lamps, it is estimated, will cost \$6,500 installed.

WHITEFISH, MONT.—The Northern Idaho & Montana Power Company is contemplating the installation of an improved street-lighting system in Whitefish.

GALLUP, N. M.—The large transformer station on a power line from the Gallup American Coal Company's plant to the city was recently destroyed by fire.

Canada

VANCOUVER, B. C.—The Granby Consolidated Mining, Smelting & Power Company, it is reported, is contemplating the purchase of coal lands in the Nanaimo district of British Columbia, at a cost of more than \$1,000,000.

ST. CATHARINES, ONT.—The Lincoln County Council has decided to light the Queenston and Grimsby stone road. This highway is 27 miles long.

WESTON, ONT.—Plans are being considered by the Water, Power and Light Commission for increasing the output of substation of the municipal electric-lighting system. It is proposed to replace three of the 50-kw. transformers with three having a capacity of 100 kw.

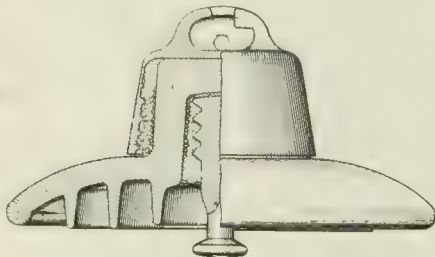
METABETCHOUAN, QUE.—Work will begin at once on the construction of a hydroelectric plant in Metabetchouan, to cost about \$40,000. Eugene Gagne is reported interested in the project. J. A. Claveau of Chicoutimi is engineer.

Miscellaneous

ST. JOHNS, NEWFOUNDLAND.—Application has been made to the City Council by the St. Johns Street Railway Company for permission to extend its car lines in several directions.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Nov. 3, for steel cable, cast-iron pipe, condenser pipe, steel balls, cable thimbles, spelter, copper gauze, etc. Blanks and further information relating to this circular (No. 1177) may be obtained at the above office or the offices of the assistant purchasing agent, 24 State Street, New York, N. Y., and Audubon Building, New Orleans, La.

1,242,907. INSULATOR; Arthur O. Austin, Barberton, Ohio. App. filed May 12, 1916. Improved construction, combination and arrangement of parts by which any stresses or strains due to the unequal expansion or contraction of the parts, or the bursting or blowing out of the insulator proper, may be permitted without causing the actual separation of the parts or causing the insulator unit to fail mechanically.



1,242,907—Insulator

1,242,910. MOTOR-CONTROL SYSTEM; Howard L. Beach, Edgewood Park, Pa. App. filed Aug. 6, 1915. Provides a plurality of resistors, which are connected in shunt relation to the motor armature.

1,242,936. SYSTEM OF DISTRIBUTION AND CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Feb. 19, 1914. Relates to alternating-current, single-phase distribution systems and to the control of polyphase induction motors adapted to be operated therefrom through the agency of a so-called phase converter.

1,242,937. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed May 25, 1914. Special reference to the regulation of phase converters that are employed for converting single-phase alternating-current energy into polyphase energy for supplying polyphase dynamo-electric machines.

1,242,962. TRANSFORMER FOR METERING SYSTEMS; Jesse E. Mateer and Walter R. Woodward, Wilkinsburg, Pa. App. filed Sept. 10, 1915. Combination of voltage and current transformers utilized in a polyphase metering system.

1,242,971. STABILIZING AND POWER-FACTOR CORRECTING MEANS FOR ELECTRICAL CIRCUITS; John F. Peters, Edgewood Park, Pa. App. filed March 4, 1916. Adapted to furnish power to electric arc furnaces or other power-consuming devices.

1,242,988. APPARATUS FOR OXIDIZING GASES; Frank C. Schmitz, New York, N. Y. App. filed Oct. 21, 1914. Improvements.

1,243,004. METHOD OF ELECTRIC WELDING AND ARTICLES PRODUCED THEREBY; Albertis C. Taylor, Warren, Ohio. App. filed March 12, 1917. By the application of pressure and the crossing of two separate electric currents in a restricted area in the opposed meeting surfaces of the said pieces.

1,243,009. ELECTRODE AND PROCESS OF MAKING THE SAME; Jorgen E. Thomsen, Jersey City, N. J. App. filed Feb. 2, 1917. The composition is partly of carbon.

1,243,057. WIRE HANGER; Alexander L. Fox, East St. Louis, Ill. App. filed Dec. 7, 1915. Body is rigidly or firmly clamped between the supporting wire and the connecting yoke, so that it cannot readily be turned either for the purpose of releasing or mounting it without the use of the polygonal enlargement or head on the binding device.

1,243,111. GALVANIC CELL; John F. Sanders, Roseburg, Ore. App. filed July 19, 1915. Improvements in cathodes for galvanic cells.

1,243,166. ELECTRIC SWITCH; Gerald W. Hart, West Hartford, Conn. App. filed July 12, 1916. Produces an electric switch which is subject to manual and electric control in such a manner that it is opened manually and closed electrically.

1,243,202. STORAGE BATTERY; William H. Muzzy, Dayton, Ohio. App. filed Feb. 26, 1916. Evaporated water is automatically replaced.

1,243,204. CURRENT-COLLECTING DEVICE; Louis C. Nichols, Norwood, Ohio. App. filed May 15, 1914. Provides a brush-holder and cross-connecting device of improved construction and capable of being assembled as a unitary device and independently of the casing or other part of the dynamo-electric machine.

1,243,246. OUTLET BOX; William A. Bonnell, Brooklyn, N. Y. App. filed Dec. 24, 1914. Type provided with conduit openings normally closed by means of removable plates, known as knock-outs.

Record of Electrical Patents

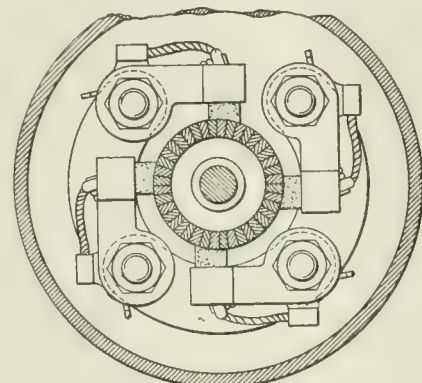
Notes on United States Patents
issued on October 16, 1917

1,243,274. METHOD AND APPARATUS FOR ELECTRICALLY MAKING COPPER TUBES; Elisha Emerson, Auburn, R. I. App. filed Jan. 26, 1917. Provides a fusible ring of a material such as lead and of the diameter which the inner circumference of the tube is to possess, and then rotates the ring in a weak sulphuric-acid solution until the desired metallic thickness has been deposited on the ring; then splits the ring and applies heat thereto so as to cause the lead or other material to melt and run out of the copper tube, leaving the latter finished and ready for use.

1,243,280. ELECTRIC ACTION FOR ORGANS; Ellis F. Frost, Washington, D. C. App. filed Nov. 15, 1915. Improvements.

1,243,283. ELECTRICAL SERVICE CUT-OUT SEAL; William W. Givot, Omaha, Neb. App. filed Aug. 16, 1915. Improvements.

1,243,286. SLIP RING FOR DYNAMO-ELECTRIC MACHINES; Wilhelm Gscheidlen, Berlin-Schmargendorf, Germany. App.



1,243,204—Current-Collecting Device

filed May 28, 1914. Provides a slip ring for machinery of this kind which consists of a material of high conductivity and at the same time possesses great tensile strength in its peripheral direction.

1,243,307. SYSTEM OF DISTRIBUTION AND CONTROL; Benjamin G. Lamme, Pittsburgh, Pa. App. filed March 23, 1914. Has particular reference to phase converters to be employed in converting energy from a single-phase system into polyphase energy for operating dynamo-electric machines.

1,243,308. SIGNAL SYSTEM; Malcolm E. Launbranch, Chicago, Ill. App. filed July 28, 1916. In connection with display signs.

1,243,358. SUPPORTING MEANS FOR ELECTRIC MOTORS; Charles F. Stoddard, Boston, Mass. App. filed Aug. 21, 1911. So designed that the vibration and noise from motors shall be reduced to a minimum.

1,243,368. SEPARATOR FOR STORAGE BATTERIES AND PROCESS OF PRODUCING THE SAME; Theodore A. Willard, Cleveland, Ohio. App. filed June 30, 1914. Improvement.

1,243,369. TUBULAR DIAPHRAGM FOR STORAGE-BATTERY ELECTRODES AND PROCESS OF PRODUCING THE SAME; Theodore A. Willard, Cleveland, Ohio. App. filed Aug. 3, 1914. Improvement.

1,243,370. STORAGE-BATTERY SEPARATOR AND PROCESS OF PRODUCING THE SAME; Theodore A. Willard, Cleveland, Ohio. App. filed Feb. 1, 1915. Such that the separators will have greater mechanical strength and greater porosity, and hence higher efficiency, and can be more cheaply produced.

1,243,412. ELECTRIC SADIRON; Davydd C. Hughes, Chicago, Ill. App. filed Jan. 15, 1917. Consists in the arrangement of the heating elements along the side walls of the base, in means for clamping the elements against these walls, in the structural formation of the heating elements, in improved means for electrically connecting these elements together and to the terminals of the iron, and in the mounting of the terminals upon the base of the iron.

1,243,416. PROCESS OF MAKING ALLOY CASTINGS; Woolsey McA. Johnson, Hartford, Conn. App. filed March 3, 1914. Provision of a process which can be economically operated upon any desired scale, whether large or small, and which is, moreover, capable of operation, if desired, in an intermittent manner and without substantial or material loss of the volatile metal.

1,243,430. SYSTEM OF DISTRIBUTION AND CONTROL; Benjamin G. Lamme, Pittsburgh, Pa. App. filed Dec. 26, 1913. Special reference to the control of railway polyphase induction motors which are adapted to receive energy from a single-phase system of distribution.

1,243,433. DOOR LOCK; William A. Lurie, Chicago, Ill. App. filed Aug. 30, 1915. For controlling the opening of the lock from a distance.

1,243,481. ELECTRIC LIGHT FIXTURE; Richard M. Beard, New York, N. Y. App. filed July 1, 1916. Reflector may be temporarily supported in place while the lamp socket and other portions of the fixture are being secured in position, means being thus furnished whereby the entire fixture may be readily assembled and placed in position by one man.

1,243,482. ELECTRIC PUSH BUTTON; David E. Blair, Montreal, Quebec, Can. App. filed April 10, 1915. Street cars.

1,243,490. ELECTRIC HEATERS; Harry W. Denhard, Milwaukee, Wis. App. filed Jan. 30, 1911. Electric irons.

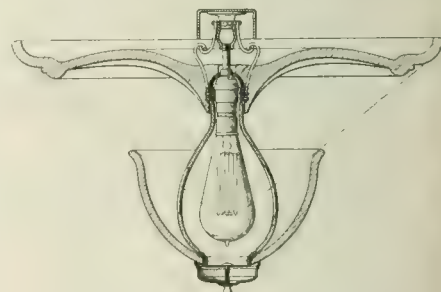
1,243,524. METHOD AND APPARATUS FOR TREATING AIR; William T. Hoofnagle, Glen Ridge, N. J. App. filed May 25, 1915. Relates to an improved method of treating air, gases and vapors electrically, and to an apparatus for carrying out the method.

1,243,571. ELECTRIC CONTROLLING SYSTEM; Herbert S. Valentine, Philadelphia, Pa. App. filed June 30, 1915. Provides a motor-controlling system, including a solenoid or similar brake, a controller and controlling resistance, all so connected that a breakage in the resistance will cut off current from the brake winding and thereby cause setting of the holding brake at any running position of the controller.

1,243,589. ART OF ARC WELDING, HEATING AND METAL WORKING; Charles L. Coffin, Parks, Ga. App. filed April 5, 1916. Improvements.

1,243,608. THERMOSTATIC INDICATOR; John M. Johnson, Kansas City, Mo. App. filed May 24, 1917. For disclosing the temperature of automobile radiators and the temperature of the water therein.

1,243,628. VIBRATOR; Walter van B. Roberts, Princeton, N. J. App. filed June 2, 1916. For use in foundries and similar places.



1,243,481—Electric Light Fixture

1,243,665. CONTROLLER FOR ELECTRIC MOTORS; George H. Whittingham, Bancroft Park, Md. App. filed Nov. 8, 1915. For driving individual machines.

1,243,675. STANDARD ELECTRIC LAMP; George T. Irwin, Toronto, Ontario, Can. App. filed Nov. 6, 1916. Means whereby a lamp bulb and shade may be adjusted to any desired position convenient to the user.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN

Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, NOVEMBER 3, 1917

No. 18

The Transportation Tangle

EVERY one who has interest in the shipment of electrical supplies and necessities is feeling the pinch of bad freight service. The number of express shipments has risen enormously under this compulsion, as have also the transportation charges which must stand on the purchaser's books in one form or another. Quite aside from the matter of fuel, everything that is necessary in electrical service is in the same unhappy condition. Embargoes come and go without warning, and in certain parts of the country where munition works are dominant there is virtually, if not officially, an embargo all the time. If the public service corporations are to carry on business successfully, they must somehow be able to get supplies just like other manufacturing concerns, and it is worth while stopping to look into the nature of some of the difficulties. The chief difference between transportation by freight and by express lies in organization. Freight shipments are delayed, not by insufficient speed of the trains, but by getting tied up at junctions, by cars getting lost on the sidings, and in general by a rather slovenly way of handling the whole matter. Part of the difficulty lies with the railway men themselves, who are just now swamped with an amount of traffic enormously greater than they have been used to taking care of; but the chief burden is chargeable not to inefficiency but to incompleteness of the organization complicated by grave faults on the part of the shippers.

One of the most formidable difficulties with which railway men have had to contend in the past is inability to compel shippers to load and unload cars promptly. Freight cars are convenient storage space for many purposes. If a little mistake has been made in the preparation of a shipment for an expected date, it is a perfectly simple thing to prevent the rolling stock from rolling while awaiting its completion. If it is inconvenient to unload a car to-day, to-morrow or next day will serve. Besides this there is the still further abuse of material being held up in cars waiting for a change in the market, a situation of which many examples have been pointed out in the newspapers, with reference particularly to speculative food shipments. Now, if consignees are going to get goods with any degree of promptness, all must co-operate in seeing that no car is delayed an hour beyond the time necessary for the getting of goods which are ready at hand into the car or getting them out into storage.

The possible function of the electric roads in a carefully planned freight-carrying system ought to be studied very thoroughly. Very many electric roads have freight franchises already, and in this time of

necessity a great extension in freight-carrying privileges would seem desirable. Virtually all the electric roads are of standard gage and have roadbed and rails capable of carrying freight cars. It would be somewhat astonishing to the average man to see how many efficient routes between important termini could be worked out over existing electric roads with a little increase of the facilities for interchanging traffic between them and the steam roads. The free use of the electric lines would very frequently put an important parallel route into service. The electric roads are the capillaries of the industrial circulation, and when an artery of traffic is tied they can be put to important, even if abnormal and temporary, use.

Minimum Cost of Transformer Design

A CONSTANT-POTENTIAL lighting transformer is a device for delivering power at standard frequency to a secondary circuit when connected to constant-potential, high-tension mains. Under such conditions it might be supposed that the form, dimensions and weight of a transformer for a given output could be accurately determined and fixed. As a matter of experience, however, there are no fixed and definite designs or dimensions for a transformer. It is impossible to say that any single design or set of dimensions is the best possible. The question at once arises, for what best conditions is the design made? Is it for best efficiency at rated load, or for average load regardless of cost? Or is it for the minimum cost of production without regard to efficiency? Or, again, is it for minimum temperature elevation, or for best automatic voltage regulation? The various criteria of production cost, operating cost, bulk, weight, pressure regulation, efficiency, temperature elevation, factor of dielectric strength, etc., are more or less in mutual conflict; so that a design which inclines specially toward one of these criteria may not conform to the others. Under a given set of commercial conditions transformer designs tend to a certain general compromise, which results in a satisfactory transformer, all things being considered and in the order of their greatest importance.

Although transformer designs have to be compromises, and although the actual dimensions employed may range over moderately wide limits without departing from ordinary specified requirements, yet it is desirable to have rules for determining specific dimensions under narrower conditions than those ordinarily encountered. For example, it is desirable to be able to find the best design dimensions for a trans-

former in which economy of materials shall be the essential condition, or again for another transformer in which the minimum losses of power shall occur. These narrower problems may not be capable of being solved in general terms absolutely; but they may be capable of being solved for a particular type of structure, such as for a core transformer or for a shell transformer of known factory type, the detailed dimensions of which are to be found. When the designer possesses rules for solving these design problems, one by one, he is able to ascertain how far his final design for general compromise under multiple conditions departs from the best designs for each single condition in turn.

The article of Prof. B. C. Dennison which appears this week discusses several of these specific designs of constant-potential transformers, with particular reference to transformers supplying customers from distributing mains and where neither the currents nor the voltages are excessive.

It is interesting to observe that in Fig. 10 the total costs of core and coils entering into a series of designs for a given set of conditions are discussed with reference to certain dimensional ratios X , Y and Z . Over a reasonably wide range these curves are fairly flat, indicating that these ratios may be modified to a certain extent on each side of the minimum value without greatly increasing the total cost of material.

Industrial Applications of Electric Power

IN THIS issue Prof. C. E. Clewell presents the first of a series of articles relating to the broad field of engineering applications of electric power to industrial operations. There can be no doubt as to the vast influence which manufactured power has had in the industrial development of the country during the last few years. In fact, it is problematical whether this remarkable progress in manufacture would have been realized without the corresponding developments in ways and means of applying power which have characterized many steps of industrial efficiency.

As Professor Clewell points out, these applications of power have been greatly affected by the electric motor because of its high efficiency in both large and small sizes, and moreover by the increased flexibility in transmission and distribution permitted with electricity as a substitute for the older methods of line shafting and belt drives. In these articles, therefore, aside from the detailed discussions of various specific motor and control applications, an important emphasis will be given to the ways in which the motor has proved superiority over older methods and older factory power sources.

A significant feature of the first article is the large importance which it attaches to the engineering possibilities in this field of applied power. The peculiar character of the work calls for the specially trained engineer who has ability to analyze not only the electrical problems connected with the motor and its operation, but who can, moreover, analyze with equal

skill the mechanical features of the machinery to be driven and thus combine in his solution the most efficient types of motor and control to operate the machinery at lowest first cost and the least possible operating expense.

That this is particularly difficult engineering is evidenced by the fact that more than ordinary trouble has been experienced in finding men capable of handling successfully the problems concerned with motor applications, including, as such problems do, a large proportion of mechanical as well as electrical engineering details, and often presenting perplexing and indefinite features. In other words, the special province of the application engineer is a given problem with many factors and indefinite relations which must be reduced to a definite basis by careful study and analysis.

Some of the ways in which such an analysis may be approached are shown by practical charts. Through these Professor Clewell indicates the processes of a manufacturing organization by definite outlines and thus the close relationship between the electric power problem and many of the branches in the average industrial organization, some of which at first glance might seem to have no connection with the economic influences produced by electric drive. One of the most striking points is the fundamental importance of the motor in the conservation of labor expense, a feature set forth clearly by contrasting the great differences between various typical industries on the basis of the value added to the product by manufacture.

In the study of factory power, and more particularly of the electric motor, the outstanding items of power economy and increased production may be looked upon sometimes as dependent merely on the relative electrical and mechanical efficiencies of the various motors, on the one hand, and the actual increase in output brought about through a motor-driven machine, on the other. However, as the author points out, while these two items do constitute the starting point in most of the problems, the expert is confronted with a large number of factors, any one or all of which may make up the net advantages included by these two primary items.

Any given example may thus be resolved into a study of the type of motor and control available for the particular requirements, corresponding study into the mechanical requirements themselves, and a summary of the operating conditions which may be expected to follow application of the motor. Furthermore, these considerations are rendered more valuable by proper emphasis upon the economies afforded by the adoption of such a system of drive in comparison with older methods. Since Professor Clewell has had the close co-operation not only of motor and controller manufacturers but also of prominent machine tool builders, the viewpoint is that of these two groups together with that of the user of the product. Taken as a whole, the subject matter is of unusual and widespread interest and includes factors of much importance to a number of the branches in electrical engineering and manufacturing:

Development in Incandescent Lighting

THE address before the Illuminating Engineering Society in Chicago by President Stickney, an abstract of which we published in last week's issue, is an interesting contribution to our knowledge of the current situation. The profession well knows how close Mr. Stickney has been to the development of modern lighting for some years past and how shrewd and sound his judgments of development are likely to be. An interesting fact which will be entirely new to the general public is the effect of the coming of war conditions on lamp manufacture. Some of the necessary materials are not so readily and cheaply available as they once were, and the engineers have been hard put to it at times to overcome the sudden difficulties with which they have been confronted. The manufacture of the modern incandescents is still in a state of flux, and the engineers are necessarily cautious about trying to fill rigid specifications lest they find that in so doing they run into unforeseen difficulties which may work out badly for the consumer whom improvements are intended to benefit. For the same reason they are fighting unusually shy of special lamps unless for well-defined purposes where the demand is clear and definite, such, for example, as the incandescent lamps for motion-picture projection. The use of the arc has long been a nuisance in this field of work, and certainly for the smaller houses not projecting pictures upon a large scale of magnification the new incandescent lamps will fill a long-felt want.

One very curious fact to which Mr. Stickney called attention is the relative increase of the carbon lamp, which we have generally supposed to be almost obsolete. For this condition Mr. Stickney could not suggest any really plausible explanation. Possibly, we think, the chief reason may be the fact that the smaller metallic-filament lamps are not yet generally on the free list of companies which furnish free renewals, and are relatively expensive in paid renewals. Often, therefore, the consumer would rather pay a larger bill for energy to avoid renewal expense, which sometimes comes in relatively large amounts. This is quite in line psychologically with the general fact that a man will pay an expected bill much more cheerfully than an unexpected one thrust suddenly upon him, even though the latter may represent, as it does in the case of incandescent lighting, a real economy. Pressure is being brought now on the users of light to cut down their consumption, and it strikes us that the wise method of doing

this is to use lamps consuming less energy and more skillfully installed, instead of cutting out altogether illumination which is really valuable and ought not to be discontinued. Included in these efforts at economy must be the utilization to its fullest value of the gas-filled lamp. This is now only partly developed, but the signs are clear that in the future it is going to prove one of the important solutions of the economical lighting problem, to an extent which the average consumer does not yet realize.

Perhaps the most important single truth that Mr. Stickney drove home in his address is that at the present time there is a real demand for color modification in illumination. This takes two directions, first, approximation to daylight effects, and, second, variations of hue for purely artistic reasons. Light with modern lamps and the present prices for energy is astonishingly cheap, perhaps the cheapest manufactured necessity, and certainly the only one which has consistently fallen in price through a period of astounding increase in the cost of everything else one needs. The effect of the blue-bulb gas-filled lamp in the accurate presentation of colors is well known. Mr. Stickney points out that the CO₂ tube gives more precisely daylight values for color matching, but the blue lamp, or a lamp scientifically blue-screened, gives sufficiently close approximation for most purposes at very much higher efficiency. On the other hand, lamps tending toward a yellow or amber certainly give very rich interior lighting and a far pleasanter effect than the unmodified metallic-filament lamps. The interesting feature of their use is that by their means illumination of warm and pleasant tone can be obtained at a very moderate sacrifice of efficiency, leaving the unit far better economically than the older illuminants of the approximately desired hue. The National Electric Light Association has a committee working on this very problem, and ere long some definite and useful results should be obtained. To compensate the branch of lighting in which war conditions may render economy necessary comes the advent of protective lighting for the many works associated with the forwarding of the war. To go into details of these is manifestly improper. It is sufficient to say that well-installed protective lighting will probably go far to check those criminal activities the extent of which is already too evident. Despite the war, incandescent lighting is going forward, not backward, and the lighting companies on the whole are going to do more business instead of less.

THE second installment by Prof. C. E. Clewell on engineering problems involved in industrial motor and control applications will be presented in the next issue of the ELECTRICAL WORLD. He will discuss the tendency of industrial plants to adopt central station service under present conditions, pointing out the relative economy of privately developed and purchased energy. Cases will be cited where the isolated plant is essential, and the author will give an impartial statement of the advantages

The Coming Issues

and economies of central station power. Another feature of the Nov. 10 issue will be a symposium on the success which has been attained with different makes of stokers in burning low-grade fuels. In addition, a contribution will be presented by A. O. Austin on the precautions to be observed in insulating high-voltage lines, the increased possibility of interruption with extension of a system or failure of a few units of a suspension string, etc., and there will be other timely contributions.

Electric Power for Industrial Operations

The Importance of Electric Drive in Industries Where Labor Constitutes a Large Percentage of Production Expense—Necessity of Basing Selection of Equipment on Practical Data

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

SYNOPSIS.—This article treats of the influence of electric power on manufacture as one of the principal items which have contributed to manufacturing development, the part played by manufacture in adding to the value of industrial products showing the large distinction which sometimes exists between the gross value of a product and the labor item. The points of special interest in any industry are discussed in their relation to the power problem. Analysis of the various items which go to make up the selling price and examples of certain methods are employed to contrast steam versus electric operation. The article is concluded by a brief discussion of the general grouping of industrial operations according to the nature of their load characteristics, with considerable emphasis on the principal advantages of electric motor drive and a summary of the ways and means whereby these advantages may be secured.

PROBABLY the most powerful and dominating single influence which has contributed to industrial development is the applicability of electric power to such a variety of purposes. The coming of the steam engine, in spite of its enormous beneficial effects, resulted in many limitations. Among these was the necessity of installing the engines near the factory floors because of the impossibility of mechanical power transmission over more than short distances. While the steam engine presented the possibility of high efficiencies in large sizes, it became relatively inefficient in small sizes. Moreover, there was no easy and convenient means for transforming the mechanical power of the engine into light, chemical energy or even heat, nor for efficiently breaking up the power supply required by a large factory floor into small units.

On the other hand, the development of electric generators and motors has been the means for the application of power in new ways, the motor in particular having permitted higher efficiency in small as well as large units. Moreover, the adoption of electric light and power in the various industries has been the basis of greatly increased flexibility in the arrangement of buildings and machinery, due primarily to the many advantages of power transmission and distribution in electrical rather than mechanical form.

With the increasing adoption of electric power for industrial purposes a new field has opened for the trained engineer in the study and handling of those special problems relating to industrial motor applications. To him is assigned the task of reducing the whole problem to a scientific and effectively practical basis. The following notes will indicate that the problem, while often involved and difficult, is susceptible to fairly definite analysis.

FACTORS IN THE VALUE OF AN INDUSTRIAL PRODUCT

Any comprehensive study of the motor application field should take due account at the outset of the elements which enter into the problem of manufacture. Foremost, perhaps, in these elements as related to the power problem is the value which is added to any

product by manufacture. In other words, what part of the final value of any product has been due to the basic cost of materials and how much has been the result of workmanship during the operations of manufacture?

Several typical cases¹ are illustrated in Fig. 1. The first case shows the average condition for all manufacture. That is to say, of a total of somewhat over twenty billions of dollars given as the gross value of all manufactured products in 1909, about 40 per cent, or about eight and a half billions, represents the value added by manufacture.

In a case like the second in Fig. 1, where the value added by manufacture is only 12 per cent, it follows that the cost of materials forms a very high percentage of the final value, and it would be expected that the

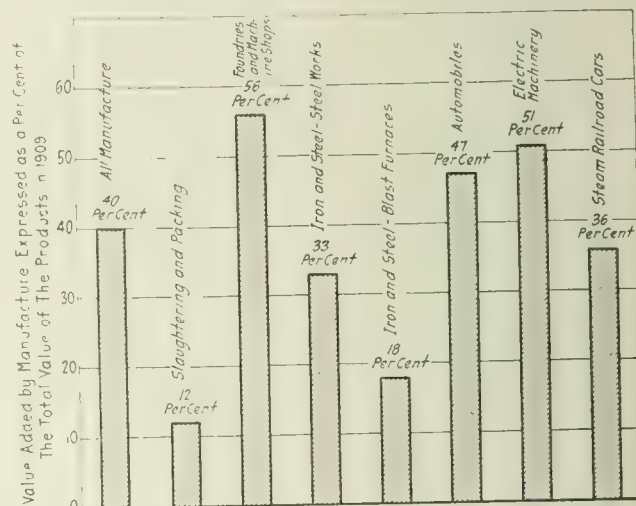


FIG. 1.—PERCENTAGE OF THE TOTAL VALUE OF PRODUCTS IN CERTAIN INDUSTRIES CONTRIBUTED BY MANUFACTURE

labor item would be correspondingly small. This as a matter of fact is true, the wage-earners employed in the slaughtering and packing industry being only about one-sixth of those in the foundry and machine-shop industry in spite of the fact that the former, according to 1909 census reports, is higher in the gross value of products than the latter.

The reason for emphasizing this point is to call attention to the wide variations in the labor item for different industries, because, as will be pointed out in the development of the subject, the effects of economy in scientific motor applications often lie far more in the indirect result of the aid to labor in making possible more efficient production than in the direct results of economy through the use of more efficient motors with the attendant great reduction of mechanical losses

¹Figs. 1, 2, 3 and 5 have been designed by the author on a basis of information found in the excellent papers on this subject by D. B. Rushmore, *Transactions A. I. E. E.*, Vol. XXXIV, pp. 171, 1276, 1277 and 1282.

in contrast to line-shaft drive. Hence the greatest advantages of the motor may be expected in those industries where labor predominates or at least forms a relatively large proportion of the final gross value of any given product.

From a glance at the chart in Fig. 2 it might be concluded that the motor application problem is related

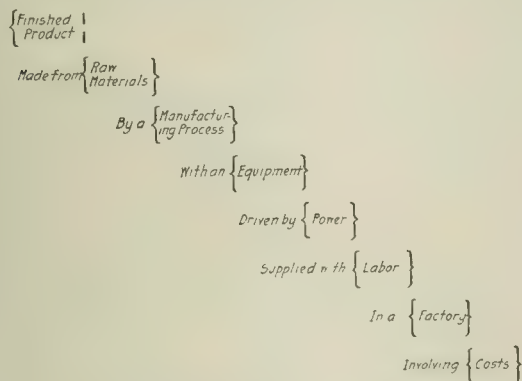


FIG. 2—DIAGRAMMATIC REPRESENTATION OF PRINCIPAL POINTS OF INTEREST IN ANY INDUSTRY

to only one or two of the items listed—power and possibly labor. A closer study will show, however, that practically all of the items are more or less intimately tied up with effective power supply. Thus the original and operating costs as well as the actual arrangements of buildings may be considerably influenced by the method of power supply. Labor, power and equipment are in like manner all influenced to a greater or less extent, the labor by its ability to do more and better work with a well-designed power supply, the power being decreased by any increase in the efficiency of the method of drive, and even the equipment itself often being modified both in original design and in its placement on the shop floors and its operation by the method of drive.

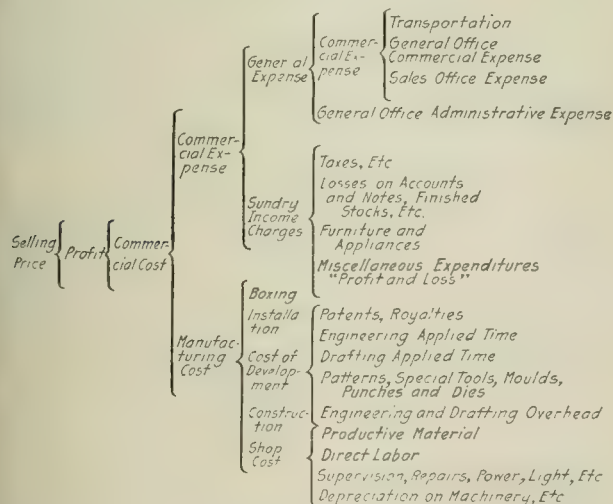


FIG. 3—RELATIVE VALUES OF FUNDAMENTAL POINTS INVOLVED IN THE COST OF A FINISHED PRODUCT

In somewhat the same manner it might be shown that one manufacturing process in contrast to some other process for accomplishing the same results may have a bearing either directly or indirectly on the power problem, and finally the nature of the raw materials will influence considerably the horsepower requirements of given machine tools and will also tend to influence the rate of production in certain cases.

Hence, as a general preliminary proposition, it may be concluded that practically every phase in the logical analysis of manufacture has in one way or another a larger or smaller relation to the question of the power supply. The purpose, however, in amplifying these interrelations is not to magnify unduly the power

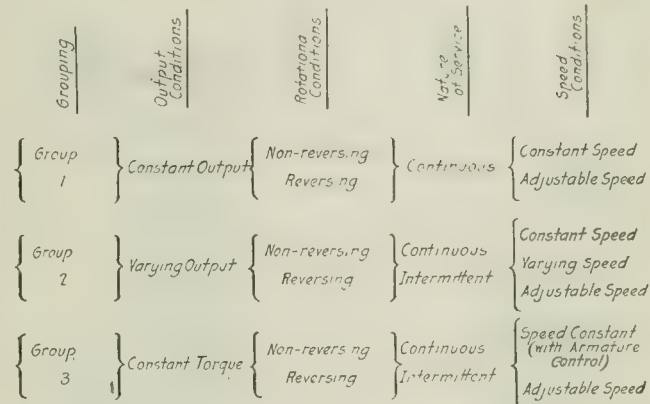


FIG. 4—ONE PLAN OF GROUPING, BASED ON THE CHARACTERISTICS OF THE VARIOUS TYPICAL LOADS

problem, but merely to point to the fact that the influences of motor drive are usually broader and more numerous than that covered merely by economy through reduced friction and belt losses. This and subsequent discussions will therefore treat the situation from the broader rather than the more narrow point of view.

COST FACTORS IN THE FINISHED PRODUCT

Additional interest is attached to a chart like that of Fig. 2, where the items in the cost of a finished product are analyzed. For instance, by studying Fig. 3, starting with the selling price at the extreme left, the various items which contribute to the final price may be seen to depend on various groups of expense. Thus the commercial cost of a product is dependent on the two principal items of commercial expense and of manufacturing cost. In the present study the last-named item is the one of interest. Moreover, it may

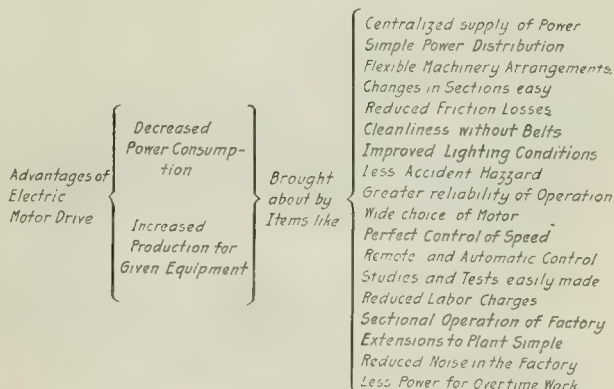


FIG. 5—PRINCIPAL ADVANTAGES OF ELECTRIC MOTOR DRIVE AND CHANNELS THROUGH WHICH THEY MAY BE SECURED

be noted that the manufacturing cost is itself dependent on a number of factors, whereas the advantages of electric drive will subsequently be shown to influence mainly the sub-item of shop cost, and specifically that part of the shop cost which relates to direct labor and to power.

This chart is very useful in gaining a comprehensive view of the industrial power problem in its bear-

ing on the broad general question of the total or final cost of a product, and it will be found advantageous to keep these relations in mind in connection with the more specific discussions to follow.

If any given case of electric drive is selected at random, it will usually be found that a quantitative estimate of the advantages of the electric drive in com-

parison with other possible methods of power supply may be made by a careful analysis of the individual items involved in the operation of the particular device in question. To illustrate this point certain figures are presented in Tables I, II and III, based on the operation of large excavating shovels by steam and by electric power.² In Table I, for example, an itemized list of all labor charges is given for such a shovel, first, for steam operation, and, second, for electric operation. The totals show a saving in the labor

drive on a basis of one shift for a day. The direct-current motor drive shows a considerable saving over the steam drive per day while the alternating-current motor drive is somewhat more expensive than steam operation, despite the lower labor item, because of higher interest and repair charges.

Steam Operation	\$ 6.00	Shovel Runner	\$ 6.00	Electric Operation
	4.00	Craneman	4.00	
	2.50	Fireman		
	10.50	Six P. men	10.50	
	1.75	Watchman		
	1.50	Coal Passer		
	2.50	Teaming		
	1.50	Oil and Waste	0.75	
	\$ 30.25	Totals	\$ 21.25	
		Saving per Shift:	9.00	

TABLE I—SUMMATION OF THE LABOR ITEMS CHARGEABLE TO EACH SHIFT IN THE GENERAL CASE OF EXCAVATING SHOVELS

drive on a basis of one shift for a day. The direct-current motor drive shows a considerable saving over the steam drive per day while the alternating-current motor drive is somewhat more expensive than steam operation, despite the lower labor item, because of higher interest and repair charges.

Table III, by contrast, shows that when the corresponding figures are tabulated for three shifts per day the labor item in each case becomes larger in proportion to the fixed charges. The alternating-current motor drive becomes less expensive than the steam drive,

	Steam Driven	Direct Current Motor Driven	Alternating Current Motor Driven
Interest	\$ 5.20	\$ 7.75	\$ 10.85
Depreciation	4.03	6.00	8.43
Repairs	8.66	7.75	10.85
Labor	30.25	21.25	21.85
Totals	\$ 48.14	\$ 42.75	\$ 51.98

TABLE II—SUMMARY OF TOTAL COSTS PER SHIFT FOR VARIOUS METHODS OF SHOVEL DRIVE

while the direct-current motor is even more favorable than indicated by Table II. These figures indicate then the general basis on which comparisons of various methods of drive may be made, and they furthermore show what large changes may be made by slight readjustments in the assumptions made.

Every precaution possible should be taken with such problems to be guided by figures which are based on practice rather than on assumptions. To use figures of the latter type in selecting equipment involves the risk not only of initial mistakes, but also of possible daily losses throughout years of service simply be-

	Steam Driven	Direct Current Motor Driven	Alternating Current Motor Driven
Interest	\$ 5.20	\$ 7.75	\$ 10.85
Depreciation	4.03	6.00	8.43
Repairs	13.00	1.63	16.28
Labor	20.75	63.75	63.75
Totals	\$ 39.98	\$ 89.13	\$ 99.31

TABLE III—TOTAL COSTS PER THREE SHIFTS FOR VARIOUS METHODS OF DRIVING EXCAVATING SHOVELS

cause the original choice was based on theoretical rather than practical considerations.

One of the outstanding features in motor application work is the fundamental importance of the load to be driven. The analysis of the problem usually resolves itself into a careful study of the requirements

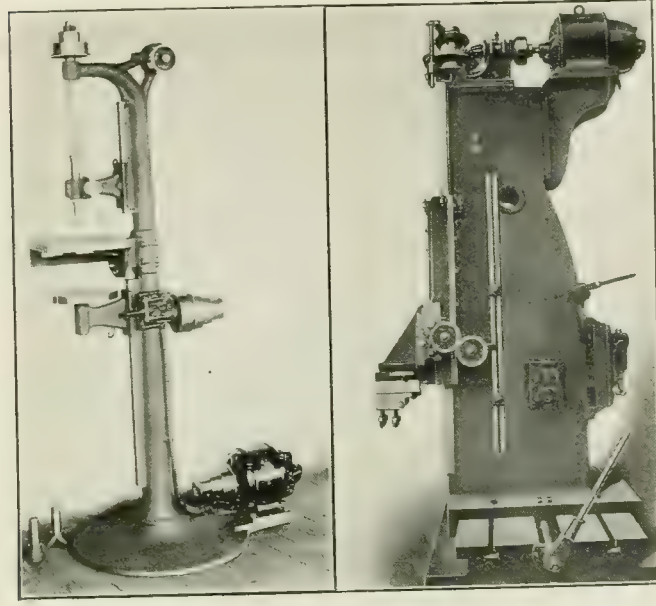


FIG. 6—SELF-CONTAINED INDIVIDUAL MOTOR DRIVES EMPLOYING BELT AND GEARING RESPECTIVELY

parison with other possible methods of power supply may be made by a careful analysis of the individual items involved in the operation of the particular device in question. To illustrate this point certain figures are presented in Tables I, II and III, based on the operation of large excavating shovels by steam and by electric power.² In Table I, for example, an itemized list of all labor charges is given for such a shovel, first, for steam operation, and, second, for electric operation. The totals show a saving in the labor

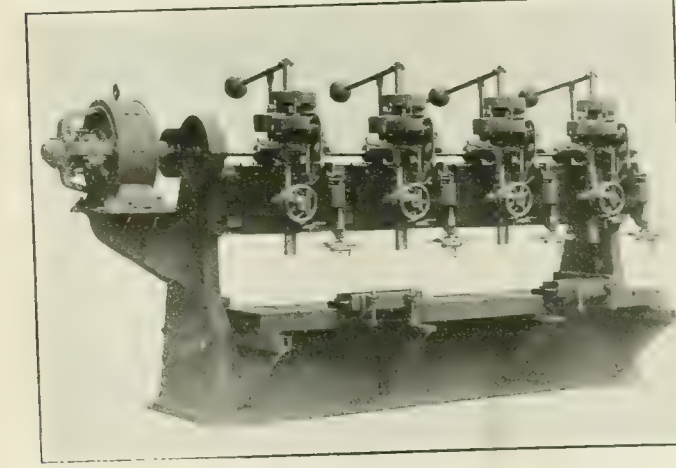


FIG. 7—MODIFIED FORM OF INDIVIDUAL ELECTRIC DRIVE WHERE ONE MOTOR SUPPLIES POWER FOR A NUMBER OF OPERATIONS

charges of \$9 per shift in favor of electric operation, this saving being due primarily to the elimination of certain labor, such as that of fireman and coal passer, which is obviously unnecessary with electric drive.

²These three tables are based on data of H. W. Rogers found in the Transactions A. I. E. E., Vol. XXXIV, pp. 1332-1334.

of the load, an equally careful study of the operating characteristics of the available motors for the work, and finally the suitable adaptation of one to the other.

A general classification of load characteristics applicable to all cases will be given at this point, since it serves to give a broad view of the physical items involved in any particular problem. Fig. 4 is presented to cover such a general classification in terms of the output necessary to maintain the load, and the rotational, service and speed conditions which are usually experienced in practice.³ The advantage of such a chart lies in the fairly complete picture it gives of the possible variables in any given problem, and of the kinds of things which constitute the basis for the work of the expert in this field.

There are two chief elements of advantage in electric drive, namely, decreased power consumption and increased production. These items, however, are not always easy to reduce to a tangible, convincing basis unless the other advantages (Fig. 5) which go to bring about power savings and larger production are care-

³Fig. 4 has been designed by the author on the basis of a somewhat similar table due to A. C. Lanier, *Transactions A. I. E. E.*, Vol. XXXIV, p. 176.

fully analyzed in whole or in part and evaluated at least as far as possible to definite figures. Many of the items to the right in Fig. 5 are not readily determinable in the every-day operations of a plant, even where every facility may be provided for the study of the situation. It is just here that the unusual qualifications of engineers for such work become apparent.

With increasing experience on the part of electrical manufacturers it is possible that the motor application field will gradually become standardized. As a matter of fact, the mass of data already available from practical cases is very great, but in spite of this fact persons who are most deeply concerned with the engineering development of industrial motor and control equipment do not hesitate to admit that there is still much room for improvement and that very little is known even to-day about the action and physical refinements of certain parts of the control equipment. From this standpoint, therefore, as well as from that of the great importance of the whole subject to industrial efficiency, the study and analysis of some of the well-defined phases of the question presents a field of utmost concern, both to the engineer and to the manufacturer.

August Central Station Operation

Returns Indicate Total Earnings for the Month of \$37,000,000 for Light and Power, an Increase Over August, 1916, of 14 per Cent, and an Output of 1,910,000,000 Kw.-Hr., an Increase Over the Same Month of 19.5 per Cent

RETURNS received by the ELECTRICAL WORLD from 56 per cent of the total rated generating capacity of the electric light and power central stations of the United States for August last indicate that the earnings of the entire industry throughout the country for that month in the sale of energy for

TABLE I—CENTRAL STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percent- age of Industry Represented	INCOME FROM THE SALE OF ENERGY			Kw.-Hr. OUTPUT		
		1916	1915	Per Cent In- crease	1916	1915	Per Cent In- crease
Sept.....	64	21,432,000	18,600,000	15.2	1,268,339,000	1,037,976,000	21.2
Oct.....	64	22,882,000	20,164,000	13.5	1,347,602,000	1,125,132,000	19.9
Nov.....	64	24,819,000	21,744,000	14.4	1,396,537,000	1,148,221,000	21.7
Dec.....	62	25,306,000	22,029,000	15.0	1,345,883,000	1,112,280,000	21.0
1917		1917	1916		1917	1916	
Jan.....	63	27,408,000	23,969,000	14.4	1,495,829,000	1,180,884,000	26.7
Feb.....	63	25,204,000	22,295,000	13.1	1,240,995,000	1,036,014,000	20.0
March.....	64	23,949,000	20,913,000	14.6	1,409,129,000	1,139,453,000	23.6
April.....	63	22,927,000	20,165,000	13.8	1,328,092,000	1,086,554,000	22.5
May.....	62	23,369,000	20,307,000	15.2	1,459,085,000	1,163,483,000	25.3
June.....	62	22,644,000	19,416,000	16.6	1,345,537,000	1,101,493,000	22.3
July.....	61	21,727,000	18,599,000	16.8	1,305,318,000	1,089,922,000	22.1
August...	56	20,306,000	17,829,000	14.0	1,260,284,000	1,056,462,000	19.5

light and power companies were \$37,000,000, an increase over the previous August of 14 per cent. The output for the same month for the entire industry was 1,910,000,000 kw.-hr., an increase over August, 1916, of 19.5 per cent.

The percentage of increase over the corresponding month of previous years for August was noted to be

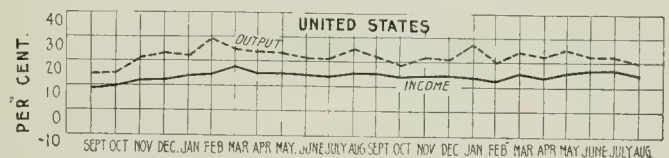
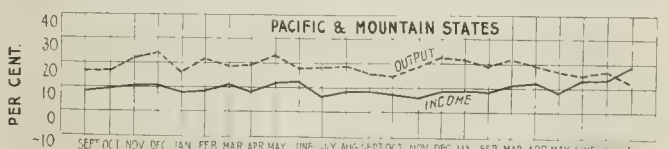
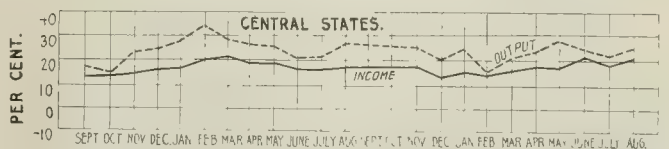
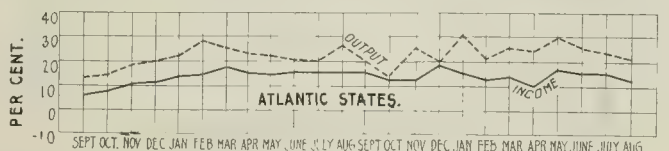
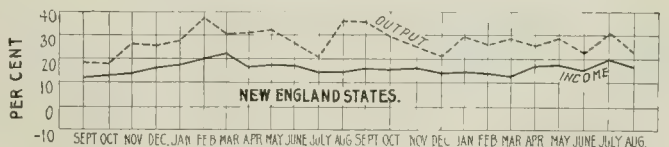


FIG. 1—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES



FIGS. 2 TO 5—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

slightly less than for the preceding months. This is especially true of the East, as will be noticed in Table II. During the month of August the Eastern states underwent a very trying experience with hot weather. Numerous plants found it advisable to close down for a day or two during the height of the heat wave. The

tack the white-hot tungsten filament or wire, but in the colder zones of the lamp oxidizes the vaporized tungsten to tungsten trioxide. This oxide is not volatile and is deposited on the glass bulb and other parts of the lamp, but the deposit is practically colorless compared with the deposit of tungsten metal. In fact, the non-vola-

TABLE II—CENTRAL STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

TABLE II—CENTRAL STATION RETURNS																
Month	Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States (Illinois Excluded)			Percentage of Industry Represented	Pacific and Mountain States		
		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase
INCOME																
September	65	2,315,000	1,982,000	16.8	66	8,631,000	7,445,000	16.0	56	6,505,000	5,537,000	17.8	88	3,979,000	3,644,000	9.2
October	65	2,684,000	2,331,000	15.2	65	8,887,000	7,930,000	12.1	56	6,968,000	5,895,000	18.2	87	4,213,000	3,889,000	8.3
November	65	2,912,000	2,516,000	15.7	65	10,061,000	8,859,000	13.5	56	7,410,000	6,313,000	17.4	87	4,246,000	3,947,000	7.5
December	65	3,203,000	2,814,000	14.0	66	11,059,000	9,348,000	19.6	56	7,898,000	6,997,000	13.0	75	2,987,000	2,735,000	9.3
1917		1917	1916			1917	1916			1917	1916			1917	1916	
January	64	3,181,000	2,762,000	15.1	66	11,400,000	9,874,000	15.6	56	8,081,000	7,013,000	15.2	86	4,602,000	4,020,000	9.5
February	64	3,039,000	2,686,000	13.1	65	10,249,000	9,021,000	13.6	55	7,471,000	6,530,000	14.4	86	4,284,000	3,926,000	9.2
March	64	2,861,000	2,547,000	12.3	65	10,203,000	8,902,000	14.7	56	6,692,000	5,754,000	16.5	86	4,193,000	3,780,000	11.0
April	64	2,756,000	2,357,000	17.0	65	8,601,000	7,765,000	10.7	56	7,132,000	6,094,000	17.0	86	4,282,000	3,821,000	12.1
May	64	2,640,000	2,253,000	17.2	65	9,495,000	8,118,000	16.9	52	6,912,000	5,914,000	16.9	86	4,173,000	3,883,000	7.5
June	64	2,613,000	2,262,000	15.5	65	9,281,000	8,017,000	15.7	51	6,687,000	5,525,000	21.0	80	3,914,000	3,488,000	12.2
July	65	2,382,000	1,983,000	20.2	65	8,919,000	7,687,000	16.1	53	6,649,000	5,606,000	18.6	80	3,734,000	3,288,000	13.4
August	65	2,274,000	1,946,000	16.8	55	7,567,000	6,744,000	13.7	52	6,807,000	5,624,000	21.0	77	4,052,000	3,437,000	18.0
KW.-HR. OUTPUT																
September	65	98,350,000	73,343,000	34.2	66	446,534,000	369,815,000	20.8	56	387,626,000	307,485,000	26.2	88	335,817,000	288,332,000	16.4
October	65	107,756,000	83,705,000	28.8	65	426,151,000	373,705,000	14.2	56	408,364,000	324,509,000	25.9	87	355,014,000	306,828,000	15.8
November	65	111,873,000	89,015,000	25.7	65	533,252,000	424,746,000	25.6	56	415,491,000	334,044,000	24.4	87	346,847,000	293,518,000	18.2
December	65	117,763,000	97,387,000	21.0	66	535,410,000	444,923,000	20.4	56	425,510,000	354,258,000	20.0	75	256,006,000	206,838,000	23.8
1917		1917	1916			1917	1916			1917	1916			1917	1916	
January	64	120,211,000	93,163,000	29.1	66	564,699,000	429,432,000	31.5	56	437,923,000	351,335,000	24.5	86	363,094,000	298,990,000	21.4
February	64	110,114,000	88,324,000	24.7	65	418,407,000	341,877,000	22.5	55	373,988,000	328,158,000	15.8	86	326,891,000	274,079,000	19.3
March	64	121,434,000	95,515,000	27.2	65	539,028,000	425,376,000	27.0	56	383,046,000	311,841,000	23.0	86	365,541,000	301,721,000	21.3
April	64	108,968,000	87,237,000	25.0	65	449,445,000	362,752,000	24.0	56	390,103,000	317,505,000	22.9	86	368,557,000	309,474,000	19.1
May	64	110,991,000	86,675,000	28.3	65	527,004,000	405,719,000	30.3	52	415,795,000	325,986,000	27.7	86	394,554,000	336,541,000	17.3
June	64	105,312,000	85,856,000	22.7	65	496,784,000	392,605,000	26.5	51	391,070,000	315,852,000	24.0	80	341,524,000	298,544,000	14.5
July	65	99,440,000	75,624,000	31.5	65	494,965,000	396,538,000	24.8	53	376,201,000	309,415,000	21.7	80	333,316,000	287,092,000	16.1
August	65	102,090,000	82,581,000	23.6	55	412,540,000	340,831,000	21.0	52	410,774,000	329,166,000	24.8	77	332,482,000	301,332,000	10.5

same was true of office buildings and stores. During those nights people prepared to stay outdoors, and for that reason the consumption of energy for electric lighting was somewhat less. There were also some labor disturbances, particularly in some of the Western mining regions, which caused a cessation of operations in many instances extending over a period of days.

The five tables that have been presented for some time in this article showing the percentage of increase over the corresponding months of previous years by companies grouped according to size have been discontinued owing to the form of report used by certain properties. The properties have been grouped, and therefore it is not possible to show the size of localities actually served.

The accompanying curves show graphically the results of increase in per cent as contained in Tables I and II.

Oxygen-Filled Tungsten Lamp

A tungsten lamp which overcomes the deterioration set up by destructive current discharges through chlorine vapors evolved from substances introduced into the lamp bulb to prevent blackening is the work of Ernest Friederich, Berlin, Germany, disclosed in patent No. 1,240,700.

According to the inventor, it is contemplated that the tungsten incandescent body shall burn in an atmosphere which contains oxygen of low pressure. Strange to say, oxygen of low pressure does not noticeably at-

tack the white-hot tungsten filament or wire, but in the colder zones of the lamp oxidizes the vaporized tungsten to tungsten trioxide. This oxide is not volatile and is deposited on the glass bulb and other parts of the lamp, but the deposit is practically colorless compared with the deposit of tungsten metal. In fact, the non-vola-

tility of the reaction product formed is of importance, for the pressure in the lamp is not increased and gas discharges through the gaseous medium are prevented. The definite effect of the oxygen occurs at pressures so low that they cannot be measured by the ordinary methods, since the pressure is always less than five one-thousandths of a millimeter of mercury and usually less than one one-thousandth of a millimeter. The best effects cannot be obtained by simply filling the lamps with a small amount of gaseous oxygen or by imperfectly exhausting them. Under such circumstances the oxygen would very quickly disappear during the burning of the lamp. By introducing into the interior of the lamp substances which at the temperature and under the conditions which prevail in the lamp have a certain small oxygen pressure due to dissociation or decomposition they give up continuously as much oxygen as is consumed by the oxidation of the vaporized tungsten. Some of the suitable substances are oxides, peroxides, nitrates, nitrites, chlorates, perchlorates, chromates, bichromates, etc. In particular, manganese superoxide is very satisfactory and barium chlorate especially so. It may be noted that some of these substances may be decomposed more or less in the lamp during burning, or perhaps during the exhaustion of the bulb which usually takes place at a somewhat high temperature. For example, the barium chlorate may be decomposed into barium chloride and barium perchlorate, in which case perhaps the latter would be the effective substance, or potassium permanganate can be decomposed into potassium manganate and manganese superoxide.

Minimum-Cost Method of Transformer Design

First of Two Articles Applying the Method Worked Out to Shell,
Core and Multiple Magnetic Circuit-Type Transformers
with Uniform and Non-Uniform Flux Density

BY B. C. DENNISON

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SOME time ago it came to the notice of the writer that Charles LeG. Fortesque with others had worked out methods of theoretical transformer design, deriving the ideal values of the ratios of height to width of opening, width to depth of core, and core area to coil area, in order that for any assumed values of copper and iron density the design might give either maximum efficiency or minimum cost. The method, in brief, was to express the volumes of iron and copper in terms of the variables mentioned and so write the loss (or cost) equation; then, by taking partial derivatives with respect to each of the three variables and equating to zero, to solve for numerical values under the conditions of any particular design.

The writer is unaware of the form in which these results finally appeared, but being then at work along similar lines in the attempt to develop a method—one which should be more satisfying than that of Arnold—of determining the theoretically correct proportions of the transformer in a given design, his interest was stimulated and directed by this suggestion, and the results outlined in this paper were gradually worked out. He believes that credit for the general method should be given to Mr. Fortesque.

DESIGN CONDITIONS CONSIDERED

The problem under consideration is to determine the theoretically correct proportions and dimensions for constant-potential transformers for these conditions:

Case I.—For assumed values of flux and current den-

Case III.—For an assumed ratio of iron and copper losses to find the dimensions giving minimum cost for a transformer of given rating.

These cases will be investigated for the following types of transformer: (A) Shell-type, uniform flux density; (B) shell-type, non-uniform flux density; (C) core-type, uniform density, rectangular cores; (D) core-type, non-uniform densities, rectangular cores, and (E) multiple-magnetic-circuit transformers, non-uniform densities, rectangular cores.

SYMBOLS EMPLOYED IN DEVELOPING FORMULAS

The following symbols will be employed.

A_i = gross area of iron core.

A_o = gross area of coils in opening.

c = height of opening (see Fig. 1).

a = width of opening.

h = gross depth of core section.

b = width of single core.

k_i = space (stacking) factor of iron.

k_o = space factor of copper.

V_i = net volume of iron.

V_o = net volume of copper.

w_i = loss per cubic inch of iron core.

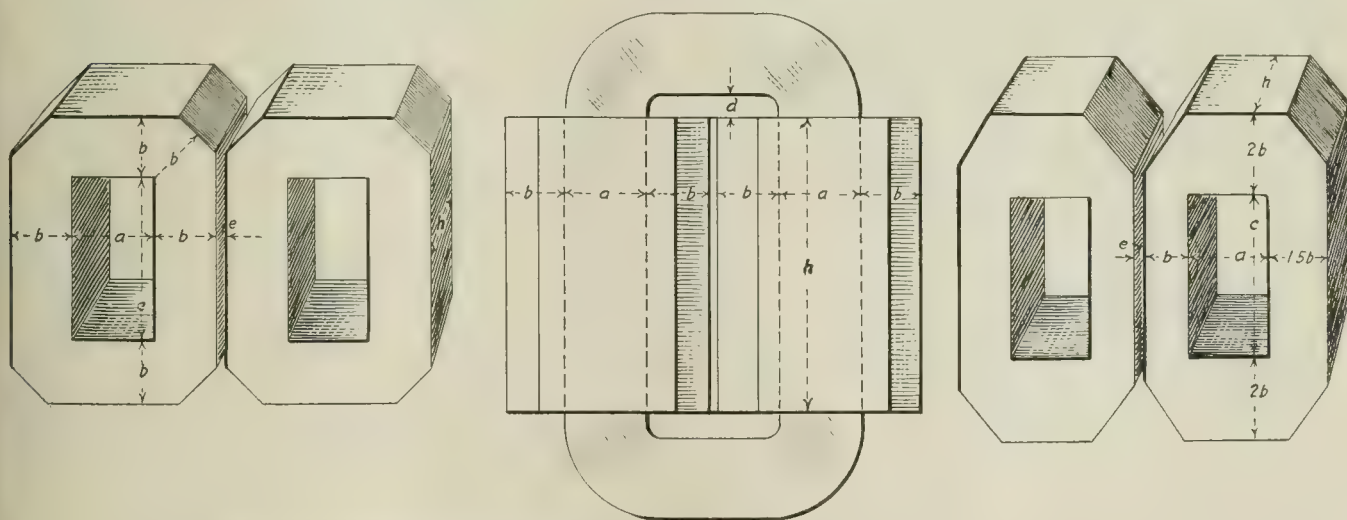
w_o = loss per cubic inch of copper.

C_i = cost per cubic inch of core, including labor.

C_o = cost per cubic inch of copper, including insulation and labor.

$P = A_i \times A_o$.

d and e = clearances (see Figs. 1 and 2).



FIGS. 1, 2 AND 3—CORE AND COMBINED COILS AND CORES OF SHELL-TYPE TRANSFORMER FOR UNIFORM FLUX, ALSO CORE FOR NON-UNIFORM FLUX

sity to find the dimensions giving the maximum efficiency for a transformer of given kva. frequency and voltage.

Case II.—For assumed values of flux and current density to find the dimensions giving minimum cost in a given transformer.

E = high-tension kilovolts.

T = high-tension turns in series.

B = flux density in core (kilo-lines per square inch).

ϕ = total flux in core, in megalines.

s = current density in copper (kilo-amperes per square inch).

I = high-tension current at rated kva.

The proportions to be determined are:

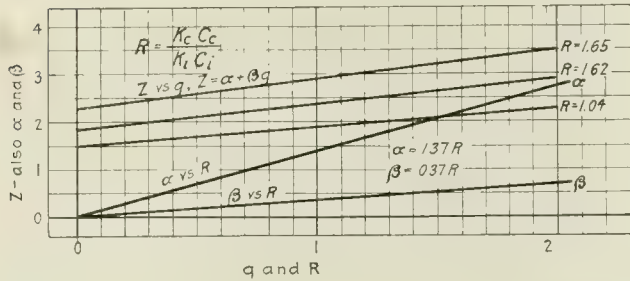
$$c/a = X, h/2b = Y, A_i/A_o = Z.$$

From the general transformer equations,

$$\text{kva.} = EI,$$

$$E = 4.44Tf\phi 10^{-8},$$

$$\phi = BA_i k_i 10^{-8},$$



FIGS. 4 AND 5—VARIOUS RELATIONS FOR SHELL-TYPE TRANSFORMER WITH UNIFORM CORE SECTION

$$I = sA_o k_c / (2T10^3),$$

the following relations are obtained:

$$\text{kva.} = 2.22fBs k_c k_i A_o A_i 10^{-5} \quad (1)$$

or

$$A_i A_o = P = \frac{\text{kva.} \times 10^5}{2.22 \times fBs k_c k_i} \quad (2)$$

If in a given transformer kva., E and f are known, B , s , k_c and k_i may be assumed, so that the product $P = A_i A_o$ is determined. B is usually fixed by permissible iron loss or exciting current, and s by the permissible copper loss or coil heating.

METHOD OF DETERMINING THEORETICAL PROPORTIONS

Type A.—Shell-Type Transformers with Rectangular Cores, Uniform Flux Density.

Case I. Design for Maximum Efficiency.

For maximum efficiency the total loss must be a minimum, or

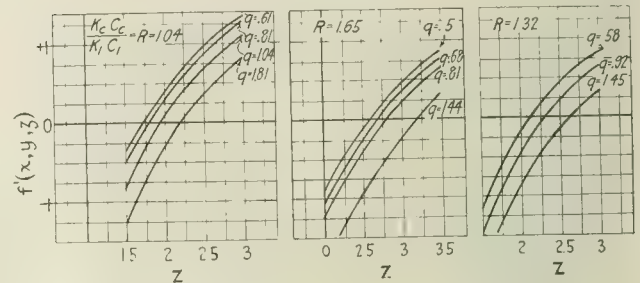
$$V_i = 4bhk_i(a + 0.83 \times 2b + c) \quad (4)$$

Likewise, the copper volume,

$$V_c = 2k_c ac(h + 2b + \pi a/2 + 2d + e). \quad (5)$$

Expressing these volumes in terms of the ratios, X , Y and Z , since $A_i A_o = P$ and $A_i/A_o = Z$,

$$A_o = \sqrt{P/Z}, \quad (6)$$



and

$$A_i = \sqrt{PZ}, \quad (7)$$

Also, since $ac = A_o$, and $c/a = X$, from (6) it follows that

$$a = (P/ZX^2)^{1/4} \text{ and } c = (PX^2/Z)^{1/4}. \quad (8)$$

Since $2bh = A_i$, and $h/2b = Y$, from (7) it follows that

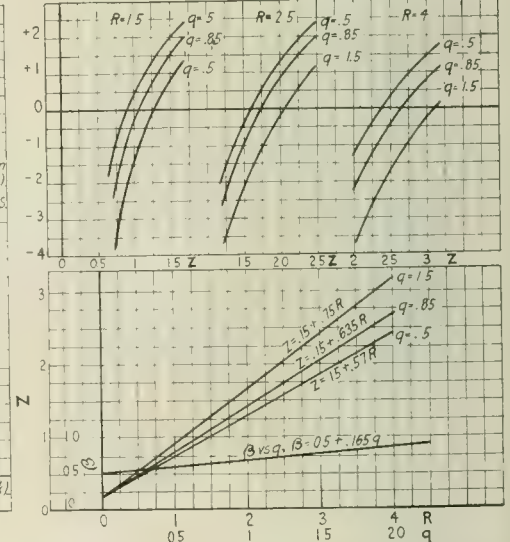
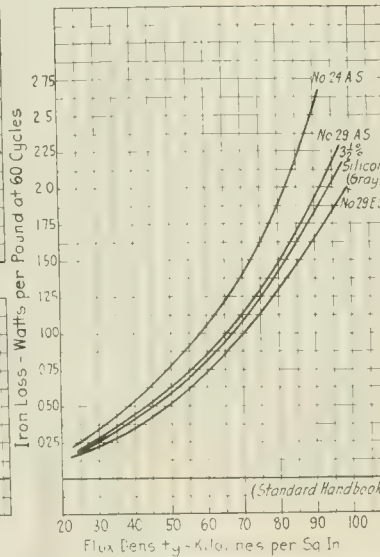
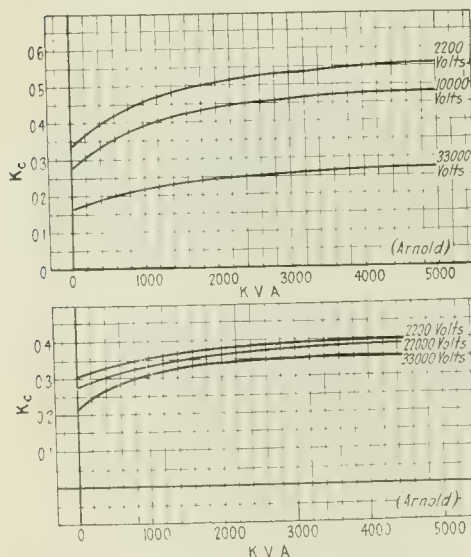
$$2b = (PZ/Y^2)^{1/4}, \text{ and } h = (PZY^2)^{1/4}. \quad (9)$$

Rewriting equation (4),

$$V_i = 2k_i(PZ/Y^2)^{1/4} \times (PZY^2)^{1/4} [(P/ZX^2)^{1/4} + 0.83(PZ/Y^2)^{1/4} + (PX^2/Z)^{1/4}] \\ \times 2k_c \sqrt{PZ} [(P/ZX^2)^{1/4} + 0.83(PZ/Y^2)^{1/4} + (PX^2/Z)^{1/4}]. \quad (10)$$

Rewriting equation (5),

$$V_c = 2k_c \sqrt{PZ} [(PZY^2)^{1/4} + \frac{\pi}{2} (P/ZX^2)^{1/4} + (PZ/Y^2)^{1/4} + 2d + e]. \quad (11)$$



FIGS. 6, 7, 8 AND 9—SPACE FACTORS FOR SHELL AND CORE TYPE TRANSFORMERS; PROPERTIES OF TRANSFORMER STEEL, AND SOLUTION FOR Z IN SHELL-TYPE TRANSFORMER WITH NON-UNIFORM FLUX

$$V_i w_i + V_c w_c = \text{a minimum.} \quad (3)$$

From an inspection of Figs. 1 and 2 the volumes in terms of the dimensions become:

$$V_i = 4bhk_i(a + 2b + c),$$

or, taking out the corners,

Substituting from equations (10) and (11) into equation (3), the loss in the transformer, in terms of X , Y and Z , etc., becomes

$$\text{Loss} = 2w_i k_i \sqrt{PZ} [(P/ZX^2)^{1/4} + 0.83(PZ/Y^2)^{1/4} + (PX^2/Z)^{1/4}] + 2w_c k_c \sqrt{P/Z} [(PZY^2)^{1/4}$$

$$+ (PZ/Y^2)^{1/4} + \frac{\pi}{2} (P/ZX)^{1/4} + 2d + e]. \quad (12)$$

To determine when this loss is a minimum, partial derivatives of equation (12) with respect to X , Y and Z are taken and equated to zero, as follows:

$$\frac{\partial (\text{loss})}{\partial X} = 2k_i w_i \sqrt{PZ} \left[\left(\frac{P}{Z} \right)^{1/4} \left(-\frac{1}{2} \right) X^{-3/2} + \left(\frac{P}{Z} \right)^{1/4} \left(\frac{1}{2} \right) X^{-1/2} \right] + 2k_c w_c \sqrt{\frac{P}{Z}} \left[\frac{\pi}{2} \left(\frac{P}{Z} \right)^{1/4} \left(-\frac{1}{2} \right) X^{-3/2} \right] = 0. \quad (13)$$

Dividing by $\sqrt{P}(P/Z)^{1/4}$, $1/\sqrt{X}$, $1/Z$, to simplify, and solving for X ,

$$X = 1 + \frac{\pi}{2} \left(\frac{k_c w_c}{k_i w_i} \right) \frac{1}{Z} = 1 + \frac{\pi}{2} \times \frac{R'}{Z}, \quad (14)$$

the ratio factor, $k_c w_c / (k_i w_i)$, being replaced by R' . Taking the partial derivative of the loss with respect to Y and equating to zero, and simplifying,

$$Y = 1 + 0.83 Z/R'. \quad (15)$$

Taking the partial derivative of the loss with respect

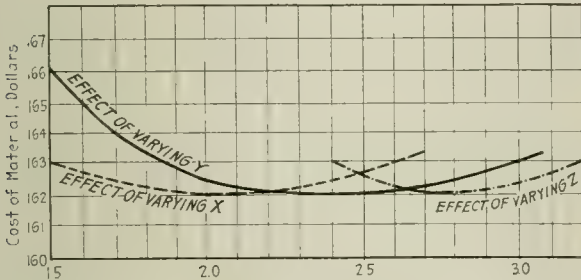


FIG. 10—VARIATION OF COST OF MATERIALS WITH CHANGE OF PROPORTIONS FOR A SHELL-TYPE TRANSFORMER HAVING UNIFORM CORE DENSITY

to Z , equating to zero and simplifying as far as seems possible, the somewhat awkward expression remains that

$$\frac{1+X}{\sqrt{X}} + 2.5\sqrt{Z/Y} - R' \left(\frac{1+Y}{\sqrt{YZ}} + q \frac{(Z)^{1/4}}{Z} + \frac{3\pi}{2\sqrt{XZ}} \right) = 0. \quad (16)$$

In the latter equation q has replaced the expression $\frac{2(2d+e)}{(P)^{1/4}}$

Equation (16) is probably best solved by assuming various values of Z , for several fixed values of q and R' ($= k_c w_c / k_i w_i$), then solving for corresponding values of X and Y , and evaluating (16). The values of this function, when plotted against Z , form a curve passing through zero, thus giving the value of Z which satisfies the equation. As the solution is identical with that of Case II (minimum cost), it will be given in detail after Case II has been developed.

Case II. Proportions for Minimum Cost.

For the total cost of material to be a minimum

$$V_i C_i + V_c C_c \text{ a minimum.} \quad (17)$$

Equation (17) is identical with (3) except that the constants C_i and C_c replace the constants w_i and w_c respectively, so that the solution will give the same final equations as Case I with the exception noted.

Therefore, for minimum cost of material,

$$X = 1 + \pi/2 \times R/Z, \quad (18)$$

$$Y = 1 + 0.83 Z/R, \quad (19)$$

and

$$\frac{1+X}{\sqrt{X}} + 2.5\sqrt{\frac{Z}{Y}} - R' \left(\frac{1+Y}{\sqrt{YZ}} + \frac{3\pi}{2\sqrt{XZ}} + q \frac{(Z)^{1/4}}{Z} \right) = 0, \quad (20)$$

where

$$R = \frac{k_c C_c}{k_i C_i}, \text{ and } q = \frac{2(2d+e)}{(P)^{1/4}}$$

As stated above, the values of Z satisfying equation (20) are determined by assuming various values of Z , for various values of q and R corresponding to usual designs, substituting in (20) and noting the crossing of the axis. This is shown in Fig. 4. The values of Z resulting are then plotted against q for each of the values of R and are found to lie on straight lines of the form,

$$Z = \alpha + \beta q. \quad (\text{See Fig. 4.}) \quad (21)$$

Likewise the values of α and β are plotted against R and two straight lines through the origin result, such that

$$\alpha = 1.37R, \quad (22)$$

and

$$\beta = 0.37R, \quad (23)$$

and so that the equation for the unknown Z becomes

$$Z = 1.37R + 0.37Rq. \quad (25)$$

Equation (25) is perfectly general for shell-type transformers having rectangular core sections and uniform flux density, no matter what the voltage, frequency or type of service. These latter specifications will modify the factors k_c , k_i , C_c , C_i , q and P , but not the general expressions for X , Y and Z .

The application of the method previously outlined will be apparent from the following examples:

It is required to design a 75-kva., 60-cycle, 2200/110-volt shell-type transformer for distributing service.

Assumptions:

$B = 60$ kl./sq. in. in all sections.

$s = 1.3$ kiloamp./sq. in.

$k_c = 0.35$ (see Fig. 6). $k_i = 0.85$.

$d = 1.25$ in. $e = 0$.

$C_c/C_i = 4$. (For example, $C_c = \$0.14$ and $C_i = \$0.035$.)

From equation (2)

$$P = A_i A_o = \frac{75 \times 10^3}{2.22 \times 60 \times 60 \times 1.3 \times 0.35 \times 0.85} = 2425.$$

$$q = \frac{5}{\sqrt[4]{2425}} = 0.7, \quad R = \frac{0.35 \times 4}{0.85} = 1.65.$$

From equations (25), (18) and (19),

$$Z = 1.65(1.37 + 0.37 \times 0.7) = 2.7.$$

$$X = 1 + 1.57 \times \frac{1.65}{2.7} = 1.97 = 2.0.$$

$$Y = 1 + 0.83 \times \frac{2.7}{1.65} = 2.35, \text{ say } 2.4.$$

Therefore, the dimensions will be:

$$A_o = \sqrt{\frac{2425}{2.7}} = 30 \text{ sq. in. } A_i = 2425/30 = 81 \text{ sq. in.}$$

$$a = \sqrt{30/2} = 3.87 \text{ in. } c = 30/3.87 = 7.75 \text{ in.}$$

$$2b = \sqrt{81/2.4} = 5.75 \text{ in. } h = 81/5.75 = 14 \text{ in.}$$

Volume of iron:

$$V_i = 2 \times 81 \times 0.85(3.87 + 0.83 \times 5.75 + 7.75) \\ = 2250 \text{ cu. in.}$$

$$\text{Weight} = 2250 \times 0.28 = 630 \text{ lb.}$$

$$\text{Cost of core (approximately)} = 2250 \times \$0.035 = \$78.8.$$

Iron loss:

For $B = 60$ kl. the loss per pound of iron is 0.75 watt (see curve, Fig. 8, for No. 29 E. S.).

Iron loss is then $F = 630 \times 0.75 = 475$ watts.

Volume of copper:

From equation (5)

$$V_c = 2 \times 0.35 \times 30(14 + 5.75 + 1.57 \times 3.87 + 2.5) \\ = 595 \text{ cu. in.}$$

$$\text{Weight of copper} = 595 \times 0.32 = 190 \text{ lb.}$$

Approximate cost of coils:

$$\text{Cost} = 595 \times 0.14 = \$83.3.$$

$$\text{Copper loss} = 0.81 \times s^2 V_c = 0.81 \times 1.3^2 \times 595 = 810 \text{ watts.}$$

$$\text{Total cost} = \$78.8 \times \$83.3 = \$162.1.$$

Total loss at full load:

$$\text{Loss} = 475 + 810 = 1285 \text{ watts.}$$

Efficiency at full non-inductive load:

$$\text{Per cent loss} = \frac{1285 \times 100}{75,000 + 1285} = 1.69.$$

$$\text{Efficiency} = 98.31 \text{ per cent.}$$

Efficiency at half load:

$$\text{Per cent loss} = \frac{(475 + 202) \times 100}{37,500 + 677} = 1.77.$$

$$\text{Efficiency} = 98.23 \text{ per cent.}$$

As a test of the theoretically determined values of X , Y and Z , several designs are worked out and the results tabulated herewith. Curves of the cost of material are also plotted against the variables X , Y and Z in Fig. 10.

DESIGN FIGURES, VARYING ONE OR MORE PROPORTIONS

No.	X	Y	Z	A ₀	A ₁	a	2b	c	h	V _i	V _c	Cost (Dollars)		
												Core	Coils	Total
1	2	2.4	2.7	30	81	3.87	5.75	7.75	14	2250	595	78.8	83.3	162.1
2	2	2.4	2.4	32	76.2	4.0	5.63	8.0	13.5	2160	625	75.6	87.5	163.1
3	2	2.4	3.0	28.5	85	3.75	5.96	7.5	14.3	2350	570	82.5	79.8	162.3
4	2	2.4	3.2	27.5	88.2	3.7	6.1	7.4	14.6	2420	558	84.8	78.2	163
5	1.5	2.4	2.7	30	81	4.47	5.75	6.7	14	2190	615	76.8	86.1	162.9
6	2.5	2.4	2.7	30	81	3.46	5.75	8.65	14	2320	582	81.3	81.5	162.8
7	2	1.5	2.7	30	81	3.87	7.35	7.75	11	2480	566	86.9	79.2	166.1
8	2	3.0	2.7	30	81	3.87	5.19	7.75	15.6	2190	617	76.7	86.3	163
9	2	1.9	2.7	30	81	3.87	6.52	7.75	12.4	2340	578	82.1	80.8	162.9
10*	1.56	2.36	1.76	37.1	65.2	4.87	5.25	7.6	12.4	1865	722	65.5	101	166.3

*The proportions used in this example are those of a transformer of similar specifications shown on page 348 of Arnold's "Wechselstromtechnik," Vol. II.

It should be noted that the maximum increase above the minimum cost is only \$4.20, or about 2.6 per cent. Therefore there is a wide range over which the proportions of this type of transformer may be varied without greatly increasing the cost of material.

Case III. For an Assumed Ratio of Iron and Copper Losses, to Determine the Dimensions Giving Minimum Cost of Material.

The solution for this case is identical with that of Case II, except that the product Bs is to be assumed rather than the separate values. Then, having determined all principal dimensions, as in Case II, the values

of B and s are adjusted as follows. If it is desired that iron loss = $p \times$ copper loss, where p is the proportionality factor, then (approximately)

$$mB^2V_i = pms^2V_c, \quad (26)$$

where m is a constant obtained from the core-loss curve of the iron and n is the specific resistance of the copper. For example, using the No. 29 E. S. steel at 60 cycles, $m = 0.58 \times 10^{-4}$, while $n = 0.82$ at 70 deg. C., so that equation (26) becomes

$$0.58 \times B^2V_i = 0.82 ps^2V_c \times 10^4.$$

In general

$$B = s\sqrt{npV_c/mV_i}; \quad (27)$$

but the product, $P' = Bs$ has been assumed, therefore

$$B = \sqrt{P'} \times \left(\frac{npV_c}{mV_i} \right)^{1/4} \quad (28)$$

Example.—Suppose that in the example of Case II it had been desired that the relation of iron loss to copper loss, or p , had been 0.5. By assumption $Bs = 60 \times 1.3 = 78$, therefore

$$B = \sqrt{78} \left(\frac{0.82 \times 10^4 \times 0.5 \times 595}{0.58 \times 2250} \right)^{1/4} = 58.2, \text{ and } s = 1.34.$$

Type B.—Transformers of the Shell Type with Non-uniform Flux Densities.

With the relative core widths shown in Fig. 3, the volume of iron in the core (ignoring corners) is

$$V_i = 2k_i[(b + 1.5b)(c + 4b) + 4ab]h \\ = 2k_iA_i(2a + 5b + 1.25c).$$

Allowing for corners removed,

$$V_i = 2k_iA_i(2a + 4b + 1.25c). \quad (29)$$

As before, the volume of copper is

$$V_c = 2k_cA_o(h + 2b + 1.57a + 2d + e).$$

Total cost of material will be

$$\text{Cost} = V_iC_i + V_cC_c \\ = 2k_iC_iA_i[2a + 4b + 1.25c] + 2k_cC_cA_o \\ [h + 2b + 1.57a + 2d + e].$$

This is to be a minimum. Expressing the dimensions in terms of P , X , Y and Z ,

$$\text{Cost} = 2k_iC_i\sqrt{PZ} \left[2 \left(\frac{P}{ZX^2} \right)^{1/4} + 2.0 \left(\frac{PZ}{Y^2} \right)^{1/4} \right. \\ \left. + 1.25 \left(\frac{PX^2}{Z} \right)^{1/4} \right] \\ + 2k_cC_c\sqrt{\frac{P}{Z}} \left[(PZY^2)^{1/4} + \left(\frac{PZ}{Y^2} \right)^{1/4} + \frac{\pi}{2} \left(\frac{P}{ZX^2} \right)^{1/4} \right. \\ \left. + 2d + e \right]$$

To make this value a minimum, partial derivatives are taken and equated to zero, giving

$$X = 1.6(1 + \pi R/4Z), \quad (30)$$

$$Y = 1 + 2.0 Z/R, \quad (31)$$

and

$$\frac{2 + 1.25X}{\sqrt{X}} + 6.0 \sqrt{\frac{Z}{Y}} - R \left[\frac{1 + Y}{\sqrt{YZ}} + \frac{3\pi}{2\sqrt{XZ}} \right. \\ \left. + q \frac{(Z)^{1/4}}{Z} \right] = 0. \quad (32)$$

Equation (32) was solved for Z as in Case II, for various values of R and q , and the Z so determined was plotted in Fig. 9 against R and found to be a straight line passing through the point $Z = 0.15$. Thus the curves of Z versus R could be represented by the equation

$$Z = 0.15 + \beta R.$$

Again plotting values of β against q , it was found that
 $\beta = 0.5 + 0.165q$,

so that

$$Z = 0.15 + R(0.5 + 0.165q). \quad (33)$$

Example.—For the same specifications used in Type A the following design is obtained.

Assuming $B_{max} = 90$ kl./sq. in., and other quantities as before,

$$P = A_i A_o = \frac{75 \times 10^5}{2.22 \times 60 \times 90 \times 1.3 \times 0.85 \times 0.35} = 1620.$$

$$q = \frac{5}{(1620)^{1/4}} = 0.79.$$

Then

$$Z = 0.15 + 1.65(0.5 + 0.165 \times 0.79) = 1.19.$$

$$X = 1.6[1 + 0.785(1.65/1.19)] = 3.34.$$

$$Y = 1 + 2.0(1.19/1.65) = 2.5 \text{ (used 2.8).}$$

Now

$$A_o = \sqrt{1620/1.19} = 36.9 \text{ sq. in.}$$

$$A_i = 1620/36.9 = 44 \text{ sq. in.}$$

$$a = \sqrt{36.9/3.34} = 3.32 \text{ in.}$$

$$c = 36.9/3.32 = 11.1 \text{ in.}$$

$$2b = \sqrt{44/2.8} = 3.96 \text{ in.}$$

$$h = 44/3.96 = 11.1 \text{ in.}$$

Therefore,

Volume of iron (allowing for corners), $V_i = 1.7 \times 44(2 \times 3.32 + 2.0 \times 3.96 + 1.25 \times 11.1) = 2130 \text{ cu. in.}$

Cost of iron, $D_i = 2130 \times 0.035 = \74.5 .

Iron loss, $W_i = 2130 \times 0.74 \times 0.28 = 440 \text{ watts.}$

Volume of copper, $V_c = 0.7 \times 36.9(11.1 + 3.96 + 1.57 \times 3.32 + 2.5) = 588 \text{ cu. in.}$

Cost of copper, $D_c = 588 \times \$0.14 = \82.2 .

Copper loss, $W_c = 0.82 \times 1.3^2 \times 588 = 810 \text{ watts.}$

Total cost of material = \$156.70. This shows a gain of some 3 per cent over the straight shell-type transformer.

In the second part of this paper the remaining types of transformers—namely, core type and multiple magnetic-circuit transformers—will be treated and a comparison will be made of the representative designs of various types.

New Conditions Affecting Rate of Return

Changes in the Money Market Due to the War and Great Demand for Capital,
 Together with Increases in Operating Cost, Justify Higher
 Rate of Return, Says James D. Mortimer

THE question of rate of return on public utility capital is bound up irretrievably with that of rate of return on other capital. That all interest rates are now on a higher level the current prices of bonds and stocks tell eloquently. Government and private borrowers alike have to pay more for money. How the necessary capital expenditures shall be financed

is a problem for whose solution the public and public service commissions are as responsible as the public utility itself. Higher cost of money, like the higher cost of materials and labor, points to higher rates to consumers.

In connection with a recent hearing before the Missouri Public Service Commission, James D. Mortimer, as president of the Union Electric Light & Power Company of St. Louis, gave careful attention to the increasing importance of the rate of return under present changing conditions. The case at issue was brought some years ago by the Engineers' Incitation Club, alleging discriminatory rates and excessive profits by the Electric Company of Missouri in the handling of power from the Keokuk hydroelectric development. An appraisal has been made. The company petitioned that the case be dismissed. No objection was made by

MR. MORTIMER ON CHANGING RATE OF RETURN

The facts justify a higher rate of return than in the past.

All interest rates are certain to be on a much higher level.

Even at high rates the amount of money that can be borrowed is limited.

The only method of finance now open is that of selling 7 per cent preferred stock to customers.

counsel for the plaintiff to this petition, but the commission declined to take this action without giving specific reasons for its decision, and the case has gone through the usual course.

Mr. Mortimer said that in the recent past electric light and power utilities have been regarded as among the best public utility investments. They have made a strong appeal to the various classes

of investors. There seem to be three principal classes of such investors who have provided the money for the expansion of public utilities. There is the investor who is satisfied with a rate of return running in normal times from 5 per cent to 5¾ per cent and who wishes such return evidenced by a contract; he purchases bonds. There is the investor who desires a higher return, who wishes that the return shall commence immediately, and who is willing to purchase stock and wishes the return fairly well assured; he purchases a preferred stock. There is, finally, the investor who is willing to forego any actual return during the first few years, but who expects his return to be much larger than the other two investors require, and who expects an appreciation in market value of his investment; such an investor purchases common stock.

When regulatory commissions some years ago an-

nounced that capital invested in public utilities was entitled to $7\frac{1}{2}$ per cent to 8 per cent per annum after providing for all ordinary operating expenses and a proper allowance for future replacements, said Mr. Mortimer, it tended to give stability to public utility investments and the market for public utility securities rapidly expanded and strengthened. Because there were some more or less indefinite factors connected with the question of a return of $7\frac{1}{2}$ per cent to 8 per cent, it was not entirely clear upon what basis this return was to be computed, but it was quite properly assumed that the new capital would be entitled to these rates of return. The elements of value making up the measure of utility capital were not very well defined, although the early decisions of regulating commissions made it pretty clear that there would be added to the reproduction cost of the physical property a proper allowance for working assets and going value. The United States Supreme Court had held that all these elements were entitled to consideration and that a going property was worth more than the bare physical bones of plant. It was also quite properly assumed that the regulating commissions would make an adequate allowance in the cost of production of service for future replacements of physical property.

NOT A COMPLETE MONOPOLY

In arriving at a return of $7\frac{1}{2}$ per cent to 8 per cent, it was reasoned that the bare interest cost of money was 6 per cent and that $1\frac{1}{2}$ to 2 per cent in addition should be allowed for profit. This return would probably have been sufficient in normal times for a utility enjoying a monopoly in a large city and with the equivalent of a guarantee that such return would be continued during both good and poor industrial conditions. Unfortunately, Mr. Mortimer added, no public utility enjoys a complete monopoly because there is always competition. An electric utility must compete with the gas utility and the private power plant. In St. Louis the Union company, in addition to these sources of competition, encounters competition from two other concerns and passes completely out of the class of a monopoly.

Mr. Mortimer then showed that the recent rise in the cost of labor and materials has increased operating expenses at a rate much faster than any possible economies resulting from increased volume, density or higher load factor. These increases in costs have made returns unstable, and the immediate future of the public utility business has been far from bright. To the utilities the purchasing power of money has decreased; their selling prices have been fixed, and they cannot procure increased returns except with the approval of the regulating commission. This lack of stability in return and hesitancy on the part of some commissions to authorize badly needed increases in rates have made public utility investments far less attractive, and they have largely passed out, for the time being, from the conservative class. The inflation in values resulting from the enormous government borrowings is certain to remain with us during the continuation of the war and is likely to continue for some years after the war's termination.

The deduction which Mr. Mortimer draws is that these facts now place the junior securities of public utility corporations in the semi-hazardous class and

justify the payment of a higher rate of return than has been the custom in the past. All interest rates are certain to attain and maintain themselves on a much higher level than during the period preceding the outbreak of the war. Permanent financing of public utility corporations is not possible at this time. Temporary financing by the sale of short-term notes secured by bonds in ample margin was possible up to a month or so ago, but the interest rate cost to the issuing company was 8 per cent or more. Thus new money cost a higher rate than the utilities were earning. But even then the amount of money that could be borrowed was very limited compared with the cost of the additions to physical property.

There is now no market for short-term bond-secured notes even at these high interest yields. The only method of finance now open is that at present being pursued by the Union company in selling 7 per cent preferred stock to customers. The amount of money that can be obtained from this source is presumably limited. Mr. Mortimer added:

"A return of 10 per cent or 12 per cent would not be too high for public utilities during these times. Even these rates would not likely attract any very large sum into the business during the continuation of the war, although they might be regarded as reasonable after the war's termination. The point that I wish to make clear and to emphasize is that pre-war standards are useless in estimating reasonable rates of return for public utility investments because the whole plane of interest rates and security yields has been very much elevated.

GOVERNMENT AID MAY BE REQUIRED

"The whole level of utility charges will have to be raised if the public utility business is not to be struck a blow from which it can never recover. Even then it is doubtful if public utilities can at present secure the capital they require for expansion. Government aid may be required in some cases where the continued growth of the utility is necessary to provide service for government purposes.

"In the long run, the utility jointly with the regulating commission should endeavor so to adjust rates that the actual rate of return earned on the utility capital will neither be higher nor lower than the cost of money to the utility. This we believe is the equitable viewpoint. It will assure the lowest rates consistent with fair cost and prevent speculation in securities of public utility corporations.

"The ideal system of ownership is that where each customer has a proprietary interest in the utility in proportion to the service rendered him. This we are endeavoring to formulate through our movement to sell stock to customers. We believe in the eventual mutual ownership of public utilities as the best from the standpoint of the customers and from every social and economic view. Such a movement if carried to the possible limit would greatly promote community and individual thrift and prevent public utilities from serving as a bone of contention in politics. There would then be no demand for ownership by the municipality, and the problems of regulation would comprise only those of seeing that the charges for services were equitably distributed as between the different classes of customers."

Use of Electricity in the European War

Transmission Lines Indispensable in Territories Occupied by the Armies — High-Tension Lines in France to Remain After the War and Help in Restoration
—Lessening the Effect of Coal Shortage

BY CAPT. GUSTAVE P. CAPART*

IT IS not intended in this article to deal with the rôle played by electricity in the munition plants, but only with the industrial uses to which it has been put within the army zone. Charlemagne while waging his wars made roads. In the great war now being

nature is the thing which next to nourishment contributes the most to maintain the morale of the men. Moreover, the use of electrical energy in the territory occupied by the armies increases the product of manual labor in multiple forms, a consideration not negligible in a war of attrition such as that we are waging.

From the electric central stations behind the front high-tension lines which form part of the network of peace times radiate. The military lines are connected with the public network and are designed so that they may be extended in the case of an eventual retreat by the enemy, and so that they will in their turn form part of the network of peace times in the day when hostilities shall be terminated. The armies, in addition to the fighting units, are composed of great supporting bodies in the rear which all make large use of electricity. The staff headquarters, the photographic and cartographic services, the hospitals, the magazines of munitions and the road service for transporting them, the aerial carriers, the forest service supplying the sawmills, the repair shops for the automobile service, the lighting of the aviation hangars and of the fields used by the bombarding escadrilles that operate at night, all depend on the great distribution system operated as it would be in times of peace.

The high-tension lines are erected by gangs of mili-



FIG. 1—TRANSMISSION LINE IN REAR OF FIGHTING ZONE

waged we have made not only roads and railroads, but also conveyors of energy. To-day it is indispensable to build electric lines in territories held by the armies.

We will sum up in a few lines the rôle of electricity in the zone behind the troops, then we shall see what its rôle is in the zone near the firing line. In the first case the organization of the electrical service of the army is concerned; in the second case the organization within the individual army division which is the unit of combat. These are two distinct organizations which must not be confounded. One may be considered as a territorial organization resembling that of peace times, the other as a provisional organization of a temporary character.

ELECTRIC ORGANIZATION OF THE ARMY

The object of the electric organization of the army is to distribute light and motive power as near as possible to the firing line by applying the established methods of the industry. Electric lighting of a general

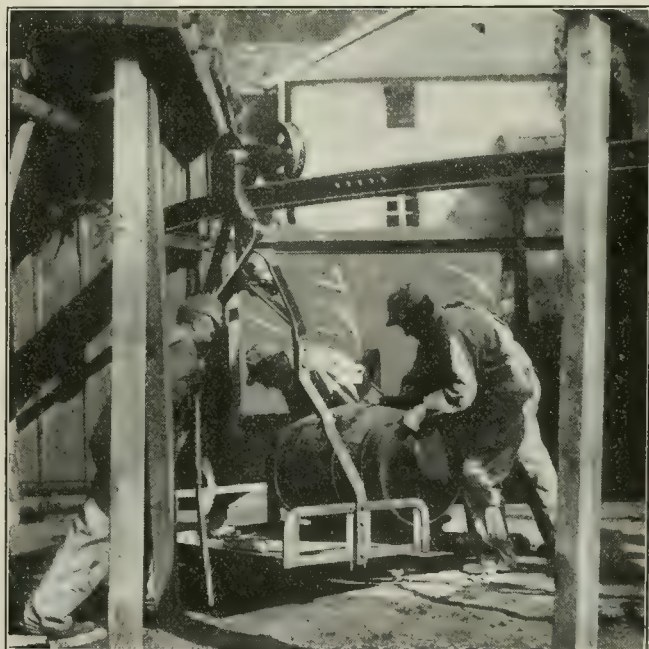


FIG. 2—LOADING AN ELECTRICALLY PROPELLED WAGON

tary electrical workers under the command of an engineer officer. The companies of electricians belonging to the army install the interior equipment and make the connections with the general system. By proceeding in this way a great economy of effort and men is

*Captain Capart is a member of the general staff of General Pétain and is now in the United States as a member of the French scientific commission.

effected. The little outfits of electrical apparatus utilized at the beginning of the war are now at the front, as will be told later, in regions where the artillery fire of the enemy will not permit the maintenance of high-tension aerial lines.

The high-tension lines in the zone occupied by the armies must be constructed in accordance with all the rules of the art. These lines should, indeed, remain in existence after the war. They pass beside ruined towns which must be made to arise from their ashes, and the lines must contribute to the resuscitation of these dead places and the resumption of their industrial life. At the present moment France is pushing the development of means to carry electrical energy into the army zone in order to lessen the effects of the shortage of coal and of cars. The centralization of the consumption of fuel will lead to a marked economy.

ELECTRIC ORGANIZATION AT THE FRONT

In the front lines of the army the utilization of electrical energy is above all demanded for the illumination of the shelters and of the tunnels which connect the first positions with the second. For these purposes electrical outfits of very feeble power are used, the network never being extended far because of the danger of the cables being broken by the bombardment. Another purpose for which electricity is employed at the front is in the laying of mines, where it is useful in ventilation, lighting, boring, removing earth, operating compressors, etc. Some very important installations of this kind have been made on the German side as well as on the French.

At the end of 1915 we had installed a complete plant for distributing energy in the Hauts de Meuse at one of the most unhealthy situations on the front. A 1500-volt substation was established at 80 m. (262 ft.) from the first line, which bordered a series of immense mining tunnels. Many of the cables had to be carried across a ravine. This work was not accomplished without danger because many times a day the cables were cut by the explosion of projectiles and repairs had to be made under fire.

On April 17 last, at the moment of the attack upon Mont-sans-Nom in Champagne, the Sixth Zouaves, reaching the summit of the position, took possession of a kind of shelter lighted by a little electric plant of 20 hp. installed 10 m. (32.8 ft.) under ground. Less than an hour after this position was taken the electrical

workers of the Fourth Army had the Boches' electric installation working to aid the French.

The Italian army also makes a very large use of electricity at the front. Besides the applications already mentioned, its electrical organizations have installed numerous plants to aid in supplying the mountain batteries with munitions.

I could multiply such examples infinitely, but this short account is sufficient to show the importance of the creation of an electric service in the zone of the armies. Better than any other country the United States can effect an organization of this character. American electrical workers will be able to do in France a work equal to that of their colleagues in the regiments of railroad men. They will at the same time serve as pioneers of the American electrical industry in France and will prepare with their French comrades the economic war of to-morrow against the Central Empires.

ELECTRIC SERVICE AT CAMP JACKSON, S. C.

**Columbia Railway, Gas & Electric Company Provides
Service Quickly for the Army Cantonment
Near Its System**

Service for the army cantonment at Columbia, S. C., is being furnished by the Columbia Railway, Gas & Electric Company. Alfred Lewis Kenyon, general manager of that company, has given the following particulars to the ELECTRICAL WORLD:

The contract for electric service for the army cantonment at Columbia, S. C., was applied for on July 27. Work was immediately started on the six-mile (9.6-km.), 13,000-volt, three-phase transmission line from the city limits to the camp. Service was rendered on Aug. 10. The installation consists of six 250-kw., 13,000-volt transformers. Distribution is standard, 2300 volts primary, 110 volts secondary, three wires. About 900 kw. will be used for lighting and 700 hp. for motors, of which 200 hp. will be used for pumping water, the rest being used for laundry, bakery and other motive power.

Service is supplied from the Columbia Railway, Gas & Electric Company's general 25,000-hp. transmission system, operated from Parr Shoals on the Broad River, 28 miles (4.5 km.) from Columbia, at 66,000 volts. At Columbia a second hydraulic installation on the Congaree River supplies 10,000 hp., and a steam reserve plant of 8000 hp. is also ready for instant service in case of need.

Prompt delivery of transformers was secured through assistance of the War Department.

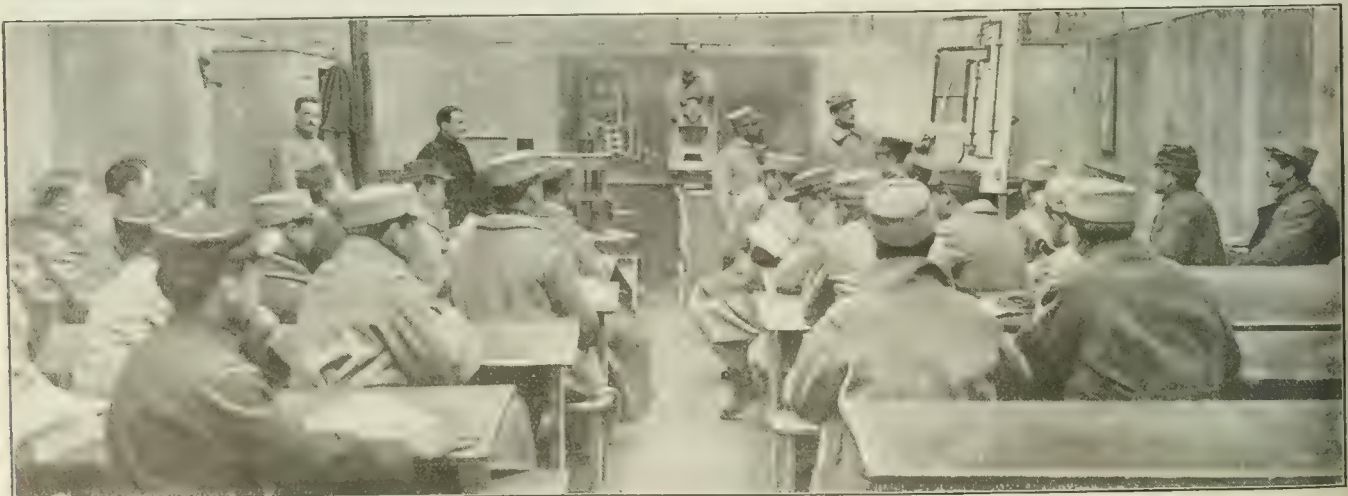


FIG. 3—TEACHING SOLDIERS ELECTRICAL DUTIES AT LYONS SCHOOL

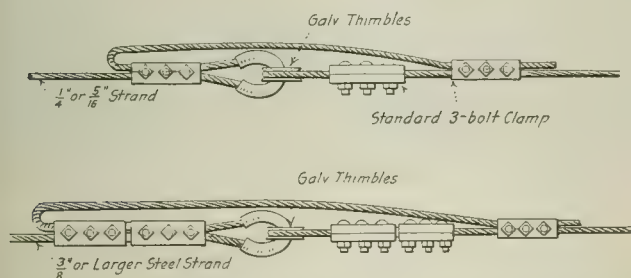
STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

A METHOD OF SPLICING STRANDED-STEEL CONDUCTORS

Western Company Uses Splices Made Up with Standard Three-Bolt Guy Clamps—Construction Avoids Heating at Joint

The use of stranded steel conductors for high-voltage distribution lines has necessitated modifications in many details of construction which have in the past been standardized in construction employing copper. The



STRANDED-CONDUCTOR SPLICE THAT DOES NOT RUN HOT

familiar Western Union soldered splice or the solderless sleeve splice is not advisable for steel conductors, particularly where, by installing long spans, advantage is taken of the high tensile strength of the steel. The soldered splice lacks strength, and the twisted sleeve splice is subject to corrosion.

To obviate this difficulty, one California company utilizes splices made up with standard three-bolt guy clamps. As will be seen in the accompanying illustration, three clamps are required for a splice in a 1/4-in. (6.4-cm.) or 5/16-in. (7.9-cm.) conductor, and five in a 3/8-in. (9.5-cm.) conductor. In each case it will be noted that the clamp which provides the electrical contact between the two cables is subject to no mechanical stress. Since both clamps and conductors are double-galvanized, no corrosion is to be expected. Experiments have shown that this form of splice when properly made up is as strong mechanically as the cable itself, and there is no tendency of the splice to run hot owing to lack of conductivity.

IMPORTANCE OF KEEPING BOILER TUBES CLEAN

Reasons Why Mechanical Cleaning Is Much Simpler, Safer and More Efficient than the Hand Method

BY ALBERT MARTINEAU

In these days when coal is so scarce and of such unprecedentedly high intrinsic value every pound used to better advantage is a victory for economy that should not be overlooked. Yet many tons of coal are being wasted daily just because the boiler heating surfaces

are prevented from absorbing all the heat they might because of soot and ash that have clinkered and fused and become incrustated upon them. If every central station manager, large and small, were to keep a close watch on a thermometer in the stack, comparing the temperature of the flue gases before and after a thorough cleaning of the boiler heating surfaces, it would not be long before keeping them clean would be made as important a task of the boiler-room force as making steam. It is not uncommon to reduce the temperature of the flue gases 150 deg. by cleaning. Moreover, a close examination of the soot removed from boiler tubes is a good indication of whether combustion is being obtained efficiently and whether firing is being carefully done.

Apart from the ever-present need for using all the heat obtained, it is possible that many users are now burning different coal from that they used a few months ago, making it perhaps necessary to clean boiler tubes oftener than was the case previously. The rapidity with which soot and ash and clinker incrustations form—and their formation is cumulative in effect—depends very largely upon the coal—anthracite or bituminous or semi-bituminous—and the rate of evaporation as affected by “forcing.”

Two factors that require consideration in maintaining boiler heating surfaces in efficient heat-absorbing condition are how often they should be cleaned and how thoroughly this should be done. The next questions are how these requirements may be met with maximum effectiveness, greatest safety, the minimum of time, and preferably the minimum of expense. If the soot and powder-like ash are removed soon after their deposit, the accumulation of more material, which becomes a hard, tenacious mass and which requires strenuous methods of removal, can be delayed although not entirely prevented. The question then becomes whether to employ hand or mechanical cleaning.

Blowing out the soot and ash by a hand hose under live steam or compressed air is the oldest method. It is a job the value of which depends upon the amount of care exercised by the worker as to how efficiently the heating surfaces are cleaned. Perhaps there is no better way of ascertaining how thorough such work has been than to use a flashlight.

Hand blowing, justified on small boilers, assumes a very different aspect with large units. The length of tubes is greater, making them more difficult to reach and clean by hand. Many more tubes are used, making it a simple matter to miss some. In any case hand blowing always takes much more time to accomplish than mechanical blowing. Frequent cleaning necessitates opening the hand-holes provided for blowing, thus giving ample opportunity for cracks and leaks to be left after closing through haste or carelessness. The result is that air infiltration is very likely to occur, interfering with combustion efficiencies by causing a low per-

centage of CO₂. A marked drop in the percentage of CO₂ and also of flue-gas temperatures after the hand blowing of a boiler, while indicating that the heating surfaces are cleaner, may also indicate that air infiltration exists.

In hand blowing the question arises whether to use live steam or air, and if air whether it should be by the pressure or vacuum system. The use of steam is dangerous but often convenient, air not being always available whereas steam is. Many extremely painful injuries are suffered owing to the use of steam, while compressed air also causes trouble by blowing grit and ash into the eyes. The vacuum system is the safer, though many assert that compressed air gives more efficient results.

Some companies continue old and unsafe methods because they do not appreciate the wasteful expense and risk of doing so. Many others believe that the initial cost and maintenance charges of mechanical cleaning are not justified because the saving in fuel shows such a small balance in favor of mechanical cleaning. Safety, the shorter time required to clean, the reduction of air infiltration, the ability to keep a boiler in service longer, the cost of banked fires for hand blowing, these are some of the factors that should be included and placed to the credit of mechanical cleaning, although they are items not readily evaluated in dollars and cents.

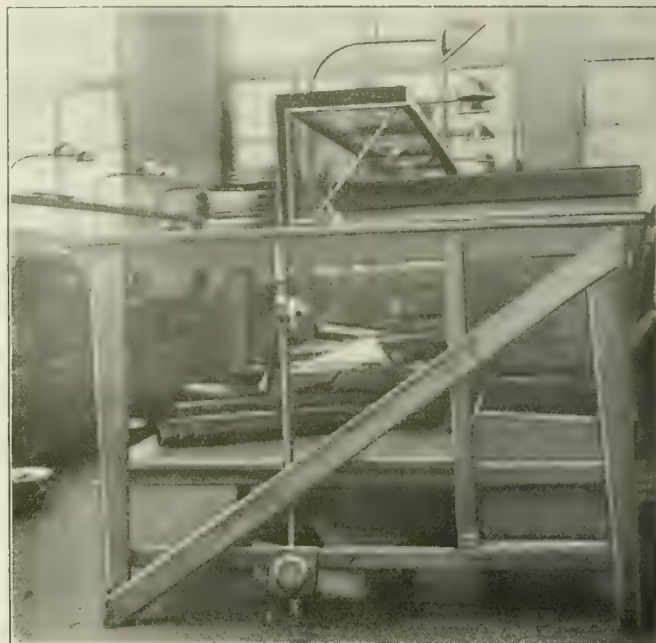
The mechanical soot cleaner does not take the place of the wire brush and scraper for periodic use, but it mechanically blows out the soot and ash before they accumulate to fuse and form incrustations, interfering with the heat transfer and the draft up the stack. The mechanical cleaner enables a boiler to be cleaned several times during the day, which is not usually feasible with hand cleaning. This necessarily means cleaner surfaces, more efficient utilization of the furnace gases and the maintenance of greater steam-making capacities at all times instead of rapid reduction. Mechanical cleaning cleans all parts of the boiler, and at once, which is not possible with hand cleaning. Where the superheater is placed in the boiler it is often neglected, and this results in a decrease in superheat and in efficiency of the turbine unless some convenient means of cleaning is employed.

LIGHTING ARRANGEMENT FOR SHOE FACTORY CUTTING BENCH

Improved Lighting Scheme Used in a New England Shoe Factory—Obstruction to Work and Glare Avoided

In place of the suspended lamp cords and swinging units formerly used, with the disadvantage of obstruction to the work of a cutting bench at the shoe factory of Lunn & Sweet, Auburn, Me., the lighting installation shown herewith has been provided under the direction of the chief electrician, Ernest Bragdon. Brackets carrying two 40-watt lamps with an intermediate snap switch are carried over the table top and fitted with metal reflectors of Holophane type 55, which screen the workers from glare. The brackets are of pipe-conduit design and are provided at their lower ends with flanges through which they are screwed into the table. To plates on the under side of the table are fastened outlet boxes, the lead wires being run to taplet of pressed

steel which receives a conduit riser running upward from a junction box near the floor as shown. Below the junction box, and thence through the floor to wiring on the ceiling of the floor below, the wiring is in BX



METHOD OF LIGHTING SHOE-CUTTING BENCH

conduit, which terminates in a fuse block on the ceiling and provides a most convenient and flexible arrangement in making the actual wiring installation.

OBTAINING FLEXIBILITY IN MOUNTING OF MOTORS

Method of Providing Clear Span Below Machine and Arrangement Necessary Where Driving Connection Is Close to Floor

Flexibility has always been a characteristic of the electric drive, and the installation of motors for both

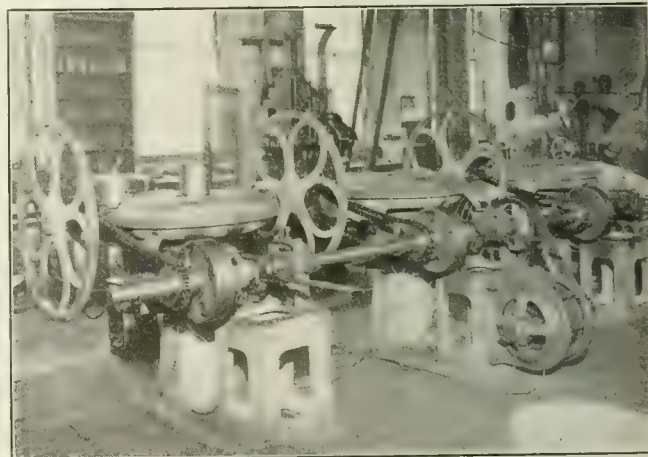


FIG. 1—MOTOR ATTACHED TO PEDESTAL OF ONE MACHINE AND DRIVING SEVERAL UNITS

group and individual machine operation offers many opportunities for convenient arrangement. In Fig. 1 the motor driving a machine group through silent-chain connection is attached to a vertical pedestal in such a manner as to leave the floor space below free for clean-

ing. A short, compact chain connection is provided, and ventilation conditions are better than with the motor on the floor. As the motor is of the induction type and designed for operation in the position shown, there is a saving in space and convenience in maintenance specially favorable in this installation. In Fig. 2 a motor driving a direct-connected machine unit is shown. In

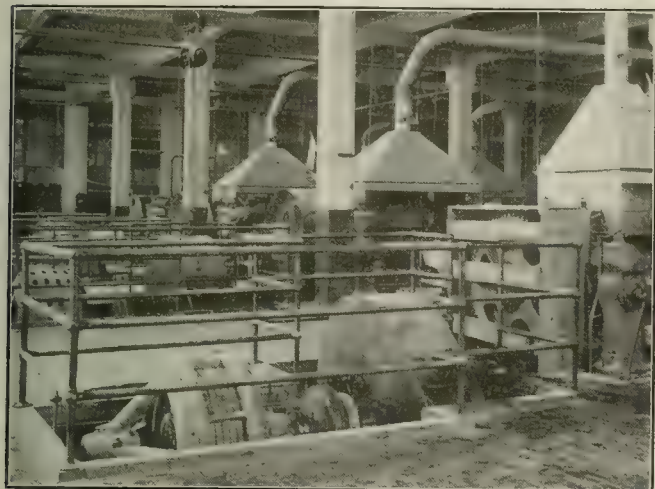


FIG. 2—MOTOR SET IN PIT TO ALLOW CONNECTION WITH MACHINE DRIVEN

this case the machinery requires that the driving unit be set low with respect to the floor, and this has accordingly been cut away so that about 50 per cent of the motor is housed in the pit shown. The depressed space is easily cared for on the ceiling below by reinforced-concrete construction, and the pipe guard shown in the illustration protects employees from the pits.

A SIMPLE METHOD OF FINDING MOTOR LOAD

Watt-Hour Constant of Watt-Hour Meter Used to Determine Power Demand—Data for Various Kinds of Meters in Tabulated Form

The accompanying table is an enlargement of the one given in the Oct. 6 issue of the ELECTRICAL WORLD,

TESTING CONSTANTS FOR 110-VOLT, 60-CYCLE STANDARD WATT-HOUR METERS*

Make of Meter	Type of Meter	CAPACITY IN AMPERES									
		3	5	10	15	20	25	40	50		
General Electric.	J; J-1; JN; FN; D-1; DN	$\frac{1}{2}$	0.5	0.5	1.0		1.0		2		
General Electric†	I; I-8; I-14.	$\frac{1}{2}$	0.3	0.6	1.0		1.5		3		
General Electric‡	C; C-5; C-6; C-9; J-2; D-2	$\frac{1}{2}$	0.2	0.4	0.6		1.0		2		
Westinghouse‡...	A; round...	$\frac{1}{2}$	$\frac{1}{2}$			$\frac{2}{3}$		$\frac{2}{3}$			
Westinghouse‡...	B; C; OA; D; C	$\frac{1}{2}$	$\frac{2}{3}$	1	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	$1\frac{1}{2}$		
Fort Wayne§...	K; K ₁ ; K ₂ ; K ₃ (above serial No. 345,000)...	0	25	0.5	0	75	1	1	25	2	2.5
Sangamo...	F...	$\frac{1}{2}$	$\frac{2}{3}$			$\frac{2}{3}$		$\frac{2}{3}$			
Sangamo.....	D.....	$\frac{2}{3}$	$\frac{2}{3}$			$\frac{2}{3}$		$\frac{2}{3}$			
Columbia‡...	All	$\frac{5}{14}$	$\frac{5}{9}$	$\frac{5}{6}$			$\frac{25}{14}$		$\frac{25}{9}$		
Duncan.....	All (under serial No. 150,000)...	0	25	0.5	1		1			2	

*For 220-volt meters double the constant.

†For polyphase meters double the constant.

‡For three-wire and polyphase meters double the constant.

§For three-wire meters double the constant; for polyphase meters multiply the constant by four, except type K₃ polyphase meters, for which the constant is doubled.‡

page 671, for determining power demand by the use of the watt-hour constant of a watt-hour meter, as it includes three-wire and polyphase meters. The statement made in the former article that the multiplying factor for 440-volt service is four does not hold in all cases. The table was prepared by Willard S. Wilder of the meter and testing department of the Milwaukee (Wis.) Electric Railway & Light Company.

HOW COMPANY MINIMIZES SERVICE INTERRUPTIONS

Liberal Use of Disconnecting Switches on Overhead Lines Assists in Localizing Trouble and in Maintaining Continuous Operation

The accompanying illustration shows four 2300-volt lighting and power circuits and the six 5000-volt arc circuits leaving the power house of the Crawfordsville (Ind.) Electric Light & Power Company through 200-amp. Delta-Star disconnecting switches. At various strategically selected points in the distribution system the lines have been "phased out" and similar switches have been installed to permit opening certain sections of line and feeding in from other directions. In this way provision has been made for localizing trouble and preventing serious service interruptions.

The method of installing the switches is shown in the picture. The conductors, instead of being cut straight through at the junction pole, are interrupted by two porcelain strain insulators fastened at the ends of a short piece of messenger wire. This messenger wire is then tied in on the glass insulators. Taps from the conductor running in each direction are then brought down to the terminals of the switch. Each switch itself is mounted on a 1-in. (2.54-cm.) piece of hard-wood board which is attached to the double cross-



EACH CONDUCTOR LEAVING THE POWER HOUSE PASSES THROUGH A DISCONNECTING SWITCH ON THE JUNCTION POLE

arm. The disconnecting switches were selected for this service on account of the fact that they can be safely and quickly operated. F. H. Miller, manager of the Crawfordsville company, said that this method of arranging for emergencies on distribution lines was especially valuable in case of danger from fire.

CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

SHORTENING THE TRIAL AND PAYMENT PERIODS

The Old Idea of Ten Days' Free Trial and Twenty-four Months to Pay Is Giving Way to Five Days and Eight Months

It is only a few years since the free-trial and deferred-payment plans were new in the electrical business. These selling ideas were taken up extensively by central stations and dealers at a time when even electric flatirons were hard to sell. There was a dearth of business in the land and, so everybody thought, it behooved the merchant to be liberal. Electrical merchants did as much as they could to extend easy and acceptable terms. Flatirons, vacuum cleaners, washing machines—in fact, almost anything—could be secured by customers with good credit on ten days' free trial. This was particularly true during campaign periods. Terms of payment also were made easy for the purchaser. House-wiring was sold on terms of nothing down and twenty-four months to pay.

But nowadays business is not so hard to get. There is a pretty lively demand for electrical goods for cash. Moreover, experience has shown that it does not take ten days for a woman to decide whether or not she likes a vacuum cleaner. In house-wiring and other campaigns a majority of the purchasers will wipe out their indebtedness before the end of the stated period, especially if they are paying interest on the sales company's investment. So there seems to be a growing tendency to reduce the duration of the trial period to five days or less. Deferred payments have likewise been reduced in number, apparently with little or no adverse effect on sales, until now eight months to pay is considered in some quarters as good as twenty-four months was formerly.

TRAINING NECESSARY TO SELL ELECTRIC RANGES

Analysis of Subject and Recommendations Are Made by Sub-Committee at Recent Northwest Convention

Recommendations of a very concrete nature were presented by L. S. Gilham before the recent convention of the Northwest Electric Light & Power Association in the report of the range sub-committee on training salesmen, demonstrators and company employees. It was brought out at the beginning that investigation points to the fact that not only is the average central station electric appliance salesman immature in years, as compared with the average salesman in the general run of other businesses, but the average central station salesman is too quickly hired—particularly the men who cover cities and other localities in personal calls upon customers and prospective customers in residen-

tial sections. Consequently the committee recommended a more detailed inquiry into the qualifications of prospective salesmen than is now the average custom; and in addition, as an important factor in determining the prospective salesman's qualifications, it urged the adoption of a policy by which more than one man would see and talk with a prospective salesman before he is employed. It was further recommended that not only should more than one man talk with the applicant, but that two or more interviews be secured with him before he should be put to work.

PRINCIPLES OF APPLIANCE SALESMANSHIP

In regard to selling goods on their merits the committee urged electric lighting utilities to instill into their appliance salesmen the following principles:

Perhaps in no other line is the folly of even the slightest misrepresentation so obvious as in the selling of electric appliances to the consumers of your own company's energy. The first profit is small. The important consideration is that the customer should use the appliance after she gets it; that she should like it, and that her use and satisfaction with it should pave the way for the sales of other appliances. The surest way to defeat this object is to misrepresent.

For instance, if a customer asks if an electric range is as cheap to operate as a gas range, say "No," frankly and promptly—but explain, of course, that your answer applies only to the actual cost of the fuel and not to the cost of the fuel and the food combined. Your candid and unequivocal admission of fuel cost will make her believe your explanation on the point of shrinkage of the food. When you are discussing the easy operation and care of the range, volunteer the information that the oven has a tendency to rust more readily than in other ranges, and that certain systematic measures must be taken to offset this tendency. Then, if her oven does rust, she will not blame you for selling her an inferior article or blame your company for permitting it. She knows it is her own fault, and her confidence in her range and in you and your company is not shaken.

Absolute frankness about the incidental shortcomings of your appliance will beget a confidence that will last and that will result in the sale of more appliances.

Be interested in your customer's actual needs. Don't try to load her up with more installment payments than she can conveniently take care of, for even the most useful appliance will lose its charm if it is the cause of financial worry. Don't sell her anything she won't use at all or enough to justify its purchase. And don't misrepresent.

The committee stated that it was of the opinion that:

A salesman's wage scale slightly more favorable to the men than the majority of salaries now being paid, the selection of men of more mature age and judgment than the average appliance salesman now at work, careful initial consideration of the salesman's qualifications, the establishment of a policy that the applicant must pass muster on two or three different occasions and with two or three different men before he goes on the pay roll, followed by a more intensive training than is now customary, will go far toward improving the work of the sales forces of the central stations and will go still further toward elimination of the vast amount of actually harmful work that must now be laid to the door of inexperienced, inefficient salesmen who day after day go into the homes of users of electric service and

who, through their lack of understanding of the field for electric appliances in the home, as well as their inability to explain and illustrate properly the use of such appliances, are responsible in a large degree for the lack of understanding and appreciation of such appliances by the average man and woman.

As regards demonstrators and employees the committee had the following to say:

A much higher power than a central station manager is responsible for the few successful demonstrators of electric cooking now at work among users of electric ranges throughout the country.

The need for thousands of capable demonstrators is so apparent as to make discussion of the situation unnecessary.

It is your committee's belief that a natural aptitude in cooking, combined with facility of speech and absolute sureness of their knowledge of the operation of an electric range as applied to a wide range of cooking, is the essential that central station men must look for in employing demonstrators.

Your committee believes that very little investigation of conditions among those employees of central stations who most come in contact with the public will very quickly divulge the fact that the paramount need in the training of such employees is constant emphasis of the necessity of unflinching courtesy, together with a better fundamental knowledge of household electric appliances, their uses, advantages and economy of operation.

ADVERTISING TO CLASSES OF CUSTOMERS EFFECTIVE

Results of a Campaign in Which Devices Suited for
Certain Trades and Professions Were Ad-
vertised by Direct Appeal to Such Customers

Careful analysis of the results of a great deal of direct-by-mail advertising has led some members of the commercial department of the Commonwealth Edison Company of Chicago to form the following conclusions: If direct advertising—letter or circular matter—is mailed to residential customers in order to get the attention of women, it is possible to create a desire for the electrical device, but it is difficult to get a woman to fill out an inclosed card requesting a salesman to call. She prefers to go downtown or to her neighborhood store to look over the stock and buy. The exceedingly persistent tactics of the many house-to-house salesmen in nearly every trade are probably responsible for this apparent lack of responsiveness in the city's feminine population. There are instances in which circular letters to residence customers have brought good results, but the responsiveness is not assured with so much certainty as in the business field.

On the other hand, direct advertising sent to commercial and manufacturing companies on central station lines brings good results, a part of which are traceable. The men in these industries are busy and would rather have the central station company send its representative to explain a device in which they have become interested than to take the time to go to a store to look into it themselves. For this reason mailing cards sent with advertising to commercial and manufacturing institutions are returned.

Realization of this has led the company to conduct a mailing campaign aimed at the responsive commercial and manufacturing field. The table herewith gives a summary of this work and of the traceable results it has accomplished. In addition to the traceable re-

sults, this sort of advertising always brings business into the company's stores. Observations of the sales in advertised lines show that the data in column six of the table should be increased by from 20 per cent to

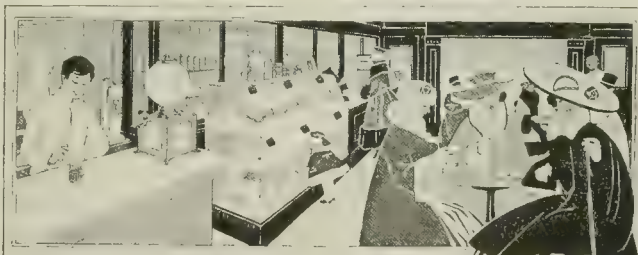
RETURNS FROM ADVERTISEMENTS MAILED TO BUSINESS HOUSES

Date Mailed	Number of Pieces Mailed	Classes of Trade Appealed to	Devices Featured	Number of Replies Received	Sales Made by Following Replies
Nov., 1916	3,200	Drug stores, saloons, ice-cream parlors	Water-heater, drink mixer, electric stove	43	30
Dec., 1916	2,000	Drug stores, saloons, ice-cream parlors	Drink mixer	39	22
Jan., 1917	6,000	Tailor shops	Tailors' irons	56	38
Feb., 1917	2,000	Doctors, dentists, hospitals	Electric sterilizer	180	9*
May, 1917	2,000	Women who sew at home	Sewing-machine motor	75	65
May, 1917	5,000	Small stores	Vacuum cleaners	65	40
Oct., 1917	10,000	Barber shops, beauty parlors, baths	Fans, vibrators, shoe drill, water heater, violet-ray machine, humidifier for cigars, hair dryer, razor sharpener, hair cutter	40†	26
Oct., 1917	5,000	Industrial plants, restaurants, stores	Exhaust fans	16†	

*Poor deliveries on goods account for lack of greater number of sales. †To date.

50 per cent to get a correct measure of the effectiveness of the advertising.

As the table indicates, no circular matter was used.



Hot Drinks On Cold Days

AFTER a short walk on a cold day, a hot drink is a necessity. It warms the body, soothes the throat, and gives a good appetite. It is a good thing to have a hot drink when you are out in the cold. The hot drink is a good thing to have when you are out in the cold. The hot drink is a good thing to have when you are out in the cold.

After a short walk on a cold day, a hot drink is a necessity. It warms the body, soothes the throat, and gives a good appetite. It is a good thing to have a hot drink when you are out in the cold. The hot drink is a good thing to have when you are out in the cold. The hot drink is a good thing to have when you are out in the cold.



DRINK MIXERS



Commonwealth Edison Company
EDISON BUILDING, 72 West Adams Street
Contract Department Heating and Appliances Division

TEAR OFF ALONG THIS LINE

GENTLEMEN

Please receive of me a list of the following:
☐ WATER HEATER ☐ DRINK MIXER ☐ ELECTRIC STOVE

With the understanding that this does not obligate me in any way.

Yours truly,

NAME _____

ADDRESS _____

PHONE _____

TYPICAL COLORED ADVERTISEMENT SENT TO CAREFULLY
SELECTED PROSPECTIVE CUSTOMERS

in the summer months because the company was conducting an intensive campaign with salesmen. The data on replies, if analyzed in conjunction with intimate knowledge of the mailing lists which are used,

indicate a distinct advantage in favor of special lists. For instance, the sewing-machine advertisement "pulled" strongly, in part because the list was a good one secured from a department store. It comprised women who make a business of doing sewing at their homes. The data on the October campaigns were still incomplete at the time of writing.

ATTRACTIVE COLORS AND CAPTIONS

As typical of the mailing pieces used in this campaign, one of the water-heater and drink-mixer advertisements is reproduced herewith. The art work as well as the printing is done in two colors—black and red. The headings used over the advertisements mailed in the consecutive months, as shown in the table, were as follows: November, "A Warm Reception," "Hot Drinks on Cold Days"; December, "A Good Mixer"; January, "For a Pressing Business"; February, " $H_2O + e/r = ?$ "; May, "Ask the Woman Who Uses One," "Bright, Clean Stores Attract the Best Class of Trade"; October, "Electric Time Savers for the Backs," "Ventilation."

STANDBY SERVICE INSURES STEADY STEEL PRODUCTION

Outline of Provisions of Contract for This Central Station Service and Sketch of Conditions That Led Up to It

In a certain steel mill in the United States the possibility exists that the flow of producer gas to its large gas engines might be interrupted for a short period. Should this failure occur, hydrogen, which is also fed to the engines to be exploded with the producer gas, might continue to be fed to the engines and be exploded in an unadulterated state in the engine cylinders. An exploding charge of pure hydrogen in this fashion would without doubt wreck the cylinder and possibly the entire engine. Inasmuch as the engines in question are rated at 5000 kw., the power loss and consequent mill delay resulting from such an accident would be very disastrous.

To insure itself against shut-down from these causes, the steel company has contracted with a light and power company for 5000 kw. in standby service. The circumstances leading up to the completion of this contract are told by the general manager of the central-station company as follows:

At the time the steel company's plant was under construction the company made a power contract with us for operating one of five centrifugal pump units supplying water for the various operations in its plant. This pump requires approximately 500 kw. and operates continuously twenty-four hours per day. The contract was made on account of the great importance of having an absolutely continuous supply of cooling water for the blast-furnace linings. The other pumping units are normally operated from the steel company's gas-engine-driven plant. A year ago the company asked us to install in our substation adjoining its plant transformers equal in capacity to one of its gas-engine-driven units in addition to the 500 kw. of continuous load, and to hold this amount of power for the company's use in emergencies, at the same time offering to pay the entire cost of installing the necessary apparatus.

We thereupon placed orders for two 2500-kw., three-phase transformers, stepping down from 33,000 volts or 66,000 volts to 6600 volts, the pressure used in the steel company's plant, and have just recently completed this in-

stallation. In doing so we have removed the 500-kw., three-phase transformer formerly used for supplying power to the steel company's pumping unit, and this power is now taken from one of the larger three-phase units, the other one not being normally connected on either the high-tension or the low-tension side. We built a single three-phase combination overhead and underground transmission line from our substation to the generating plant of the steel company, which is kept alive up to the disconnecting switches on the line side of an oil switch connecting directly to the steel company's main 6600-volt station busbars.

The contract provides that the steel company may in emergencies connect one or two additional pumping units to our circuits without notice to us, but that in the event of its requiring a greater amount of power than these three pumps would take it is to give us sufficient notice and we have the right to say whether it can have the emergency power or not, and if so, how much. In case we elect to give the company the power, the other transformer is placed in service and the operators in the steel company's station synchronize their machines with our system and take power up to the limits previously fixed. These limits are fixed, of course, by the demand being made at that time on our plant by other large and important wholesale customers.

Thus far we have operated in parallel with the steel plant only for short periods in order to try out the apparatus and connections, but we feel sure that the arrangement will be perfectly satisfactory, although the speed regulation of the gas-engine-driven units is not close enough to provide smooth parallel operation with our waterwheel-driven generators. The fluctuations have not been serious enough to disturb either our voltage or frequency.

ONE WAY TO POINT OUT THE EXISTENCE OF A MARKET

How a Central Station Company Which Does Not Sell Appliances Stimulated Local Activity in Vacuum Cleaner Sales

The Dayton (Ohio) Power & Light Company does not do a retail appliance business. It does endeavor, however, to keep retail dealers at Dayton as well as manufacturers awake to the fact that Dayton is a good market for electrical goods. Last March the company, temporarily discontinuing its policy of staying out of the retail business, put on a thirty-day suction-sweeper campaign. In that period the campaign crew of ten men sold 200 cleaners.

This in itself was a good month's work, but the after effects of the sale were also gratifying. In the months following the sales the local electrical dealers all found the demand for vacuum cleaners very much stronger. While they could not attribute this directly to the sale, it is believed that the interest aroused by the central station's campaign force was in the main responsible for stimulating these retail sales. Moreover, three sweeper companies which formerly thought Dayton a poor market have now opened branches there, since the thirty-day campaign pointed out how easily a vacuum cleaner demand could be created in the city. What the company's campaign really accomplished, besides selling 200 cleaners outright, was to show other cleaner manufacturers and agents that they were not properly cultivating the local cleaner market. Thomas F. Kelly, commercial manager of the Dayton Power & Light Company, in speaking of these results before the commercial men of the Ohio Electric Light Association, expressed the belief that the full results of this campaign should interest central station men who under present circumstances do not wish to finance an expensive campaign.

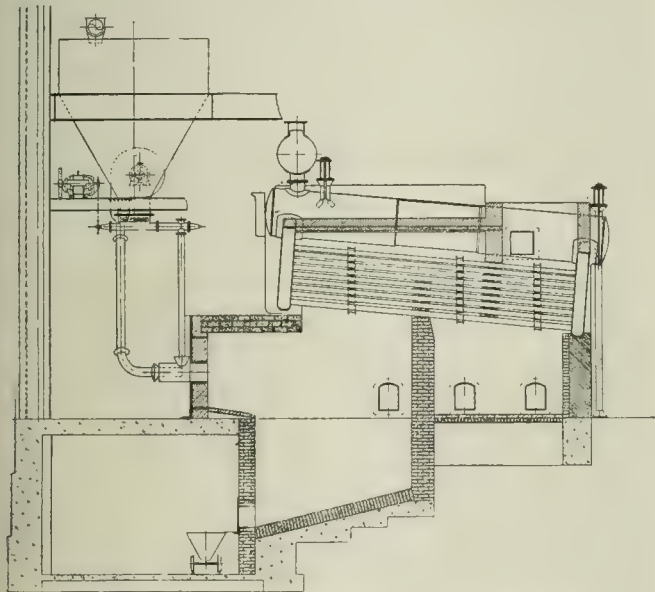
ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

EFFICIENT UTILIZATION
OF FUEL OF LOW GRADE

Results of Test Give Promise of a Future for Powdered Coal—The Furnace Has Been in Constant Use for Nine or Ten Months

AT THE Parsons (Kan.) plant of the Missouri, Kansas & Texas Railway is a boiler installation which has been equipped throughout for utilizing pulverized fuel. Some very low-grade fuels are being burned, and from the results of tests which have been made the future for powdered coal seems bright, ac-



ARRANGEMENTS FOR BURNING POWDERED FUEL

cording to H. R. Collins and Joseph Harrington, co-authors of an article on "Methods for More Efficiently Utilizing Our Fuel Resources" in the October issue of the *General Electric Review*. The plant is completely equipped with crushing, drying, pulverizing and conveying equipment, which is fully described in the authors' original article. The construction of the boiler and furnace and the relative position of the hopper supplying pulverized fuel to the furnace are shown in the diagram.

Three different fuels were tested last June having a considerable range in quality. The first was Texas lignite, which had been stored in the open air for over six months and subjected to freezing and thawing and influence of the sun and wind all this time. It was not necessary to dry this lignite to the same degree that the other coals were dried, as 17 per cent of the moisture in the coal as fired did not affect its apparent quality at all. The second coal, which was a fairly high-ash fuel from southern Kansas, is that which is usually burned at this plant. For the last test a car-load of semi-anthracite screenings was obtained.

As shown by the accompanying extracts from the performance data, the furnace and grate efficiency were very high, and the loss due to combustible in ash was negligible. In the case of the Cherokee slack the ash fused and ran down to the bottom in molten streams. Practically no dust was encountered in the ash pit with this fuel. All of the ash remaining appeared to be liquefied or at least deposited in a plastic condition.

During the test there was a slight gray haze apparent at the top of the stack. Analysis showed that only 2 per cent of this, however, was combustible. Since the CO loss was in direct proportion to the length of the plane, this indicates that there is some relation between the volatile matter in the fuel and the CO loss. Gas temperatures nearly 200 deg. Fahr. in excess of what could probably be expected were obtained in the stack, but this was due to the dirty condition of the boilers before the tests were started.

Without doubt the furnace condition with the semi-anthracite coal, so far as could be determined, was nearly as ideal as one could imagine. The flames did not reach the tubes at any time, and the furnace gases

REPORT OF TESTS AT M., K. & T. RAILWAY SHOPS, PARSONS, KAN.
(191-hp. O'Brien water-tube boiler, vertical baffle, equipped for burning pulverized coal)

	Lignite from Texas	Cherokee Slack, Mineral Mine, South Kansas	Semi- Anthracite from Kansas
Furnace temperature, deg. Fahr.	2352.0	2329.0	2408.0
Stack temperature, deg. Fahr.	597.9	534.6	624.3
Per cent of rated horsepower developed.	119.0	129.0	137.0
Water evaporated, actual, per lb. coal as fired, lb.	4.953	6.824	8.657
Necessary losses:			
Heat absorbed by moisture and burned hydrogen up to temperature steam.	6.56	3.92	2.90
Heat absorbed by theoretical amount dry gas up to temperature steam.	4.98	5.13	4.82
Heat available for unit.	88.46	90.88	92.27
Highest theoretical efficiency.			
Furnaces and grate losses:			
Heat loss due to combustible in ash.			
Heat absorbed by excess air up to temperature steam.	0.57	0.83	0.53
Heat loss due to production of CO.	0.86	0.37	
Heat available for boiler.	87.05	89.68	91.75
Furnace and grate efficiency.	98.40	98.69	99.44
Boiler losses:			
Heat loss due to theoretical amount gas, moisture and hydrogen above temperature steam.	5.25	3.64	5.36
Heat loss due to air leakage through setting.	1.36	0.24	0.41
Heat loss due to radiation and unaccounted for.	24.27	27.89	16.33
Boiler efficiency.	65.82	64.61	75.90
Combined efficiency.	57.32	58.00	69.64
Ratio combined efficiency to highest theoretical efficiency.	64.80	63.90	75.49
Capacity of furnace, cu. ft.	874.0	874.0	874.0
Cubic feet per pound coal, minute.	35.0	43.7	51.4
Cubic feet per pound of volatile combustible per minute.	48.5	54.6	70.5

were completely burned and transparent. The unaccounted-for loss in this test was also the least and the furnace efficiency was the greatest for any of the tests. There was no apparent fusing of the brickwork, which might occur if the ash had a fluxing action thereon. This furnace has been in constant use for nine or

ten months and the interior seems to be in good shape.

The ash from the lignite and semi-anthracite coals did not fuse, but there was a small deposit in the ash pit of a yellow, sandy-looking ash which appeared to be entirely free of combustible matter. A drop in draft between the top of the third pass and the furnace of about 0.05 in. in a boiler ten tubes high, operating at 25 or 30 per cent overrating, does not seem natural, but the draft readings throughout all three tests were checked and repeatedly verified. This opens up a very interesting line of thought as to the draft requirements in this type of installation. The small loss is probably due to the small gas volume and consequent low frictional resistance in the boiler. During the three days when the boilers were under observation there was no sign of slagging of the tubes.

Generators, Motors and Transformers

Modern Dynamo-Electric Machinery.—ALEXANDER GRAY.—Continuation of a series on "Modern Dynamo-Electric Machinery," this installment dwelling on the theory of operation, design, control and method of protecting rotary converters.—*Journal of the Franklin Institute*, October, 1917.

Lamps and Lighting

Street-Lighting Specifications.—Refers to three clauses in specifications prepared by a joint committee which have caused considerable discussion. These clauses refer to the measurement of street illumination and the use of the words "minimum illumination."—*London Elec. Review*, Sept. 21, 1917.

Generation, Transmission and Distribution

Future of Hydroelectric Industry in the French Alps.—J. RÉVIL.—France has been especially favored by nature, says the author, in the possession of that source of energy which the French picturesquely term *houille blanche*, or white coal. The dynamic power inherent in her mountain streams and easily made available is estimated at more than 10,000,000 hp., leaving Germany, with only 1,500,000 hp., far behind. Large strides have already been taken in the development of these sources of water power, 528,000 hp. now being utilized in three mountain districts, as against 145,000 hp. in 1903. The author takes up in rotation the possibilities and the accomplishments in various regions as brought out in authoritative reports, closing with a strong indorsement of the project before which, he says, all others pale—that of damming the Upper Rhône and transmitting to Paris a great part of the energy that it would thus be possible to generate. A plan much favored to make this long-talked-of achievement an actuality calls for the erection at Génissiat of a dam 76 m. (250 ft.) high, thus creating a lake 23 km. (14 miles) long and covering 380 hectares (939 acres), or all the valley of the Rhône to the frontier. A fall of from 67 m. to 69 m. (220 ft. to 226 ft.), according to the period of rise and fall, would thus be obtained. The power that could be generated would equal that derivable from 1,500,000 metric tons (1,650,000 tons) of coal, or half the production of the basin of Lens. All the natural and geological conditions are declared to be favorable to building the dam proposed.—*Revue Gén. des Sciences*, Sept. 15-30, 1917.

Installations, Systems and Appliances

Modern Developments in Roentgenology.—L. ERASMUS ELLIS.—The author mentions briefly some of the most important types of apparatus used in the modern production of the Roentgen ray, pointing out that the time-honored coil with make-and-break excitation holds its own either in its original form or with some modification to improve the quality of the ray produced. The high-tension rectifier or transformer is also very popular. Some details are given about the modern types of X-ray tubes. After touching on the mechanical and physical facts connected with X-ray productions, the author turns to some medical and physical applications of this apparatus. A brief discussion follows the table.—*Transactions of the Southern African Institute of Electrical Engineers*, June, 1917.

Carbon-Tube Furnaces.—J. A. HARKER.—A discussion of the problems involved in making carbon-tube furnaces and some of the disadvantages of this type of furnace. The construction of spiral-element, hollow-tube carbon furnaces is discussed briefly, and remarks are included on induction furnaces, vacuum furnaces and those with granular and molten-metal resistors.—*Transactions of Faraday Society*, June, 1917.

Industrial Switch Gear.—Description of a three-phase outfit used in a flour mill and made out of stock parts. This feature is emphasized as it is thus possible to supply switch gear of the most elaborate character on short notice.—*London Engineering*, Sept. 7, 1917.

Electrophysics and Magnetism

Photoelectric Sensitivity of Various Substances.—W. W. COBLENTZ and W. D. EMERSON.—The paper summarizes results of an investigation of various substances to determine the increase in electrical conductivity caused by the action of light upon them and for electrical discharging activity when they were charged to a negative potential in an evacuated chamber and exposed to light. Selenium, stignite, boulangerite, jamesonite and silver sulphite show an increase in electrical conductivity on exposure to light. Pure gallium and sulphur sulphite were found to have only a small photoelectric discharging action when charged to a negative potential and exposed to light. The electrical conductivity of tellurium, boelite, bismuthinite and mixtures of the sulphite of lead and antimony were not changed on exposure to light.—*Journal of the Washington Academy of Science*, Oct. 19, 1917.

Results of Magnetic Observations.—DANIEL L. HAZARD.—Report made by the United States Coast and Geodetic Survey in 1916 giving the results of the magnetic observations in thirty-three states and territories. The declination, dip, horizontal intensity and date of test are given for each of the stations, which are indicated by their latitude and longitude.—*Department of Commerce Special Publication No. 42*.

Units, Measurements and Instruments

Suggestions for the Prevention of Mistakes in Meter Reading.—G. W. STUBBINGS.—Mistakes in meter reading, the author says, may have far-reaching consequences, causing friction with consumers and involving great trouble which is difficult to adjust. The author outlines some of the most frequent causes of error, telling how they can be avoided, and suggests a set of instructions for meter readers. Among the suggestions

are: Read the meter and make calculation twice; test the meter roughly on one lamp; make notation of stoppage of meter; compare consumption with previous reading or corresponding period; inspect seals, and avoid conversation with consumers and do not try to answer complaints.—*London Elec. Review*, Sept. 21, 1917.

A New High-Tension Meter.—P. F. DUFOR.—Meter contains only low-tension elements, the use of instrument transformers being avoided by connecting directly to the consumers' step-down transformer.—Abstracted from *Revue Gén. de l'Elec.*, in *London Elec. Review*, Sept. 21, 1917.

Probe-Wire Measurements of Anode Fall of Potential.—JOHN T. TATE and PAUL D. FOOTE.—A film of high resistance forms at the surface of a probe placed in the anode glow. If a voltmeter is employed for the measurement of anode fall, the readings must be corrected to allow for the potential drop through this high-resistance film. Such a correction would be impracticable on account of the varying nature of the film. Since the probe functions as an anode during voltmeter readings, evidence has been obtained for the existence of an anode polarization similar to the polarization at the cathode in a highly ionized gas, as observed by Skinner. The magnitude of the anode polarization is very much less than the cathode polarization. This explains the fact observed by Skinner that in an auxiliary transverse discharge through the cathode glow the resistance and the current potential curves are characteristic of the auxiliary cathode employed.—*Journal of the Washington Academy of Sciences*, Sept. 19, 1917.

A Method of Observation and Measurement of Rapid Periodic Magnetic Phenomena.—P. WOOG and J. SARRIAU.—The method employed is to make vibrate a small piece of metal attached to a Koenig manometric capsule. An examination of the deformations of the flame due to the vibrations transmitted to the capsule enables a study of the magnetic field of the vibrator to be made both as regards magnitude and variation. So as not to introduce perturbation a glass capsule is employed. The metal is a disk of iron, 18 mm. thick, with a hole 6 mm. in diameter in its center. It is fastened to the membrane on the outside of the capsule. The capsule is traversed by a current of coal gas at a constant pressure of 13 mm. of water. The electro-vibrator is placed perpendicularly to the membrane and 62 mm. distant from it. The observations of the flame are made by means of a rotating mirror, or the results may be registered photographically.—Abstracted from *Comptes Rendus*, April 16, 1917, in *Science Abstracts*, Section A, Aug. 30, 1917.

Emanation Electroscopes.—O. C. LESTER.—Results of an investigation to determine a method of calibrating emanation electroscopes and to obtain the constants therefor.—*American Journal of Science*, September, 1917.

Telegraphy, Telephony and Signals

Thomson-Houston System of Automatic Telephony.—A résumé of three patents granted to the French Thomson-Houston company in the domain of automatic telephony. These relate, first, to the operation of an automatic network embracing 10,000 lines; second, to a new arrangement by which a subscriber desiring a number that for any reason is out of service will be

connected automatically with a special line and operator; third, to a new individual commutator which allows a subscriber's line to be connected with the apparatus of a standard automatic system.—*Revue Gén. de l'Elec.*, Sept. 8, 1917.

Telephonic Transmission Losses.—K. OGAWA and T. ARAKAWA.—An account of experiments conducted at the Electrotechnical Laboratory, Tokio, Japan, to determine the transmission losses in bridged impedances, series resistances and capacitances with different types of lines and different telephonic apparatus types attached thereto. After discussing briefly the problems in telephonic transmission, the authors develop formulas for the characteristics of telephone transmission lines and finally present a number of tables and curves, giving the limiting lengths for lines with different apparatus connected thereto and relations between calculated and observed losses with apparatus inserted at different points along the line.—*Report No. 19 of the Second Section of the Electrotechnical Laboratory*, Tokio, Japan.

Relation of Audibility Factor of a Shunted Telephone to the Antenna Current.—BALTH. VANDERPOL.—According to the author the assumption that the audibility factor of a shunted telephone is in general proportional to the square of the antenna current, as stated by Hogan, seems to be invalid. For large values of the current it was found that there is a proportionality between the audibility factor and the square of the current, and for weaker signals the audibility factor was found to be proportional to the power of the current varying between 2 and 0.7 in agreement with Love's expectations. The author expects to continue the investigation.—*London Philos. Mag. and Journal of Science*, September, 1917.

Miscellaneous

Disk-Wheel Stress Determination.—S. H. WEAVER.—This article describes and applies a simplified method for determining the centrifugal stresses in a disk wheel of given irregular shapes of section. Stodola's disk theory is assumed, together with his formula for disks of hyperbolic-section profile. The formulas are then transformed so as to give the tangential stresses at the inner and outer radii in terms of the radial stresses, ratio of radii and shape constant of disk section. For commercial work approximate equations are given which cover the practical disk operations and within the limits shown have a range of error of less than 1 per cent. As a further labor-saving device when a number of disks are to be estimated, the approximate equations have been placed in an alignment-chart form. A practical example is included showing an actual application of the method to a disk wheel of the usual type.—*Gen. Elec. Review*, October, 1917.

Construction of Electrical Material.—HENRI SCHUHLER.—Extracts from an inquiry into French production of electrical apparatus and the foreign assistance which France has received. Among the subjects taken up are the French industry in the construction of electrical material before the war, construction of electrical material in Germany, German imports into France, means proposed to limit German aid and develop the French industries, and future of electrical construction after the war.—*Association Nationale d'Expansion Economique*.

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

SIGN LIGHTING AND THE FUEL SUPPLY PROBLEM

Attitude of Utilities in Fuel Conservation Is Considered by the National Committee on Gas and Electric Service

The question of electric sign lighting, as well as other matters concerning the coal supply of the public utilities, and the attitude of the utilities toward the general problem of fuel conservation were considered at a meeting of the National Committee on Gas and Electric Service in Washington on Nov. 1. It was expected also that the committee would have a conference with the Fuel Administrator to consider these various matters as they affect public utility relations.

SIGN OWNERS WANT TO KEEP THE GREAT WHITE WAY BRIGHT

Property Holders on Broadway Take Up Question of Sign Lighting with Fuel Administrator—Small Energy Consumption

About 100 owners of property on Broadway and Fifth Avenue, New York, held a conference on Oct. 29 in Washington with Fuel Administrator Garfield to discuss the subject of discontinuance of electric sign lighting. Members of the delegation argued that curtailment of sign lighting would not only deprive those who had made an appreciable investment of the income on it but would also inflict unnecessary deprivation of light which attracts hundreds of thousands to Broadway. They also said that the light represented surplus energy and did not involve extravagance or waste of coal.

Dr. Garfield said that the subject had been taken up by the Fuel Administration, but that no decision had been made as to curtailment of the lights. He spoke of the urgent necessity of saving as much coal as possible and informed the delegation that everything must be done to minimize the waste.

A compromise proposal has been suggested under which lights on Broadway would not be turned on until 8 o'clock p. m. this winter instead of at 4.30 o'clock or 5 o'clock as formerly.

John W. Lieb, vice-president and general manager New York Edison Company, made a statement on Oct. 31 in regard to the question of sign lighting in New York. He called attention to the estimate that such lighting consumes only about six-tenths of 1 per cent of the energy and that the actual saving in coal would be less than one-tenth of 1 per cent.

"It has been the experience abroad that cheerful surroundings and a certain amount of gayety have a very favorable effect on the convalescence of wounded soldiers," Mr. Lieb declared, "while gloomy surround-

ings have a depressing and unfavorable effect. For this reason our allies, while prohibiting street illumination and displays in order not to invite hostile aircraft, have found it necessary to maintain theaters, moving-picture shows and other forms of entertainment to help cheer up the soldier."

Because of these facts the situation is one of psychology rather than of economy, of impression than of actual important waste. Mr. Lieb added that if it appears important to the national or municipal authorities to eliminate the signs there is no doubt that the lighting and power companies throughout the country will co-operate in every way, without regard to any loss of revenue. The problem is national rather than local in character, and if, in order to avoid even the appearance of waste or extravagance it becomes necessary to take action, it should be undertaken by the national authorities involving a public announcement by Dr. Garfield.

WASHINGTON VIEWPOINT ON ELECTRIC SIGN LIGHTING

Coal Supply Problem Considered in Its Relation to Essential Industries—Hindsight in Water-Power Development

The Washington viewpoint on the sign-lighting question is thoroughly bound up with the order issued by the priority board, which forbade the use of open top cars for the transportation of a number of materials. Every effort has been made in Washington recently to obtain more coal for all of the industries.

The Washington correspondent of the ELECTRICAL WORLD reports that there is no intention on the part of the authorities to discourage the use of all electric sign lighting. Many questions have come up in regard to the possible use of coal and the lack of coal cars for furnishing coal not only for the public utilities but for the use of homes in many parts of the country.

It was stated to the Council of National Defense that many public utilities had been more or less obliged to run on part time for the lack of coal. It was also stated that no coal cars could be obtained. Many munition plants were obliged to run on part time for the lack of coal. In the city of Detroit alone there were more than 59,000 homes without coal.

In these circumstances the Washington viewpoint is that the electric light companies should not wastefully expend coal for furnishing sign lighting in such places as the Board Walk in Atlantic City, Broadway in New York and other celebrated "white ways" throughout the country.

Some Senators who are still in Washington, as well as many Representatives in Congress, believe that the administration should have carried out promises made five years ago, when it came into power and announced

that one of the first things to be done would be the passage of the so-called conservation bills.

The government at Washington, so far as can be ascertained by the Washington correspondent of the **ELECTRICAL WORLD**, intends to discourage the wasteful use of coal for electric signs throughout the winter. Members of the Council of National Defense hold out a hope that when the spring comes and there shall not be so much need of coal a different policy for such lighting will be pursued.

BELL MEMORIAL UNVEILED AT BRANTFORD, CANADA

Noted Inventor of the Telephone Is Present at Ceremonies Held in His Honor in Ontario City

The Bell Memorial, erected in honor of Dr. Alexander Graham Bell and his invention of the telephone in Brantford, Ont., in 1874, was unveiled at Brantford on



Oct. 24 by the Duke of Devonshire, Governor-General of Canada. Dr. Bell was present and took part in the ceremonies.

ENGINEERING COUNCIL FOR HYDROELECTRIC DEVELOPMENT

Remedial Laws Favored to Promote Conservation—Movement to Co-ordinate and Strengthen Work of Engineering Committees with Government

The Engineering Council met on Oct. 11 in the rooms of the American Society of Mechanical Engineers, Engineering Societies Building, New York.

The rules committee submitted a draft of rules for the admission of other societies to the council, and progress was made in their consideration.

The committee on public affairs reported on a number of requests that the council support pending or proposed legislation.

Remedial laws intended to promote hydroelectric development were favored and the council voted to offer its co-operation to the United States Chamber of Commerce, which is interesting itself in this matter.

A movement to co-ordinate, unify and strengthen the work of various engineering committees co-operating with the federal authorities at Washington was considered favorably. H. W. Buck and Charles Whiting Baker were appointed council conferees.

CORRECTING WASTE IN USE OF ELECTRICAL ENERGY

Empire State Gas & Electric Association, Anxious About Coal Supply, Points Out Ways of Economizing

Officials of the Empire State Gas & Electric Association, whose members feel the urgent necessity of coal conservation, have conducted correspondence with the Washington authorities in order to present their needs for consideration. The correspondence has dealt with measures for the conservation of both electrical energy and gas, and it contains a number of suggestions.

A letter sent by the association, through Charles H. B. Chapin, the secretary, to Edwin B. Parker, member of the priorities committee, is a reply to a letter from that gentleman requesting "further suggestions as to the ways and means of conserving gas and electric energy without unnecessarily disturbing commercial and industrial conditions or causing any unnecessary loss, damage or suffering."

In his letter Mr. Chapin, after referring to ways in which gas is being wasted, says in part:

Electricity is being wasted:

1. By continued use of the old-fashioned carbon-filament or gem lamps for lighting instead of the modern and more efficient tungsten lamp.

2. By continued use of old-fashioned and inefficient types of lamps for street lighting.

3. By continued use of belt drive for machinery in manufacturing establishments instead of the more efficient group or individual motor drive.

We would respectfully suggest that an educational campaign in relation to these matters might be undertaken. In our judgment the series of War Bulletins being published by the Chamber of Commerce of the United States would be an effective medium for such a campaign. In addition, cards might be prepared to be hung over gas ranges and other gas and electric appliances pointing out the need of economy.

The present waste is very great, while the means to eliminate it are simple and to the financial benefit of the consumers.

The gas and electric companies of the country should, and we have no doubt would, assist and co-operate in such a campaign as has been suggested in every way possible.

Exhibits sent with the letter of Mr. Chapin point out the economy of tungsten over carbon lamps, the continued use of inefficient types of lamps and of uneconomical methods in street lighting. Waste in factory power was also considered.

ELECTRICAL MANUFACTURERS' COUNCIL MEETS IN NEW YORK

Considers a Number of Matters of Interest to the Three Organizations Which Have Delegations to It

A meeting of the Electrical Manufacturers' Council was scheduled to be held on Nov. 2, 1917, at the Engineers' Club, New York City. This council is made up of delegations of four representatives from each of the three electrical organizations—the Electric Power Club, the Electrical Manufacturers' Club and the Associated Manufacturers of Electrical Supplies. It was expected that a number of matters of interest to the respective organizations would be presented to the council.

ENGINEERING CONFERENCE IS HELD IN WASHINGTON

Called by Ambrose Swasey—Recommendations to Be Made for Unification of Relation of Engineering Agencies to the Government

Invitations were sent recently by Ambrose Swasey to thirty-two of the various engineering bodies and committees rendering or desiring to render government service, asking each to send two delegates to a conference in Washington to be held on Oct. 26.

The delegates met at 10 a. m. on that day as guests of the Bureau of Standards. Following a statement by Mr. Swasey of the reasons for calling them together and after deliberations extending over the greater part of the day, a resolution was passed authorizing the chairman elected by the meeting (Col. John J. Carty of the Signal Corps) to appoint a committee of five, of which he was to be a member, to confer with the Engineering Council and the governing bodies of other engineering organizations with a view to formulating such recommendations, to be presented to a later meeting of the delegates, as would, if adopted by their constituent bodies, remove certain duplication of effort and representation and in general unify the relation of the various engineering agencies to the national government in the interest of the dignity of the profession and the successful conduct of the war.

PERSONAL CLASSIFICATION OF MEMBERS OF THE A. I. E. E.

Purpose Is to Enable Prompt Response to Be Made to Army, Navy and Other Governmental Departments

A blank form for information on which a complete personal classification of members may be based is being issued by the American Institute of Electrical Engineers. For the purpose of doing this work the Institute has appointed a classification committee of three members.

The form which is being issued to A. I. E. E. members is similar to one issued by the American Society of Mechanical Engineers on June 1. The form has been expanded somewhat over the one promulgated by the A. S. M. E., and it is being sent also to members of other engineering organizations. The expectation is that all known branches of engineering will undertake a classification of members on the lines proposed.

Accompanying the blank form sent to A. I. E. E. members is a letter of F. L. Hutchinson, the secretary, saying:

Various branches of the army, navy and other governmental departments, as well as many industrial establishments, are calling upon the Institute for assistance in obtaining men of specified technical qualifications. To respond promptly and effectively it is necessary that detailed information regarding the many Institute members who are available and anxious to serve shall be on file at Institute headquarters.

Accordingly the directors have authorized the secretary to request each member to fill out and return the inclosed classification form, which has been prepared by the co-operation of several engineering societies with the object of covering all branches of engineering and of providing for uniformity in classification, in the hope that ultimately the records thus obtained by different societies may be combined in a single index in a central bureau.

Your prompt co-operation, even although you have already filled out similar blanks for other organizations and whether you are available for service or not, is requested. Particular attention should be devoted to the record of your technical training and experience and the index schedule which follows.

Although the immediate need of obtaining and indexing this information is to enable the Institute to render greater service to the government, the intention is to maintain a permanent file of such data, revised from year to year. This is needed in connection with the regular work of the Institute, and will probably prove of increasing value after peace has been declared in providing for the readjustment in the industries, with a view to the utilization of the services of the membership to the best advantage of the individual engineer and of the nation.

ANNUAL CONVENTION OF NEW JERSEY ASSOCIATION

T. H. Dudley Perkins Raises Question Whether Government Should Not Consider Extension of Maturing Obligations

The New Jersey Utilities Association held its third annual convention at the St. Charles Hotel, Atlantic City, on Oct. 26 and 27. Among the addresses on the program were:

"The Proper Relations Between Public Utilities and Public Utility Commissions," Ralph E. Donges, president Board of Public Utility Commissioners of New Jersey; "The Problem of Higher Operating Costs and Commission Control of Rates," Thomas Conway, Jr., professor of finance, University of Pennsylvania; "Public Utilities Doing Their Bit," John L. O'Toole, Public Service Corporation, Newark; "Interrelation of Various Obligations for Adequate Utility Facilities Under War Conditions," George W. Fuller, consulting engineer, New York; "The Financing of Public Utilities," T. H. Dudley Perkins of Bioren & Company, bankers, Philadelphia; "The Binding Force of Term Contracts with Special Relation to Public Utility Rates," Ralph J. Baker, Harrisburg, Pa.; "The Valuation of Intangibles for Rate-Making Purposes," Dr. F. Herbert Snow, chief engineer Public Service Commission of Pennsylvania; "Utility Troubles—Their Causes, Effects and Remedies," W. H. Roth, Philadelphia.

T. H. Dudley Perkins in his paper made the following definite suggestions concerning the financing of maturing obligations:

"In every community the Liberty Loan is given the right-of-way, and every patriotic banker devotes his time to promoting the public good by helping to place these bonds among his clients. The periods of rest between the placing of these loans are fully covered by such necessary financing as renewals of maturing obligations, thus eliminating the possibility of any new financing at this time. Indeed, the question of renewal of maturing obligations is in itself a most serious problem, and with each new piece of financing being done on a higher interest basis than the last it becomes a serious question whether the government should not consider the advisability of extending the maturing obligations which have been made for a period of more than one year and the maturity of which is not provided by such installment payments as car trust rentals, etc., so that at least during the period of the war our public service corporations should not be embarrassed by this expensive and difficult operation."

INCREASE IN THE RATES OF THE MILWAUKEE COMPANIES

State Commission Holds that Utilities Have Acted with Discretion and Judgment in Contracting for Coal

As stated in last week's issue, the Wisconsin Railroad Commission has rendered a decision approving increased electric and steam heating rates of the Milwaukee companies because of the higher cost of coal. Extracts from the decision follow:

Early in 1917 the coal shortage became acute. No assurances as to delivery or as to prices could be secured covering dock coal through previous sources, and the companies in order to protect themselves and the public contracted for coal from Illinois, Indiana and Kentucky mines. These contracts are advantageous when compared with anything that could now be secured through former sources. The coal is of poorer quality, but the net B.t.u. cost is considerably less. It seems clearly established that coal could not be purchased on a more favorable basis at the present time than that contracted for by the company, and that the companies have acted with discretion and judgment. Unless unforeseen contingencies arise the companies have protected their coal supply to at least April 1, 1918.

A careful analysis has been made of the coal costs under these contracts. Considerable deliveries have already been made. Such coal has been carefully tested and the B.t.u. efficiency has been ascertained from daily tests. These tests show that the coal purchased under present contracts will average substantially 10,900 B.t.u. (not dry) per pound of coal. None of the present contracts are on a B.t.u. basis. The mine prices include costs for separation of screenings from lump and the contracts provide that mine price is based on mining and day-wage scales then in effect, and this price is to be increased or decreased with change in such scale. One increase has become effective under this provision. Contracts are for net tons.

As to electrical schedules, the application is confined entirely to the energy factor and is limited to those cases where the monthly consumption is over 1000 kw.-hr. As to the smaller consumer, the cost of coal represents a relatively small percentage of the total cost of the service, while as to the large consumer it represents a relatively large part. It is not to be overlooked that the larger users, especially of power, are receiving a service substituted for one which otherwise would demand the direct use of coal, and in proportion as coal cost increases the relative saving or convenience of the substituted use of electric energy will be more than preserved. Furthermore, it is not felt that the justice of increased rates to the smaller consumer, a large part of whose charge is now made up of the demand factor, could be ascertained without a much more detailed analysis of all factors entering into that service than would be possible in this emergency hearing. Those rates are under investigation in the main cases now pending.

Several large power users appeared not exactly in opposition to the application, but with the earnest insistence that whatever was done in the matter the commission would carefully see to it that there should not be placed upon the shoulders of such large users a burden that ought in fact to be borne by other classes of consumers. We are confident that the order herein made will not have that effect. Certainly no pains or effort has been spared on the part of the commission to make certain on this point. On the part of some of the heating consumers it was strongly urged that consideration should be given to the fact that landlords are not in a position to shift the burden of increased heating rates to their tenants through changes in leases, some of which have a long time to run. While it is true that landlords may not be in a position at once to pass the added burden, it is perfectly clear that they are in no different position in that respect from that they would occupy were they supplying their own heat. Recent applications for heating service are quite convincing on that point. Nor is it believed that the additional cost of service under the new schedule herein put into effect is as great as would be the increase in the cost of operating isolated heating plants.

The increased revenue which will be derived through the schedule authorized will not compensate the applicants for the increased cost of coal alone and does not provide for any of the increased costs of labor.

For the months of June and July the coal cost per 1,000,000 B.t.u. was 22.2 cents. Applying this coal factor as a measure for relief over and above the coal costs of 12 cents per 1,000,000 B.t.u., which the company has assumed might still be normal, would give an increased kilowatt-hour cost of 0.396 cent and an increase of 25.5 cents per 1000 lb. of live steam and 18.4 cents per 1000 lb. of low-pressure heating steam. The cost per 1,000,000 B.t.u. to the company can be substantially calculated for the period ending March 31, 1918, subject, of course, to unforeseen contingencies, and this cost amounts to substantially 20 cents. No material change is to be anticipated in this coal cost factor during that period. The order will therefore fix the increase in rates on this basis. If no change takes place, the results will be the same as though the sliding scale sought by the petitioners were adopted.

The increases allowed amount to 0.31 cent per kilowatt-hour on consumption in excess of 1000 kw.-hr. per month and 20 cents per 1000 lb. of high-pressure steam and 14 cents per 1000 lb. of low-pressure steam.

With regard to the application for authority to discontinue flat rates for heating service, the commission is of

THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY —MILWAUKEE LIGHT, HEAT & TRACTION COMPANY

AMOUNT AND COST OF COAL USED FOR THE GENERATION OF STEAM

Period	Pounds of Coal	Cost per Ton of Coal Delivered	B.t.u. per Pound	Total B.t.u. (Millions)	B.t.u. for 1 Cent	Cents per 1,000,000 B.t.u.
Year ended Dec. 31, '15...	343,789,007	\$2.46	12,350	4,245,806	97,800	9.8
Year ended Dec. 31, '16...	457,227,045	2.61	12,310	5,640,737	94,500	10.6
7 mos. ended July 31, '17...	370,587,132	3.65	11,310	4,196,750	62,000	16.1
January, 1917...	55,558,078	2.74	12,210	678,363	89,200	11.2
February, 1917...	52,440,715	2.80	12,200	639,777	87,200	11.5
March, 1917...	53,089,235	2.97	11,600	615,832	77,900	12.8
April, 1917...	53,155,060	3.16	11,075	589,619	70,000	14.3
May, 1917...	56,825,526	4.49	10,580	600,617	48,000	20.8
June, 1917...	51,095,648	4.73	10,575	543,622	45,000	22.2
July, 1917...	48,422,870	4.86	10,922	528,920	45,000	22.2

the opinion that this authority should be granted. If the effective dates of the rates herein ordered are postponed to apply only to such service as is rendered after the next meter reading, it would be about two months before bills would be rendered to certain consumers in accordance with the advanced rate, and the final meter reading and billing as to these consumers would not take place until nearly June 1. The order herein will provide for these rates being effective for six months for each consumer. This order becomes effective for meter readings taken Oct. 25. The date of the last meter reading for which bills shall be rendered in accordance with the rates herein authorized shall be April 24, 1918.

Electric Energy Schedule.—For all energy delivered in excess of 1000 kw.-hr. per month there is added to the rates now applicable 0.31 cent per kilowatt-hour.

High-Pressure and Low-Pressure Steam Schedules.—There is hereby added to the present rates an additional charge of 20 cents for each 1000 lb. of condensation for high-pressure steam heating and 14 cents for each 1000 lb. of condensation for low-pressure steam heating.

The rates above provided for shall be applicable to all meter readings from and including Oct. 25, 1917, to and including April 24, 1918. All customers affected shall be maintained in the same rotation as to meter readings and billings so that none shall pay for more days of service than the equivalent of the days of service between Oct. 1, 1917, and March 31, 1918, inclusive.

Unless otherwise hereafter ordered, the rates in effect at the present time shall in all things be restored upon the expiration of the period for the increased rates as in this order provided, except that flat rates shall not be restored.

COMPANIES ARE SOUND, SAYS SAMUEL INSULL

Increasing Coal Cost Need Affect Only Small Percentage of Total Expense of Commonwealth Edison Company

Speaking before the Commonwealth Edison Company Section of the National Electric Light Association and the Public Service Company of Northern Illinois Section of the N. E. L. A. at the annual meeting of the former organization on Oct. 25, in customers' hall, Edison Building, Chicago, Samuel Insull gave some very interesting data which show the firm position of Chicago public utility organizations. He said that the public utility business is one which it is popularly supposed could not profit in these days of general prosperity on account of the high prices of the materials used in its property and because its selling price to consumers is fixed. Arguing thus, certain people have made it appear that public utility securities were not what they have been said to be, namely, the best investment next to the securities of the United States government.

Mr. Insull said that although prices of materials used in the central station business had gone up and may continue to go up for some time, the traditional policy of the Commonwealth company of continually lowering rates will not be reversed unless this war lasts a great many years longer than is expected. The one great advantage in the central station business lies in the fact that the rapid growth of business brings an absolute necessity for new and additional machinery, and the development of the art has made it possible to purchase new machinery of very much higher efficiency than old machinery. Furthermore, growth of the business has been so rapid that old machinery which must become obsolete is at the time of obsolescence a very small percentage of total plant capacity and a small percentage of the investment involved. To illustrate this Mr. Insull referred to the fact that in 1912 generating capacity of the Commonwealth company was 230,000 kw. In 1916 it had increased 55 per cent to 360,000 kw., at the end of 1917 it will be 452,000 kw., and, on the basis of equipment now on order, in 1919 it will be 600,000 kw. In other words, the generator capacity of the company has increased threefold in seven years.

GOOD INCREASE IN GROSS

On the financial side, Mr. Insull said that in the first nine months of the year the increase in gross operating revenue amounted to \$1,726,762, or 10.5 per cent over the same period for 1916. This increase was greater than the increase for the first nine months of 1916 over the first nine months of 1915. He estimated the total increase in gross for 1917 over 1916 at more than \$2,000,000, and that the total increase in gross of 1917 over 1915 would be \$4,000,000. Taking into account the fact that the company in this time reduced its rates to an extent of \$1,000,000, the actual increase in gross business for 1917 over 1915 is more than \$5,000,000. He expressed the belief that in 1917 the company would receive from the sale of energy alone over \$25,000,000.

Mr. Insull stated that this growth was very satisfactory and that operating expenses had been kept down to a very satisfactory basis. There have been some increases, of course, but the only item which is out of

proportion is cost of coal. This he said was offset by increase in gross business, and he presented the following figures in illustration.

In 1916 the expenditures in round numbers were as follows:

Fuel	\$3,642,000
Other operating expenses.....	8,265,000
Depreciation	2,822,000
Taxes and insurance.....	1,835,000
Bonded indebtedness	2,099,000
Depreciation	3,667,000

Making total expenditures for operation and fixed charges\$22,330,000

Of this total only 16 $\frac{2}{3}$ per cent was expended for fuel. Mr. Insull added that 55 per cent of the fuel is burned in supplying electricity for operation of the Chicago elevated railways and surface lines. The Commonwealth company contracts with these companies specify that if coal increases above a certain price the company can add an increased charge. Therefore, even though no increase is made in retail rates, the increased coal cost need affect only 45 per cent of the total cost of fuel. In figuring increased cost due to the increased fuel cost, estimates should not be based on 16 $\frac{2}{3}$ per cent, but on 16 $\frac{2}{3}$ per cent less 55 per cent. Moreover, two-thirds of the coal is from company mines, and if coal prices rise out of reason the balance sheet will show a profit on mining operations from money paid to the company's own coal company.

AFFAIRS WELL IN HAND

Mr. Insull said that he was talking to employees in this way because on many former occasions he had assured them that the company securities were the safest to buy with the exception of government securities. He wished to repeat this statement as true at present, and to assure employees that their dividends were as sure as their salaries. He advised them not to become stampeded by statements of persons who know nothing about the company standing, and expressed the belief that the company balance sheet for the coming fiscal year would not show a variation of \$100,000 from last year.

Moreover, he said, if this war were going to last for any number of years, certain people would observe that the company had not yet begun to cut expenses. At the same time Mr. Insull expressed the belief that such drastic measures would not be necessary. He said that the company plans the same general policy of extension during 1918 as it followed previously.

Reverting again to the future, Mr. Insull pointed out the advantage through increased efficiency in production apparatus as the plants grow. At present, he said, the company uses on an average about 30,000 heat units to produce a kilowatt-hour or it takes about 2 $\frac{3}{4}$ lb. of coal to make a kilowatt-hour. It is estimated by the company's engineers that in 1918 the company will produce energy on about 2 $\frac{1}{4}$ lb. In 1919 he estimated that the company would produce energy on about 2.06 lb. In one or two years following 1919, he predicted, energy will be produced on less than 2 lb. of coal per kilowatt-hour.

As to the Public Service Company of Northern Illinois and Middle West Utilities Company, Mr. Insull said that the explanations which applied to the Commonwealth company also applied to these concerns.

although to a somewhat less favorable extent. He stated, however, that both would earn returns on their funded indebtedness and have something for surplus. In regard to gross business of the Middle West company subsidiaries, he said that in all probability the 1917 showing would be \$12,000,000 against \$9,000,000 for last year. Furthermore, the Middle West company will receive from subsidiaries \$1,541,000 in 1917 against \$1,479,000 in 1916.

"On the whole," Mr. Insull concluded, "we have every reason to be satisfied with the showing which our oldest and our youngest properties are making. We have very little to fear."

At the opening Mr. Insull referred to the fact that 519 employees of the company had gone to the front, and that three-quarters of these had volunteered. He expressed the belief that the preparations which the Insull companies had been making for the entrance of the United States into the war since war was first declared three years ago will stand them in good stead for its duration.

DISCUSS FUEL SITUATION AT NEBRASKA CONVENTION

N. E. L. A. Nebraska Section Gives Careful Attention to Problems of Coal and Rates—J. E. Davidson the New President

The annual convention of the Nebraska Section of the National Electric Light Association was held at the Paxton Hotel, Omaha, Oct. 24 and 25. The delegates were welcomed by Mayor James C. Dahlman. In the unavoidable absence of the president, A. C. Leflang of the Lexington Power & Light Company presided.

J. E. Davidson, vice-president and general manager Nebraska Power Company, Omaha, was called upon. Responding to the request of the members present, he discussed the future of the electric industry, the advance in prices of material and the enormous advance in coal cost, and their influence on the prevailing and future price of electricity, both for power and lighting purposes.

K. P. Goewey, Nebraska Power Company, read a very interesting paper on the sale and the future of the electric range. Both he and Walter Fagan of the Hughes Electric Heating Company interested those in attendance for over an hour by the use of lantern slides. They showed the uses of the electric range in dwelling and apartment houses. The delegates seemed to be considerably impressed and will make an effort to introduce the electric range in all central stations throughout the State.

J. B. Harvey, vice-president and manager York (Neb.) Public Service Company, read a paper on "Overhead Transmission Lines." He discussed construction methods and also gave personal experiences in the construction and operation of the transmission lines controlled by his company.

C. J. Snyder, engineer Nebraska Power Company, Omaha, read a paper on "Inductive Interferences; Rules and Regulations Covering the Construction of Overhead Transmission Lines." This described his experience in meeting with the State Railroad Commission and his efforts with the telephone companies and signal companies to work out a satisfactory basis

which will meet with the approval of all who are interested and also meet with the approval of the State Railroad Commission.

E. A. Anderson, National Lamp Works, Cleveland, gave an instructive address on modern illumination. He used lantern slides to illustrate his points and show the more modern ways of street illumination as applied to large cities and smaller towns, and also referring to interior lighting.

R. L. Ponsler, Norfolk, Neb., read a very interesting paper on "Steam Economy." Considerable discussion followed as to the merits of the various engines and turbines and his experience with the "Uniflow" engine.

W. C. Ross, Nebraska Gas & Electric Company, Omaha, presented a paper on the "Fuel Situation." This covered present sources of supply, cost with direct relation to the cost of producing energy, etc. Mr. Ross's paper was followed with close attention, as the enormous advance in price of fuel bears so directly on the present cost of producing electricity that it was the most important subject discussed at the meeting.

The officers elected for the following year are: President, J. E. Davidson, vice-president and general manager Nebraska Power Company, Omaha; vice-president, T. H. Fritts, Central Power Company, Grand Island; secretary and treasurer, R. W. McGinnis, O'Neil Light & Creamery Company, O'Neil; executive committee—W. C. Ross, Nebraska Gas & Electric Company, Omaha; J. E. Shuff, Lincoln Gas & Electric Company, Lincoln; O. J. Shaw, Lincoln Traction Company, Lincoln; W. B. Roberts, Union Company, Omaha; A. C. Leflang, Lexington Power & Light Company, Lexington; J. B. Harvey, Public Service Company, York.

The newly elected officers and executive committee met after the convention adjourned and discussed plans whereby they can increase the Nebraska membership and further the electric interests of the State, bettering conditions as to rates and public policies.

REFILLABLE FUSE RULING IN THE NATIONAL ELECTRICAL CODE

Full Text of the Revised Ruling on Refillable Fuses, as Submitted at Recent Meeting in New York

In the account of the meeting of the National Fire Protection Association published in the issue of the *ELECTRICAL WORLD* for Oct. 27 an error was made regarding the National Electrical code rule on refillable fuses. The full text of the report of the committee on switches and cut-outs on this subject follows: "In view of the misinterpretation placed on the report of the committee in the March *Bulletin* regarding refillable fuses, the committee desires to submit the revised report following: 'On the evidence presented to or obtained by the committee, it does not recommend any change in Rule 68-d, but presents this report with the understanding that (in order to obtain additional field experience) municipal and underwriters' inspection departments may permit a continuation and extension of the use of such refillable fuses as have in their opinion been shown to comply with the tests specified for standard cartridge fuses and to be suitable for use.'"

CHANGES IN PERSONNEL OF ENGINEERING FACULTIES

Listing of Resignations, Leaves of Absence, Promotions and Appointments in the Electrical Teaching Body of the United States

Owing primarily to the war, either because of national service or because of the call by industry for technically trained men, there have been many changes in engineering faculty personnel throughout the country since the last school year closed. The *ELECTRICAL WORLD* has undertaken to list these changes so far as they pertain to the electrical engineering departments of these institutions. The following is a partial list of those received up to the present; others will follow in later weeks:

Agricultural and Mechanical College of Texas, College Station, Tex.—Associate Prof. J. H. Cannon has resigned to accept the position of associate professor of electrical engineering at the University of Michigan. Walter C. Smith, who holds a degree of M. S. in electrical engineering from Union College, has been appointed assistant professor of electrical engineering.

Carnegie Institute of Technology, Pittsburgh, Pa.—A. F. Van Dyck, who was instructor in electrical engineering, has resigned to accept the position of expert radio aide in the Brooklyn Navy Yards. His position has not yet been filled. Robert E. Dunbar, who was graduate assistant in the electrical laboratory, has died, and his position has been filled by C. M. Porter of the Westinghouse Electric & Manufacturing Company.

Case School of Applied Science, Cleveland, Ohio.—A. A. Prior, instructor, entered the first officers' training camp at Fort Benjamin Harrison in May and was commissioned as first lieutenant, Coast Artillery. P. H. Ellsworth, instructor, is now first lieutenant in the Signal Corps and stationed at present at Fort Leavenworth, Kan. Because of the great loss of students in the senior and junior classes at the school it has not been necessary to fill the places of these men for the present year.

Drexel Institute, Philadelphia, Pa.—J. L. Beaver, for many years an instructor in electrical subjects, occupying the position of senior instructor in electrical engineering, has entered the engineering department of the Philadelphia Electric Company. No new appointment has been made on account of diminished enrollment.

Georgia School of Technology, Atlanta, Ga.—H. L. Freeman, formerly assistant professor of electrical engineering, has resigned to take a position with the Mississippi Agricultural and Mechanical College. Ben H. Woodruff, formerly instructor, is now first lieutenant in the engineer corps of the United States Army. C. P. Eldred, formerly assistant professor of electrical engineering, head of department, Co-operative School of Engineering, Northeastern College, Boston, has been appointed associate professor of electrical engineering. E. B. Phillips has been appointed instructor in electrical engineering. Other assistants in the department are not yet announced.

Kansas State Agricultural College, Manhattan, Kan.—C. A. Bjorkman, fellow in this department last year, has resigned to enter the army. The college has been unable to find a fellow to fill his place. G. B. McNair, assistant professor of electrical engineering, has been on leave of absence for the past year on account of his health. He resigned this summer to take the place of Prof. George B. Thomas, Colorado College, who is on leave of absence for a year. Prof. R. G. Kloeffer, formerly with the Washington Water Power Company, who was secured to substitute for Professor McNair last year, has been retained as his successor.

Massachusetts Institute of Technology, Cambridge, Mass.—Assistant Prof. Charles W. Green is a captain in the Heavy Artillery Corps, doing special work for the Artillery Board. F. G. Perry, who was instructor, is a captain in the Heavy Artillery. H. B. Richmond, who was instructor, is a first lieutenant in the Heavy Artillery. P. L. Alger, who was a research assistant last year, is a first lieutenant of

the Ordnance Corps, working on ballistic research at Sandy Hook. W. B. Littlefield, who was a teaching assistant in the department, is a second lieutenant in the infantry. E. W. Bowler, who was a research assistant last year, is a second lieutenant in the Engineer Corps. W. E. Wynne, who was a research assistant last year, is in the field artillery. J. B. Peterson, who was a research assistant last year, is at a training camp. Other members of last year's staff are instructing in the aviation ground school and the army and navy school, and two others are in research work connected with purely war matters. The three following additional instructors have been added to the staff this year: C. E. Lansil, E. A. Ekdahl and C. O. Gibbon. Prof. W. S. Franklin, who used to be at Lehigh University, has been appointed special lecturer in physics and electrical engineering, giving instruction in both departments.

Ohio State University, Columbus, Ohio.—Dr. A. E. Flowers, who last year was away from the university, on leave of absence, has returned to his university work. Last year he was occupied in connection with the appraisal of the Columbus Railway, Power & Light Company. E. W. Kellogg, who last year filled Dr. Flower's position, is now in the research department of the General Electric Company at Schenectady.

Oklahoma Agricultural and Mechanical College, Stillwater, Okla.—C. J. Moore, instructor, has resigned to accept a commission as second lieutenant, U. S. Reserve Engineers. William Spraragen, an employee of the Westinghouse Electric & Manufacturing Company, was elected to fill the vacancy.

Pennsylvania State College, State College, Pa.—Dr. E. C. Woodruff, professor of electric railway engineering, who was granted a leave of absence in the spring of 1917 to accept a captaincy in the Engineering Officers' Reserve Corps, has been granted an indefinite leave by the War Department and has resumed his duties at the college. George H. Mills, instructor in electrical engineering, has been granted an indefinite leave of absence from the college and is in the ordnance department of the army, stationed at Camp Dix, Wrightstown, N. J. Gordon D. Robinson, instructor in electrical engineering during the college year 1916-17, has resigned and has accepted a position in the engineering department of the Continental Can Company, Baltimore, Md. John D. Isenberg, Pennsylvania State 1902, has been appointed instructor in electrochemical engineering. For some years past Mr. Isenberg has been on the chemical staff of the United States Institute of Animal Nutrition at State College, Pa.

Polytechnic Institute, Brooklyn, N. Y.—As the result of the war the institute has lost Prof. W. D. Ennis, head of the mechanical engineering department, who has become a major in the ordnance department, and Herman A. Brandt, instructor in mechanical engineering, who has become an ensign in the navy. In the readjustment, Henry Martin, Jr., has assumed the instruction in power plants and thermodynamics, and Prof. Samuel Sheldon has been made acting head of the department of mechanical engineering. A number of additional instructors have also been brought into service.

Rensselaer Polytechnic Institute, Troy, N. Y.—J. D. Stacy, E. E., of the class of 1917, has been appointed assistant in electrical engineering to take the place of C. E. Merris, who resigned in June to accept a position in the power and mining department of the General Electric Company.

Sheffield Scientific School of Yale University, New Haven, Conn.—Prof. Harold V. Bozell, who was with the Sheffield school on leave of absence from the University of Oklahoma last year, has accepted a permanent position as assistant professor of electrical engineering. Frank H. Beall has been appointed instructor in electrical engineering. Mr. Beall received a post-graduate degree from the electrical engineering department of Harvard University. He then taught for a year in the graduate school and for the last two years has been in the engineering department of the American Telegraph & Telephone Company in New York. Russell G. Warner, a graduate of this school, who was for two years with the Westinghouse Electric & Manufacturing Company and was last year here as an assistant, has been appointed instructor, giving special attention to the laboratory work.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Insufficiency of Evidence in Overflow Case.—In an action against a company maintaining dams across a river whereby overflowing water damaged plaintiff's crops, evidence was held by the Georgia Court of Appeals insufficient to sustain verdict for plaintiff. *Georgia Railway and Power Company versus Johns* (93 S. E. 521).

Action for the Violation of a City Ordinance.—An action by a city to enjoin a telephone company from making a threatened increase in its rates or charges, in violation of a city ordinance and in violation of a contract between the city and the company, is not an "action for the violation of a city ordinance" within the law giving superior courts exclusive jurisdiction over actions for the violation of city ordinances, especially where the petition is based upon the alleged contract, rather than upon the threatened contravention of the municipal regulation, the Supreme Court of Iowa held (164 N. W. 168).

Duty of Employers to Maintain Safe Working Place.—In an action for damages for the death of an employee in a mine who came in contact with a hanging electric wire, where the declaration charged that it was the duty of the employer to use reasonable care to maintain the wire in a safe position, an instruction that it was the duty of the employer to use care commensurate with the danger to inspect and maintain the wire was justified, though there was no allegation to that effect, the duty of inspection being an incident to the duty of maintaining the wire, according to the Supreme Court of Appeals of Virginia (935 E. 5901). It was the duty of a mine operator to use reasonable care to make a fallen electric wire reasonably safe after he knew, or by ordinary care might have known, of the defect.

Power to Guarantee Bonds of Other Companies.—A corporation has no power to enter into contracts of guaranty or suretyship, or otherwise lend its credit to another, unless expressly authorized by its charter or by statute, except where the power to do so is implied from its express powers as necessary and proper in the furtherance of its legitimate business, according to the Supreme Court of Illinois (117 N. E. 148). A railroad company which has, in the proper exercise of its powers by law and within the limitations expressed in those sections, purchased stock in another railroad company, and which has in good faith, for the protection of its interests as such stockholder, acquired bonds issued by such other com-

pany, has implied power in order to sell such bonds for an adequate price to guarantee their payment. A railroad corporation which is subject to the laws of Ohio has no authority, express or implied, to enter into a joint contract of guarantee by which it jointly with other companies guarantees an entire issue or series of bonds issued by another company of which the Ohio company owns only a portion.

Renewal of Lighting Contract.

Where the subject matter of a suit between a borough and a light company is a contract wherein it is provided that "It is mutually agreed by and between the parties hereto, for themselves and their and each of their successors and assigns, that this contract shall go into effect on the thirtieth day of January A. D. one thousand nine hundred and eleven and shall expire on the thirtieth day of January A. D. one thousand nine hundred and sixteen; provided, however, that the borough may at its option renew this contract for another period of five years from the thirtieth day of January A. D. one thousand nine hundred and sixteen, under the terms and conditions hereof," it was held by the Court of Common Pleas of Northumberland County, Pa., in the Borough of Sunbury, versus Northumberland County Gas & Electric Company (5 P. C. R. 1917—431) (1) that the word "renew" as used in the contract should be construed to mean "to continue" or "extend"; (2) that where the borough elects to exercise its option to renew no additional contract of writing is necessary to continue in force the provisions of said contract; (3) that in such a case the jurisdiction of the equity court is not ousted by the public service act.

Workmen's Compensation in Accident in Plant Not Arising Out of Employment.

—In a proceeding under the workmen's compensation act to recover compensation for death, the burden was on the plaintiff administrator to prove that the accident arose out of and in the course of the employment, the Supreme Court of Illinois held in *Northern Illinois Light & Traction Company versus Industrial Board of Illinois* (117 N. E. 95). In a proceeding under the act, if there is competent evidence in the record which, standing alone, fairly tends to prove that the accident arose out of and in the course of the employment, neither the Circuit Court nor the Supreme Court may question its sufficiency, but whether there is any evidence in the record fairly tending to establish that fact is a question of law for the determination of the court. Where the head fireman of an electric company, in disregard of signs, fences and rules designed to keep persons out of the transformer room of the power plant, entered that room on no business of the company and was there accidentally killed by an electric shock, compensation was not recoverable for his death, although at other times he had frequently been called upon in performing the duties of the engineer to enter the transformer room.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Reservation in Acceptance of Security Issues.—After a hearing before the New York Public Service Commission, Second District, the city of Watertown finally agreed to withdraw objections filed against the proposed bond and stock issue for which the Northern New York Utilities, Inc., is now seeking authority. The city of Watertown, represented by Mayor J. R. Broom, City Attorney H. L. Hooker and F. W. Ballard of Cleveland, Ohio, accepts the suggestion made some time ago by the commission, namely, that an agreement be drawn whereby the city agrees not to block the proposed issue, but on the explicit understanding that such a concession is to have no weight in a rate case which is to be brought up in the near future.

Wisconsin Commission Approves Higher Heating Rates.—Appearing before the Wisconsin Railroad Commission, the Wisconsin Gas & Electric Company asked approval of rates for hot-water heating in Kenosha. The increase in operating expenses in 1917 was shown to be due to the increased cost of fuel, labor and various supplies. It was estimated by witnesses for the company that this increase in cost will continue to a more marked degree in 1918 on account of the war conditions. With the proposed increase in rates the revenue would create a return of 4.19 per cent on the book value of the plant and property. The commission found that the rate for hot-water-heating service in Kenosha proposed by the company is reasonable.

Burden of Proof Put on Complainant.

—The Pennsylvania Public Service Commission, in rendering a decision in the case of the North Abington Water Company versus the Abington Electric Company, sets forth that the complainant had a contract with the respondent by which the latter was to furnish electric power to the former at a fixed price. The contract was for a period of one year, to be continued thereafter until discontinued by either party on giving thirty days' notice. Pursuant to the terms of the contract, respondent notified the complainant that it had filed with the commission a new tariff and submitted to the complainant a new contract calling for new rates. The complainant contested the validity of the new rates, declaring them to be excessive, unreasonable and discriminatory. The commission held that since the complaint was filed after the increased rate went into effect the burden of proof was on the complainant; that the evidence submitted did not show excessive or discriminatory rates.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Kentucky Municipal Plant Increases Rates.—High cost of operation is responsible for an advance of about 1 2/3 cents per kilowatt-hour for electric lighting service from the municipal lighting plant of Owensboro, Ky., effective on Nov. 1.

Philadelphia Stock Exchange Approved.—At a special meeting of stockholders of the Philadelphia Electric Company it was announced that the total vote cast was 727,852 shares, all in favor of the plan for exchange of stock of the New Jersey company to the Pennsylvania company. The total number of outstanding shares is 999,510.

Examination for Cable Tester.—The Municipal Civil Service Commission, New York City, has announced an examination for cable tester, paying a salary of \$1,140 to \$1,380 a year. The duties of the position are to locate leaks and test for electrolysis of cables and to make acceptance tests on and inspections of wires and cables, underground conduits, manholes, accessories, firehouse and public building wiring for alarm systems and pole-line equipment. For further particulars apply room 1400, Municipal Building, Manhattan.

Examination for Clerk-Draftsman.—The United States Civil Service Commission announces an open competitive examination for clerk-draftsman, for men only, on Nov. 21 and 22, 1917, at various places. Vacancies in local branches of the General Land Office service, at the entrance salary of \$1,200 a year, and in positions requiring similar qualifications at this or higher or lower salaries, will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer or promotion. Applicants should apply for Form 1312, stating the title of the examination desired, to the Civil Service Commission, Washington, D. C., or to the secretary of the United States Civil Service Board at a number of cities.

Two Power Rates Encourage Pumping for Irrigation.—In the Perris and San Jacinto Valleys in southern California the area under cultivation has been greatly increased recently by the use of motor-driven pumps which supply water for irrigation. The operation of gasoline engines formerly used for pumping has been made too costly by the steadily increasing price of fuel oil, and this led to the substitution of the electric motor for the gasoline engine. With the success of electric pumping thus exploited there was a rapid increase in the power companies' busi-

ness. At present approximately 10,000 hp. in electric motors is being used in these two valleys. Two types of pumping developments have been installed, one of which, of large capacity, is used to supply the lands at irregular intervals and is assigned consequently a high rate for power. The smaller installations, using small motors and running continuously to supply reservoirs, thus earn a low power rate.

Increased Heating Rates.—The *Bulletin* of the National District Heating Association dated Oct. 15 contains a lengthy compilation of heating rates. In the last issue of the *Bulletin* and at the convention in Detroit strong emphasis was put on the question of increasing the rates and every one was urged to protect plants by increasing rates to cover the increased cost of service. The compilation is based on information from companies showing what action they have taken in raising rates.

Christmas Remembrance for Army Engineers.—The ladies' auxiliary of the Twelfth Engineers, which has drawn a large percentage of its membership from St. Louis and vicinity, is undertaking to see that each member of this regiment receives a Christmas present. A committee from the Engineers' Club of St. Louis has conferred with the committee from the ladies' auxiliary and has agreed to furnish a part of each package. Each individual package will contain candy, a magazine, a "housewife" and tobacco. The Engineers' Club is to furnish 1000 packages of tobacco. Clinton H. Fisk is chairman of the Christmas package committee.

Briefs in Boston Edison Street-Lighting Case.—Counsel for the Edison Electric Illuminating Company of Boston, Mass., and the city of Boston filed briefs with the Gas and Electric Light Commission Oct. 22 in the celebrated street-lighting rate case which was brought before the board for arbitration about three years ago and which has occupied 122 days of public hearings in the last eighteen months and embraces nearly 10,000 pages of testimony. Corporation Counsel John A. Sullivan presented a brief of 217 pages on behalf of the city, and Burdett, Wardwell & Ives of Boston, represented by Frederick Manley Ives, filed a brief of 265 pages on behalf of the company. Arguments on the basis of the two briefs have been going forward each day this week, the case of the city being presented first. Both parties have prepared printed briefs, and the documents summarize the direct testimony at much length, besides reviewing the points made in cross-examination. The fundamental question is whether the rates in the contract are as a whole fair. The contract (life ten years) dates from Dec. 7, 1914, and involves a street-lighting revenue of over \$500,000 per year. The chief basic items of interest covered by the service are 4543 6.6-amp. magnetite-arc lamps at \$87.53 per year each; 2910 40-cp. and 1157 60-cp. series incandescents at \$18.333 and \$21.136 respectively.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 893 of this number.

Worcester Polytechnic Institute Section of the A. I. E. E.—"Summer Experiences" was the subject of the first regular meeting of the Worcester Polytechnic Institute Section of the A. I. E. E., held Oct. 26.

Jovian Electric League, Los Angeles.—At the Oct. 17 meeting of the league the speakers of the day were Secretary of the Treasury McAdoo and Prof. Laird J. Stabler of the University of Southern California.

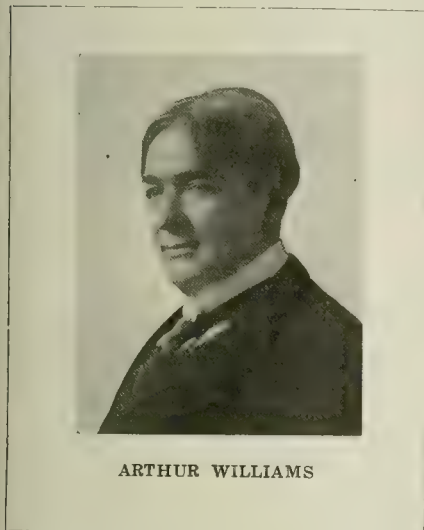
Associated Electrical Contractors, Inc., Elect Officers.—At the annual meeting of the Associated Electrical Contractors, Inc., New York City, the following officers were elected: President, H. M. Walter; vice-president, B. W. Sandbach; treasurer, J. W. Flint; secretary, H. S. Beidleman; sergeant-at-arms, B. J. Anderson.

Training of Engineers.—Prof. A. C. Lanier, chairman of the department of electrical engineering of the University of Missouri, delivered a paper on "Some Comments Upon the Training of Engineers" at a joint meeting of the St. Louis Section of the American Institute of Electrical Engineers and the Associated Engineering Societies of St. Louis, on Oct. 24.

The Electric Club as a Factor in the Progress of Dallas.—The Dallas Electric Club and Jovian League held its first meeting this fall on Oct. 15. Fred M. Lege, vice-president and general manager of the Dallas Light & Power Company, spoke on the subject of the Electric Club as a factor in the progress of Dallas. Adam H. Davison gave a five-minute talk on "The Allegiance of the Electrical Fraternity to the Buy-a-Home Movement — the Contractor's Viewpoint."

New York Section of the I. E. S.—The next meeting of the New York Section of the Illuminating Engineering Society will be held at the Engineering Societies Building Nov. 8, at 8 p. m. Two papers will be presented which are of general interest to public utility men. The first of these is entitled the "Illuminating Engineering as a Commercial Force," prepared by a committee of the Lighting Sales Bureau, National Electric Light Association, consisting of Messrs. Hogue, Law and Whitehorne. The paper treats of illuminating engineering as a basis of central station practice—the purposes of illumination engineering, first, in developing new customers; second, in promoting prospective customers; third, in promoting satisfaction to customers, with examples. The second paper is on "Value of Illuminating Engineering to the Gas Industry," by Robert Pierce.

Arthur Williams, general commercial manager of the New York Edison Company, was appointed on Oct. 24 federal food administrator for New York City to work in co-operation with various committees and commissions and the federal agent for the State in the solving of the food problems of the city. Mr. Williams is well known throughout the electrical industry. He was born at Norfolk, Va., on Aug. 14, 1868, and after having received his education at the private and public schools of Hartford, Conn., and New York City, entered the electric lighting industry in



ARTHUR WILLIAMS

New York City in 1885 as assistant in the chemical meter department. Since that time Mr. Williams has been constantly affiliated with the electric lighting interests in New York City. He was superintendent of interior construction in 1887, electrician for the company, then operating only the Pearl Street station, in 1887; superintendent of the third district in 1888, superintendent of underground department in 1889, general inspector in 1890, general agent in 1893, and is now general commercial manager. Mr. Williams has a wide connection with the national electrical associations, being a past-president of the National Electric Light Association and of the Association of Edison Illuminating Companies. He was at one time vice-president of the Electric Vehicle Association of America, now affiliated with the N. E. L. A. as a section. He is past-president of the New York Electrical Society and past-president of the American Museum of Safety, besides being a member of a number of other associations. Mr. Williams has been decorated by both the French and Spanish governments; in the latter case in recognition of his work in the interests of safety. Mr. Williams has also had military experience, having served as an officer in charge of mine laying in the New York harbor during the Spanish-American war.

E. S. Myers, formerly electrical engineer of the Fort Wayne & Northern Indiana Traction Company, has become connected with the Vicksburg (Miss.) Light & Traction Company.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

M. N. Weeks has succeeded C. G. Gross as superintendent of the municipal electric light and water plant at Grand Rapids, Wis.

James E. Hunt has been promoted to superintendent of stations A-1 and A-2 of the Philadelphia Electric Company, succeeding N. Ewell Funk.

N. Ewell Funk, formerly superintendent of stations A-1 and A-2 of the Philadelphia Electric Company, has been promoted to be assistant operating engineer.

George Buttrick, formerly superintendent of overhead work for the Bridgeport Division of the Connecticut Company, has been appointed superintendent of line construction for the Republic Railway & Light Company, Youngstown, Ohio.

A. J. Neff, who has had some eighteen years' experience in the operation, maintenance and construction of public utilities, has recently become a member of the engineering force of the General Engineering & Management Corporation, New York City, as efficiency engineer. Mr. Neff has devoted the last four years to efficiency work, having been efficiency engineer for the American Public Service Company, operating properties in Texas and Oklahoma, for the last two years. He also had charge of all improvements and construction pertaining to the power plants for this company the last year.

Sam A. Hobson, who for the last five years has been Western manager of the ELECTRICAL WORLD, has resigned, effective Jan. 1, 1918. Mr. Hobson's acquaintance in the electrical industry in the United States, due to his years of commercial association with it, is perhaps as wide as that of any individual. His work has brought him into intimate contact with every branch of the electrical business. He has handled construction and operation of electric light and street railway companies; he has been an electrical contractor; he was in the jobbing business; he worked in the sales end of a manufacturing company, and lately he has been employed in the electrical publishing business. Mr. Hobson's first work in the industry was performed for the Wyatt Park Street Railway Company of St. Joseph, Mo., one of the earliest electric railways in the country. His construction experience gained there was later utilized in superintending the building and operation of the Electric Railway & Light Company of Waco, Tex., from 1891 to 1895, of the Electric Railway Company at Atlanta, Ga., and later of the Mutual Electric Light & Power Company of San Antonio, Tex. For a short time

he was in the electrical contracting business in Waco and Austin, Tex. From 1897 to 1907 he was sales manager of the Hobson Electric Company, Dallas, Tex., where he did his full share, working with his two brothers to bring that concern from a struggling little supply house to a really great commercial institution in the Southwest. It was during his association with this company that he assisted in founding the Jovian Order and became its third reigning Jupiter. From 1907 until 1911 he was manager of the apparatus department of the Wesco Sup-



S. A. HOBSON

ply Company of St. Louis, leaving that position to become manager of the St. Louis office of the Fort Wayne Electric Works. On Dec. 1, 1912, he was made Western manager of the ELECTRICAL WORLD, with headquarters at Chicago. In addition to his Jovian work in Texas, Mr. Hobson has been active in other states. He was one of the founders of the St. Louis League of Electrical Interests, the local Jovian organization, which has helped to develop trade harmony where utter lack of it formerly existed. This is typical of his service to the industry through the Jovian Order. In the sales field Mr. Hobson's personality and knowledge of the industry have made the men to whom he has sold friends as well as customers, and he will bring this great asset into the new work he has chosen. Mr. Hobson is planning to re-enter actively his favorite field—the merchandising of electrical apparatus. He carries with him the best wishes of the McGraw-Hill Publishing Company.

Obituary

Percy L. Cobb, for the past year an electrical engineer with the Interstate Commerce Commission, division of valuation of railroads, died on Oct. 11 at Portland, Me., of typhoid fever. Mr. Cobb, who was a graduate of Stevens Institute of Technology, was at one time connected with the New York, New Haven & Hartford Railroad and with the Pennsylvania Railroad as instructing electrical engineer.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

NEW INCANDESCENT LAMP CONTRACTS ARE IN FORCE

Provisions Against Price Increase Contingency Are Made by Stipulating the Dates on Which Advance Can Be Made

On Thursday of this week the new contracts for the purchase of Mazda incandescent lamps went into effect. For the first time provisions are made against the contingency of prices having to be advanced. Formerly it was taken as a matter of course that any change in lamp prices would be downward. Manufacturing conditions, however, have changed to such an extent in the last three years that, except for a downward revision of the 50-watt size, when the demand had reached a predetermined volume, manufacturers have been able only with great difficulty to keep prices from advancing. Glass, chemicals, and labor have been a constant source of worry. Production economies have been made and have enabled the manufacturers to date to sell at the same prices, but the profits have been much smaller.

Rumors are now strong in the trade that higher prices on lamps can be expected with the new year. At any rate, provisions are made so that an increase can take place on Jan. 1, 1918, if conditions warrant it.

According to the contract for purchases advances will be effective only as of Jan. 1, April 1, July 1 or Oct. 1. It is further agreed that whatever changes are made the net price to the purchaser for any lamp purchased under the contract shall not exceed present schedules by more than 10 per cent.

All lamps billed after the date on which increases become effective will be billed at the higher rate, except that orders for immediate delivery which do not exceed the normal requirements of the purchaser for one month will be filled on the basis of prices prevailing on the date of acceptance of the order, even though delivery be delayed beyond the date of advance in price.

This contract is only for purchasers—i.e., central stations, isolated plants, etc.—not dealers.

OUTPUT OF LUXURIES MAY BE RESTRICTED

Two Courses Have Been Discussed Which Would Through Coal Supply Regulation Curtail Production of Goods Not Essential to War

The fears of manufacturers of certain classes of electrical goods that the federal government might take some action similar to that taken by Great Britain in restricting the production of goods not essential to the war and employing raw material and labor that are needed for war supplies may be realized. A report emanating from good authority in Washington last week states that restriction of production of materials not essential to the war is under serious consideration by President Wilson and action may be taken soon.

Although there has been no intimation of the exact nature of any step contemplated by the President, two courses have been generally discussed. Under one the War Industries Board would enter into voluntary agreements with specific manufacturers of non-essentials to reduce their output gradually. Under the other the President would issue a general request to manufacturers and rely on their patriotism to follow the suggestion.

The power behind both plans, it is stated, would be the government's authority to hold up coal shipments to recalcitrant producers and to control transportation through the priority director of the War Industries Board.

Agitation for measures to stop the use of many kinds of materials required for war purposes in production of luxuries or other articles not contributing to war needs has been started among many government officials, it is stated in the Washington report.

The problem involves many difficulties, particularly in determining just what materials are to be considered non-essential. Advocates of the exercise of strong powers believe, however, that a list of products the manufacture of which might be dispensed with largely during the war could be formed to meet public approval.

DEALERS MUST GIVE CHILD LABOR GUARANTEES ON GOODS

New Federal Act Requires Person Putting Goods in Interstate Commerce to Guarantee Them to Be Manufactured in Accordance with Law

By the provisions of the federal child labor act, which became effective Sept. 1 last, all dealers and manufacturers of goods parts of which, whether all or some, are purchased from other manufacturers must, before placing goods in interstate commerce, obtain from the manufacturers of such goods or parts signed guarantees that such goods or parts were produced or manufactured in an establishment in which within thirty days prior to the removal of such goods therefrom no children under the age of fourteen were employed or permitted to work, nor children between the ages of fourteen and sixteen were employed or permitted to work more than eight hours in any day or more than six days in any week, or after the hour of 7 p. m. or before 6 a. m.

Rules and regulations heretofore issued specify only the guarantee to be supplied by the manufacturer. Now the dealer to engage in interstate commerce must give a guarantee. The following form of guarantee, according to an opinion just issued by the Children's Bureau, will be sufficient to protect the dealer:

"I, the undersigned, do hereby guarantee that the articles or commodities listed herein (or specify the same) were purchased by me under a guaranty by the manufacturer or producer that they were produced or manufactured in a (mill, workshop, factory or manufacturing establishment) in which within thirty days prior to the removal of such product therefrom no children under the age of fourteen years were employed or permitted to work, nor children between the ages of fourteen years and sixteen years were employed or permitted to work more than eight hours in any day or more than six days in any week, or after the hour of 7 o'clock p. m. or before the hour of 6 o'clock a. m. (Name and place of business of dealers.)"

For products of mines or quarries the dealer will use the following guarantee: "I, the undersigned, do hereby guarantee that the articles or commodities listed herein (or specify the same) were purchased by me under a guaranty from the producer that they were produced in a mine or quarry in which within thirty days prior to removal of such product therefrom no children under the age of sixteen years were employed or permitted to work. (Name and place of business of dealer.)"

Very nearly similar forms of guarantee are provided for one supplying both goods of his own manufacture and of other manufacture. Copies of these opinions may be had

by applying to the Children's Bureau, Department of Labor, Washington, D. C.

A commission agent is considered in this connection as a dealer and therefore must place his guarantee as a dealer on all goods which he shall hereafter place in interstate commerce.

WIRING REQUIREMENTS OF SHIPPING BOARD

Quotations and Delivery Dates Desired on Miscellaneous Equipment, Including Tape, Solder, Flux, Contactors, Conduit, Etc.

The United States Shipping Board Emergency Fleet Corporation, Washington, D. C., sent out notices this week requesting quotations and delivery dates on all or any part of the following miscellaneous wiring material:

Item	Quantity	Article
1.....	1250 lb.	Friction tape, $\frac{3}{4}$ in., black Manson or equal.
2.....	2500 lb.	Rubber tape, $\frac{3}{4}$ in., Okonite or equal.
3.....	750 lb.	Solder, half and half, $\frac{1}{2}$ -lb. bars.
4.....	250 lb.	Soldering flux, first grade, 4-oz. containers.
5.....	250	Door contactors (door switch), brass, substantial.
6.....	500	Slip sleeves for 1-in. conduit.
7.....	500	Slip sleeves for $\frac{1}{2}$ -in. conduit.
8.....	2500	Grounding clamps with lugs, for 1-in. conduit.
9.....	5000	Grounding clamps with lugs, for $\frac{1}{2}$ -in. conduit.

Slip-joint fittings of items 6 and 7 are to be as shown by sketch on page 1825 of the Sept. 16, 1915, "Transactions of the American Institute of Electrical Engineers"—an article entitled "Standard Marine Electrical Installations" (Horner).

Bidders are to state the lineal feet per pound of the tape and rubber gum which are proposed.

Unit shipments are to consist of one two-hundred-and-fiftieth of the aforesaid quantities. Deliveries are to start about Dec. 1, 1917, and are to continue uniformly until July 1, 1918. Either samples or complete specifications are to be submitted with proposal. Name of manufacturer and point of manufacture and delivery are to be stated in proposal.

METAL MARKET SITUATION

Aluminum, Lead and Brass Weaker in Price During Last Week

Slight changes have occurred in aluminum, which is a point lower. Lead is also lower, likewise wire base. Brass is softer, but tin is tending upward. The demand for all metals continues active, with the buying generally restricted to immediate needs or necessary requirements.

The prevalent feeling among buyers is extremely unsettled, and prices on finished goods are governed by the fluctuations in the metal market, which is being closely watched. That the peak has been reached, however, is the general belief.

NEW YORK METAL PRICES

	Oct. 22			Oct. 29		
	£	s	d	£	s	d
Copper:						
London, standard spot.....	110	0	0	110	0	0
Prime Lake	Govt. price	23.50		Govt. price	23.50	
Electrolytic	Govt. price	23.50		Govt. price	23.50	
Casting	Govt. price	23.50		Govt. price	23.50	
Wire base	30.00 to	32.00*		29.00 to	31.00*	
Lead, trust price.....		6.50			5.50	
Nickel, ingot		50.00			50.00	
Sheet zinc, f.o.b. smelter....		19.00			19.00	
Spelter, spot	8.05 to	8.17½			7.80	
Tin, Straits		61.50			64.50	
Aluminum, 98 to 99 per cent.	35.00 to	37.00*		34.00 to	36.00	

OLD METALS

Heavy copper and wire.....	22.00 to	23.00	22.00 to	22.50
Brass, heavy	14.00 to	16.00	14.00 to	16.00
Brass, light	11.00 to	11.25	10.50 to	11.00
Lead heavy	5.25 to	5.50	4.75 to	4.87½
Zinc, old scrap	5.50 to	5.75	5.00 to	5.50

*Nominal.

THE WEEK IN TRADE

A SLIGHT building revival was noted last week in certain sections of the country. This is expected to become greater. The Italian situation has had a disturbing effect on trade because of the part it may play in delaying peace. The financial market has been depressed as a result and the credit effect is expected to be somewhat unfavorable.

Prices are still firm. Shipments east are meeting with delay in transportation. Collections are still good.

NEW YORK

Prices showed no change in standard supplies during the past week, and demand was about the same. Deliveries are being delayed on certain items owing to transportation congestion. The new lamp contracts went into effect on Thursday. Higher prices are looked for next year by the trade, but the contracts stipulate that the prices for next year shall not be more than 10 per cent greater than those now in force.

A slight revival in building is reported by the Dow Service Daily Building Reports. A study of prices made in co-operation with this bureau showed that building costs to-day are not more than 30.7 per cent over costs ruling in 1914-15, rather than 50 to 60 per cent, as generally believed. As this information gradually is impressed upon builders it is believed that more and more new construction will be undertaken. The revival noted this week was almost all work that had previously been abandoned because of high prices.

Collections are good and credits getting stricter.

LAMPS.—In the standard sizes of lamps the supply in general is reported as ample and deliveries are better than before, shipments going forward within thirty days. At least 98 per cent of the orders accepted for September delivery by one manufacturer were filled within the specified time. A shortage in miniature lamps still exists, caused by the commandeering of the entire output of the factories by the War Industries Board, and no betterment is looked for within thirty or sixty days. In the new contracts for the coming year authentic advices are to the effect that prices for 1918 will not be advanced beyond 10 per cent, effective Nov. 1. Such increases, if made, are to be graduated and at quarterly intervals. The government, through the War Board, has prohibited the use of lead, which toughens the bulb, in the manufacture of lamps, and unless some successful substitute is discovered and applied the percentage of breakage is expected to be heavier than it has been in the past.

LOCUST PINS.—Conditions in locust pins are exceedingly acute. They are unprecedentedly scarce. There is a tendency to raise prices sharply, and the situation is disturbing. Manufacturers who have contracts to fill are asking for an increase over the agreed-upon figure, to meet the demands of labor and other unavoidable contingencies. Quotations for pins are so varied that the market is hazardous. Freights to Eastern seaboard points are also a disturbing element.

GLASS INSULATORS.—Another advance of possibly 15 per cent is anticipated before Jan. 1. Insulators are scarce and at present quotations orders are being placed by jobbers and distributors as rapidly as acceptances are closed. Skilled labor and material are bothering factories. One manufacturer is advising correspondents that, in the item of fuel alone, as against \$1.10 last year, he was obliged to place his contract for 1918 at \$4.10 a ton.

CHRISTMAS OUTFITS.—This year the Christmas-tree lighting outfit includes lamps. This is a new practice that will be generally followed. Previously only a few companies furnished the equipment complete. Considerable interest is being shown by buyers, inquiries being lively and far in excess of the previous season, but trade so far is

slow. No change in prices is noted and deliveries are prompt.

FANS.—All prices were withdrawn on Sept. 20, and new figures will be ready by the first of the year, if not earlier. A scarcity of fans for 1918 is freely predicted by concerns in a position to know.

FLASHLIGHTS, ETC.—Competition in flashlights is more in evidence and is more acute than at any time heretofore. More and different grades of this merchandise have been placed on the market, but no marked changes in prices or discounts have occurred on this account. The new arrivals are in a class by themselves and have created their own field in their own way. Deliveries are up to expectation—that is, fair.

SOCKETS.—Possibly some concessions may be allowed by jobbers, who had stocked up earlier on better than prevailing prices; but the manufacturers hold a different attitude. They are holding firmly to existing quotations, and while no advances have been made, the local trade is finding it difficult to figure on the future or to determine what may happen both as to supply or prices. Deliveries are rated fair and the outlook is brightening.

COLLECTIONS AND CREDITS.—Collections are ruling firm, with the result that the customarily classed delinquent is about eliminated. There is no disposition to allow for any other arrangement than for the prompt settlement of bills.

PIPE.—Deliveries in some sizes are satisfactory. Large sizes are reported as being impossible to obtain. Freights from Pittsburgh east are causing the stringency, and L. C. L. shipments to New York City and vicinity are causing no end of trouble.

SHIPMENTS.—Shipping conditions in the metropolitan district, especially in New York City, are described as worse than anything ever before experienced. The difficulty of reaching freight terminals for outgoing shipments is represented as exasperating beyond record.

CHICAGO

The probable effect of the defeat of the Italian armies upon the minds of buyers and the increasing number of incidents which tend to show the workings of the government's priority regulations seem to be the topics of greatest interest in the trade at Chicago. It is expected that the Italian retirement will have the psychological effect of convincing the public in general, including buyers, of the probability of at least two years more of war. Had the recent battles on the Italian front gone favorably to the Allies, practically every one would have expected cessation of the war this winter, as opinion already had that trend. Actual incidents which show that manufacturers are being compelled completely to interrupt shipments of steel and copper or to divert them to government channels are becoming more and more numerous. It seems to be a well-established belief that the middle of November will see this factor taken very seriously into all calculations involving the use of basic materials. In the jobbing trade the business for October is reported to be a little better than it has been. Larger manufacturers state that conditions in the trade are about normal, but that public utilities are buying a trifle more freely owing to the fact that their meager stocks are being depleted by necessary construction. Practically all buying is still on a hand-to-mouth basis in the contractor-dealer field as well as in the public utility field. Credit and collections remain about the same.

COPPER WIRE.—Copper wire is scarce. Some mills are refusing to quote on certain sizes, especially cord. Practically all quotations are hedged with a statement that withdraws the quotation in case the mill cannot get copper.

CONDUIT.—There is some uncertainty in the conduit market. Some have thought the price would go down. Inquiries among the manufacturers show that they have no conduit on hand. The demands for other types of pipes are keeping the mills exceedingly busy. The probability is that the future will see delivery more than price the prevailing factor in conduit purchases. There is little probability of

the conduit mills' steel supply being cut off, but there is reason to believe that the output of these mills might be products other than conduit.

GOVERNMENT BUSINESS.—Commercial concerns are advising customers who want goods for government purposes to give the government requisition order numbers on ordering materials for this national work. For example, a jobber placed an order with the mill for copper wire, specifying merely that it was government business. The quotation was sixty days. Later the jobber wired the mill the requisition numbers on its government orders, and the delivery was cut to seven days. The mill had on hand government copper out of which it could fill orders carrying government requisition numbers. Even the railroads give precedence to packages with government requisition orders stamped outside.

POLE-LINE HARDWARE.—The demand is steady and the supply has not yet been affected by priority regulations, although it is easy to see how this might happen.

TRANSFORMERS.—Deliveries from six to twelve months are being quoted.

CHRISTMAS TRADE.—A few early orders continue to come in.

BOSTON

Jobbers report continued activity, with collections fair and no price changes during the last week. The advance of the United States more and more deeply into the war dominates all other affairs, and government orders, combined with actual requisitioning of products en route through the factories, are creating much uncertainty in the industrial field. Deliveries are a little better in the small-motor field, and here and there some effort is being made to establish stocks for immediate shipment. There is little expectation, however, of lasting success in this direction. It cannot be said that the government price-fixing program has as yet stabilized the market. Central stations are hard pressed to take care of business offered, and the coal situation is threatening for the smaller companies. The government, however, seems inclined to take drastic action if necessary to insure a fuel supply to utilities serving industrial plants engaged on war orders, but time is required to accomplish the necessary work involved in getting the coal from the mine to the consumer. The demand for appliances continues strong. Owing to mild weather, it has been possible to accumulate a substantial stock of electric radiators for immediate delivery from the jobber's stock.

SMALL MOTORS.—Single-phase repulsion-type motors show decided improvement in deliveries, and stocks are being accumulated in irregular sizes. On most types of motors, however, long deliveries are the rule, twenty to twenty-four weeks being a common tender. Rush orders for government service are being handled in from one-third to one-half this time, under favorable conditions. One large concern normally carrying 500 motors in its storehouse succeeded in reaching 350 last week, but the condition was only temporary, and there appears to be little or no reduction in demand. Prices remain firm.

PROJECTORS.—Buying of floodlights to round out the protection installations of industrial plants is noted. At the outbreak of the war the demand for this equipment was very heavy and applications were made hastily. Evidences of more engineering attention are now to be seen in traveling through New England, and this means a certain amount of additional but discriminating trade. Stocks are low and the demand is vigorous.

MOTOR GENERATORS.—Equipments for battery-charging service show moderate improvement in deliveries.

TRANSFORMERS.—Priority considerations control the market, and improvements in deliveries reported from some other sections are not reflected in New England.

POLE-LINE HARDWARE.—Jobbers are overstocked and the demand is very small at present. Better conditions are looked for after Jan. 1.

WIRING MATERIAL.—Isolated plant extensions are active, causing a substantial volume of trade. Consumption is low in small knob-and-tube material. Banks are hesitant

regarding loans for the erection of low-cost residences, and the outlook for the rest of the year is continued dullness.

FIXTURES.—Demand is increasing, prices remaining firm. A large amount of reconstruction and renovation work is under way, and prospects favor holiday trade.

TEXTILE MOTORS.—Business is active, and one central station reports an 800-hp. contract for tire fabric production.

ATLANTA

The electrical interests of this section were very active last week in their support of the second Liberty Loan flotation. The Southeastern Section of the N. E. L. A., which held its annual meeting at Birmingham, Ala., strongly indorsed this movement.

There is no apparent let-up in industrial construction, but residence building permits show a small decrease. Notwithstanding this latter feature, the volume of sales, especially through the jobbers, remains about the same, and on the whole there is very little change in general business conditions since last week.

Contracting business, exclusive of government work, seems to be slowing up, but the prevailing opinion is that this condition is only of a temporary nature.

Contractors' collections are good and very little financial trouble is noted in this branch of the industry.

INSULATORS.—This line continues comparatively steady, with a slight decrease in demand from street railways. A number of large shipments covered by past orders are beginning to arrive. Although the manufacturers report a betterment of the labor situation, this factor is offset by the difficulty in securing clays, and no improvement is noted in deliveries.

ELECTRIC HEATERS.—During the last cold spell, before arrangements had been made for winter heating, considerable activity was shown in this line, but the demand has slackened off to a few inquiries from industrial sources. No difficulty has been experienced in supplying the demand from local stocks.

ELECTRIC RANGES.—There is no doubt that the South is taking more interest in electric ranges and in cooking by electricity. It has always been recognized that the education of domestic labor in the South to the uses of electrical appliances has been a difficult proposition, but the successful operation of the ranges already installed has convinced a portion of the buying element. One large manufacturer with point of distribution at Atlanta reports the sale of a number of ranges throughout the South during the past few months, and up to date the sales in this line are showing a substantial increase over 1916.

ELECTRIC IRONS.—The demand for irons is excellent, and all the manufacturers are enjoying a good trade. Local stocks are in pretty fair shape and shipments coming in from day to day are replenishing stocks that might otherwise become depleted.

SEATTLE

Intense interest in the culminating week of the second Liberty Loan campaign overshadowed general business activity to the slight impairment of the trade totals that have marked the preceding weeks. Business was featured by a noticeable increase in buying from both steel and wooden shipyards, following the end of the strike of employees, noted last week. This buying was not considered new business, but merely recovered business. However, considerable new business was forthcoming during the week, buying from new industrial plants and lumber mills being noticeably increased. Operations in Seattle shipyards are nearly at normal, and Portland plants report like conditions, following the return of the striking employees.

Electrical dealers report a noticeable increase in buying from the lumber mills, and this condition is expected to obtain until the holidays, when plants usually close down for two weeks and make needed repairs and extensions. It is thought probable, owing to war conditions and heavy orders, that this custom will not be generally observed.

The local dealers report continued shortages in the larger sizes of lamps, rubber-covered wire, conduit, large motors and heavy wire, and an increasing demand for lamps of all sizes, and conduit and energy-consuming devices, particularly washing machines, flatirons, heaters and ranges. The campaign being conducted locally is justifying the most optimistic predictions. Inquiries and orders are surprisingly heavy. One large dealer states that the sale of domestic appliances, especially washing machines, irons and labor-saving devices, has never been heavier. The prices on appliances for the home remain firm. Stocks are in fair condition, and orders are coming through from Eastern factories quite satisfactorily. Larger electrical equipment, particularly motors, transformers and the like, is coming through very slowly. Prices are firm and stocks are all but depleted. There has been no noticeable increase in prices along any line for some time, and dealers do not anticipate any, saying that the peak has been reached.

There is a shortage of labor and the situation is becoming more acute. A slight relief in car shortage in Oregon is noted. The Washington condition, however, is tightening.

Ordering for the Christmas trade continues heavy. Local dealers report considerable business with the government in pick-ups to be furnished to the Bremerton Navy Yard and the American Lake cantonment; also sales of pole-line material, including transformers, insulators, etc., to the local municipal utility company. An eastern Washington power and light company is reported to have placed recently large orders for wire poles and pole-line material for improvements and considerable extension work.

As a whole dealers report credits good and collections very satisfactory.

SAN FRANCISCO

There is discussion of the objectionably low figure of 200 hp. which was the installed capacity measure established years ago of the "large user" to whom a 10 per cent discount should be quoted. The time has long passed, it is claimed, when this figure should have been raised to, say, 1000 hp. This is believed fair under present conditions and would take off the manufacturer's books considerable business which he would be glad to see the dealer or contractor get. However, no action on this has yet been definitely taken.

Little construction is under way, and orders for new stock and equipment are delayed. There is normally a coastwise exchange of stocks between the Seattle, San Francisco and Los Angeles branches of the larger electric companies, but of late the shortage of bottoms for freight shipments by water has made necessary the more expensive rail shipment, and this has accentuated shortages.

Shipbuilding orders of the larger class continue to come in in undiminished quantity for delivery about two years hence.

LAMPS.—The demand for lamps is so strong that it is believed there is considerable overbuying, induced by the difficulty of getting large quantities.

PUMPING EQUIPMENT.—The demand for irrigation pumping equipment is strong in some quarters. One power company reports an application from central valley sources for a 3000-hp. pump to be used next season for this purpose, provided consumers can get equipment by that time.

SWITCHBOARD DEVICES.—There seems to be some shortage in this line. Meters, circuit breakers and switches are in demand, and deliveries are slow.

SAFETY DEVICES.—As the National Electrical Safety Code becomes better known the demand develops correspondingly for safety devices. Motor-starting switches particularly are in this class.

SMALL MOTORS.—A falling off in the demand for small motors is attributed to the close of the irrigation season, and also to the fact that power companies have probably reached the limit of their ability to release transformers here and there in order to supplement depleted transformer stocks. There is now felt on the Pacific Coast the tendency to slower motor deliveries because of increased government demands on the factories. Last month small motor stocks were improving, but this is not true at present.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List, per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor

No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

Less than coil.....	+10% to List Net
Coil to 1000 ft.....	—10% to \$59.17
Less than coil.....	+10% to List Net
Coil to 1000 ft.....	—10% to \$68.87

Twin-Conductor

Less than coil.....	List Net to \$105.00
Coil to 1000 ft.....	\$70.00 to 10%
Less than coil.....	List Net
Coil to 1000 ft.....	10% to \$130.95

DISCOUNT—CHICAGO

Single-Conductor

Less than coil.....	+10%
Coil to 1000 ft.....	—10%

Twin-Conductor

Less than coil.....	+10%
Coil to 1000 ft.....	—10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each. Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10% to list net
1/5 to std. pkg.....	15% to 20%
Std. pkg.....	28% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+20% to 12%
1/5 to std. pkg.....	List to 20%
Std. pkg.....	28% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 30.....	.35	.35
30 to barrel.....	.31 to .3175	.32 to .3275
Barrel lots.....	.28 to .2875	.29 to .2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. Per Coil	List, Per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp.....	\$75.00 \$63.75 to \$69.75
3/4-in. d. stp.....	75.00 to 82.50 68.25 to 75.00
1/2-in. s. stp.....	100.00 85.00 to 93.00
1/2-in. d. stp.....	100.00 to 110.00 91.00 to 100.00

NET PER 1000 FT.—CHICAGO

Less Than Coil	Coil to 100 Ft.
3/8-in. single strip.....	\$75.00 \$63.75
3/4-in. double strip.....	78.75 71.25-71.27
1/2-in. single strip.....	100.00 85.00
1/2-in. double strip.....	105.00 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06 1 1/4	1 1/4.....	.33
3/8.....	.09 1 1/2	1 1/2.....	.40
1/2.....	.12 1 3/4	1 3/4.....	.47
3/4.....	.15 2	2.....	.55
1.....	.18 2 1/4	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—		
\$25.00-\$55.00	\$20.50-\$24.75	\$20.00-\$22.00
1/4-in.—		
\$28.00-\$60.00	\$22.50-\$27.00	\$22.00-\$24.00

NET PRICE 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—		
\$36.69-\$55.00	\$27.50	\$24.75
1/4-in.—		
\$40.00-\$60.00	\$30.00	\$27.50

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List Elbows, List

1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.60
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

Less than 2500 lb.....	1/4 in. to 1/2 in. 4% to 6%	3/4 in. to 3 in. 7% to 9%
2500 to 5000 lb.....	6% to 9%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

Less than 2500 lb.....	1/4 in. to 1/2 in. 2.8% to 3.4%	3/4 in. to 3 in. 5.4% to 5.8%
2500-5000 lb.....	6.4% to 6.8%	8.4% to 8.8%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

CHICAGO

List.....	\$5.00 to \$6.00
Discount.....	30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK.

	Per 100 Net
Less than 1/5 std. pkg.	\$5.00 to \$5.75
1/5 to std. pkg.	5.25
Standard package, 500.	List, each, \$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500.	List, each, \$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B	100	\$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulbs, 3 1/8 in., frosted:		
15-watt—G	50	.50
25-watt—G	50	.50
40-watt—G	50	.50
Round bulbs, 3 1/4 in., frosted:		
60-watt—G	24	.72
Round bulbs, 4 1/8 in., frosted:		
100-watt—G	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$30.00 to \$33.98
Coil to 1000 ft.	25.50 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$36.24 to \$36.56
Coil to 1000 ft.	27.18 to 27.42

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	\$20.00 to \$29.00
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CHICAGO

Net per 100	\$19.25
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OUTLET BOXES

Nos.	List, per 100
101—A, A1 1/2, 4 S.C., 6200, 320	\$30.00
102—B.A., 6200 S.E., 300, A.X., 1 1/2, 4 S.	30.00
103—C.A., 9, 4R, B 1 1/2	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list	25%-37%	20%-32%
\$10.00 to \$50.00 list	42%-45%	37%-40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list	40%	35%
\$10.00 to \$50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.00 to \$38.00
1/5 to std. pkg.	13.60 to 19.00
Standard package, 2200	List per 1000, \$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80 to \$20.54
1/5 to std. pkg.	14.80 to 19.24
Standard package, 2200	List per 1000, \$20.

PORCELAIN KNOBS

NEW YORK

	Std. Pkg.	3500 Std. Pkg.	4000 5 1/2 N.C.—Solid Nail-it—N.C.
Per 1000 Net			
Less than 1/5 std. pkg.	\$20.00 to \$29.00	\$23.20 to \$30.75	
1/5 to std. pkg.	13.50 to 15.60	18.70 to 24.20	

CHICAGO

	Std. Pkg.	3500 Std. Pkg.	4000 5 1/2 N.C.—Solid Nail-it—N.C.
Per 1000 Net			
Less than 1/5 std. pkg.	\$11.85	\$30.75	
1/5 to std. pkg.	11.10	24.20	

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/2-in. cap key and push sockets	500	\$0.33
1/4-in. cap keyless socket	500	.30
1/2-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:			
30-amp. S. R. S. T.			\$0.80
60-amp. S. P. S. T.			1.20
100-amp. S. P. S. T.			2.25
200-amp. S. P. S. T.			3.48
300-amp. S. P. S. T.			5.34
30-amp. D. P. S. T.			1.20
60-amp. D. P. S. T.			1.78
100-amp. D. P. S. T.			3.38
200-amp. D. P. S. T.			5.20
300-amp. D. P. S. T.			8.00
30-amp. 3 P. S. T.			1.80
60-amp. 3 P. S. T.			2.68
100-amp. 3 P. S. T.			5.08
200-amp. 3 P. S. T.			7.80
300-amp. 3 P. S. T.			12.00

Low Grade:			
30-amp. S. P. S. T.			0.42
60-amp. S. P. S. T.			0.74
100-amp. S. P. S. T.			1.50
200-amp. S. P. S. T.			2.70
30-amp. D. P. S. T.			0.68
60-amp. D. P. S. T.			1.22
100-amp. D. P. S. T.			2.50
200-amp. D. P. S. T.			4.50
30-amp. 3 P. S. T.			1.02
60-amp. 3 P. S. T.			1.84
100-amp. 3 P. S. T.			3.76
200-amp. 3 P. S. T.			6.76

DISCOUNT—NEW YORK

	High Grade
Less than \$10 list	List net to + 5%
\$10 to \$25 list	11%
\$25 to \$50 list	14% to 15%
	Low Grade
Less than \$10 list	5% to 10%
\$10 to \$25 list	16%
\$25 to \$50 list	24% to 25%

DISCOUNT—CHICAGO

Less than \$10 list	+5% to 5%
\$10 to \$25 list	10% to 16%
\$25 to \$50 list	14% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to net
1/5 to std. pkg.	Net to 15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List, Each
No. 155	\$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list	List Net	List Net to + 10%
\$2.00 to \$10.00 list	10% to 20%	5% to 10%
\$10.00 to \$50.00 list	20% to 30%	15% to 20%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list	25% to 50%	20% to 40%
\$2.00 to \$10.00 list	25% to 50%	20% to 40%
\$10.00 to \$50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	\$5.00 to \$7.50
Discount	25% to 30%

CHICAGO

List price	\$5.00 to \$6.00
Discount	30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

No. 18, less than full spools.	\$0.44 1/4 to \$0.65
No. 18, full spools.	0.43 1/4 to 0.55

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	\$0.64 to \$0.65
No. 18, full spools.	0.54 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net
	Less than 500 to 1000 to 5000 Ft.
No. 11	\$15.00-\$18.00 \$13.00-\$14.00 \$11.25-\$12.00
12	23.25-27.09 21.30-23.22 19.35-20.85
10	32.40-37.80 29.70-32.40 27.00-29.25
8	45.70-53.34 41.90-45.73 38.00-41.38
6	72.40-84.42 66.35-72.40 60.30-65.50

CHICAGO

	Price per 1000 Ft. Net
	Less than 500 to 1000 to 5000 Ft.
No. 14	\$18.00 \$13.50 \$12.00
12	25.21-27.37 21.30-27.39 17.40-23.46
10	35.29-38.15 29.82-32.70 24.35-39.97
8	49.91-53.83 42.18-46.14 34.45-42.29
6	78.95-85.19 60.85-61.16 51.15-54.76

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$35.25 to \$40.00
25 to 50 lb.	39.00
50 to 100 lb.	34.25 to 38.00

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	\$40.35
25 to 50 lb.	39.35
50 to 100 lb.	38.35

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Outdoor Cable Terminal

An outdoor type D. O. A. cable terminal known as the protected disconnection style has recently been placed on the market by the Standard Underground Cable Company of Pittsburgh, Pa. All the copper parts are covered



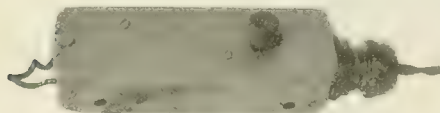
DISCONNECTING TYPE OF CABLE TERMINAL

by a porcelain hood, as shown in the accompanying illustration, which permits the disconnection of the aerial extension wire even while the circuit is alive.

All the outdoor (type D. O. A.) cable terminals made by this company are readily disconnected from the aerial conductor by means of either a set-screw, a cap-nut or a turnbuckle stem. The stem of the new terminal is a modification of the regular cap-nut stem and has some additional advantages where frequent disconnection of the aerial circuit from the terminal is necessary.

Automatic Controller

The Automatic Electric Controller Company of Seattle, Wash., is manufacturing an automatic controller that regulates the amount of current delivered to any heating appliance and maintains the heat of the appliance at an even temperature. This device is made in two types, one for alternating cur-



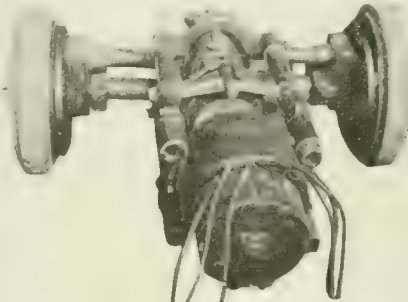
FOR USE WITH HEATING APPLIANCES

rent and the other for alternating and direct current. The controller consists of a thermostat, composed of copper and iron riveted together, which is placed immediately over a heating coil and connected in series with the load. The heat from the coil causes the thermostat to break the circuit whenever the temperature rises above a certain point. The handle on the outside

of the case can be set at any point as lettered from A to K. A corresponds with zero degrees, B with 90, and C with 160. The turning of the handle causes the contact point which touches the thermostat to move downward and bend the thermostat. Thus the more the thermostat is bent the more heat is necessary and the higher the temperature required to cause it to bend still further and break the circuit. By the use of this device it is claimed that 40 per cent of the energy now used in the excess heating of irons, percolators, toasters, chafing dishes, etc., can be saved, as the exact amount of heat required can be obtained and the excess eliminated.

Industrial Truck

In the design of the industrial truck made by the Karry-Lode Industrial Company, Inc., Long Island City, N. Y., the makers point out that particular attention has been given to strength,



DRIVING UNIT THAT CAN EASILY BE REMOVED FOR REPAIRS

flexibility, simplicity, accessibility and reliability. A 3½-hp. motor especially designed for this truck, of ample overload capacity, is a unit with the entire electrical system, giving maximum efficiency under all conditions, it is said. The frame is of 4-in (10-cm.) channel beam, securely held by cross-members of ample section, reinforced by corner plates. Every cell in the battery box is instantly accessible. The batteries are placed below the loading platform out of sight, with available room to permit of additional batteries. The rear axle is of the internal-gear type, making it possible to carry the load on a 2¼-in. (5.99-cm.) axle of seamless tubing. The driving shaft is of solid nickel steel. The wheels run on large-size Hyatt roller bearings. The controller has three speeds forward and three reverse.

A special feature of this truck is that the rear wheels and motor can be taken out in case repairs must be made on them and others installed in short time. This insures almost continuous service.

Ground Clamps

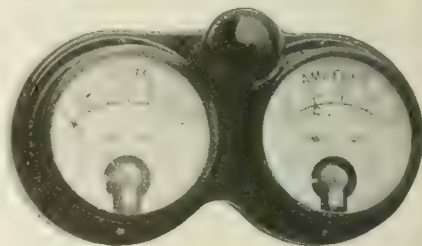
Ground clamps adjustable for rigid and flexible electric light and power conduits are made by the Utility Fittings Company of Philadelphia. The makers point out that the principal feature of these clamps is the easy way in which they may be connected to the ground pipe and ground wire. These clamps are made of soft copper, tinned all over, fitted with 1¼-in. (3.2-cm.) bolt and nut, and have been approved by the Underwriters' Laboratory.

Combination Volt-Ammeter

The General Electric Company of Schenectady, N. Y., has developed a direct-current duplex instrument with self-contained attachment for illuminating the dials. This volt-ammeter is particularly adapted to electric vehicles and small direct-current panel applications such as are used for battery-charging sets and lighting.

It consists of an ammeter and a voltmeter mounted on a bakelite base with outside dimensions of 5½ in. by 2½ in. and 1¾ in. deep (14 cm. by 7.3 cm. by 3.5 cm.).

The D'Arsonval permanent-magnet moving-coil construction is used in both elements. The resistance for the voltmeter is self-contained; the ammeter requires an external shunt. The instruments are finished in dull black and can be equipped with paper scale with black marking or with metal scale plate and white figures on black background. Voltmeter standard capacities range from 10 volts to 150 volts, and for the ammeter any desired capacity can be obtained, either for one way indication or double, showing charge and discharge readings.



COMBINED METER SIMPLIFIES INSTRUMENT INSTALLATION

For electric vehicles cable leads are furnished for connection to terminals set in back of the instrument in order that all wiring can be concealed. For panel work stud terminals can be supplied, which serve as terminals and holding lugs.

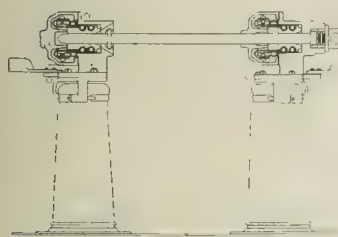
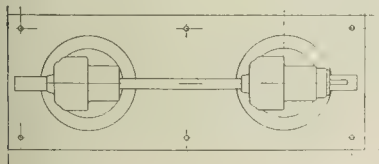
Bell-Ringing Transformer

One of the bell-ringing transformers now being manufactured by the A. E. Rittenhouse Company, Honeoye Falls, New York, is inclosed in a non-breakable pressed-steel case. An ordinary battery bell can be operated with this transformer, it is stated, once it is properly adjusted for alternating current. Where groups of bells are to be operated two transformers may be used with a secondary winding connected in series where higher voltage is desired. If higher amperage is needed, the secondary coils of the two instruments may be connected in parallel. The coils are independently wound and are designed to withstand a 2500-volt insulation test between primary and secondary coils and also between the coils and the case. Continuous short-circuit of the secondary, it is pointed out, will not burn out the instrument.

Disconnecting Switch for Restricted Quarters

The ordinary high-voltage knife-blade disconnecting switch is operated by a hook on the end of a long rod. This necessitates an amount of space for the operator directly below the switch and perpendicular to its base which depends both upon the length of the blade and of the rod used to open and close the switch. In some plants the space on which the operator would have to stand to use the switch hook at the considerable angle required is so small in relation to the height of the disconnecting switch that the usual design is practically prohibitive.

The switch shown herewith is operated from directly below by a disconnecting switch hook. The insulators, insulator caps and terminals are standard. The blade is a copper rod with a cast eye fastened on one end and a readily renewable solid brass contact



HIGH-VOLTAGE DOWNWARD-OPENING DISCONNECTING SWITCH

tip on the other. When the switch is opened a flange near the tip of the blade prevents the blade from dropping below the upper part of the lower stationary contact. A wide flare on the lower end of the upper contact leads the blade into place when the switch is being closed.

After the blade is closed a slight turn to the right or left by the operating rod locks the blade in position and prevents it from opening except when desired.

This switch is made by the General Electric Company of Schenectady, N. Y.

Alternating-Current Galvanometer

The Pyroelectric Instrument Company of Trenton, N. J., announces its Northrup alternating-current galvanometer. The maker points out that it is especially adapted to the following uses: (1) For the accurate measurement of the resistivity or conductivity of salt solutions and other electrolytes; (2) for the measurements of the resistivity of molten salt; (3) for the measurement of the resistivities of molten metals; (4) for the measurement of any resistance in which small irregular emfs. exist; (5) for the comparison of small inductances using the bridge method; (6) for the compari-



MOVING COIL IS LONG AND NARROW

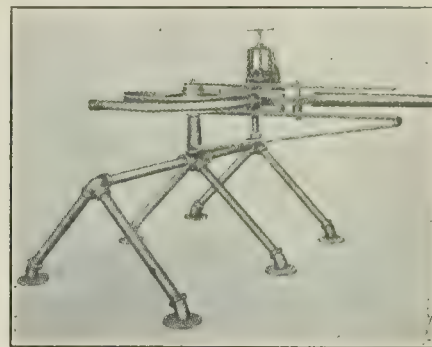
son of capacities using the bridge method.

The galvanometer is mounted on a base of ebonite provided with leveling screws. The field magnets are laminated. Magnetizing coils are wound on non-metallic spools, which are placed on the field poles as close as possible to the moving coil. Pole pieces are given a hollow cylindrical form about the moving coil, this special shape preventing the coil, when on closed circuit, from assuming a position of unstable equilibrium due to currents induced in its circuits by the alternating magnetic field. The moving coil is long and narrow, so that its moment of inertia is small, thereby permitting high sensitivity with a quick period. The entire hanging system is exposed to view through a glass front. The central housing is of non-conducting material to prevent the formation of eddy currents.

The sensitivity is adjustable through a wide range, the strength of magnetism being variable by varying the current through the field coils.

Pipe Bender

A pipe bender that bends pipes cold without treating or filling of any kind is made by the American Pipe Bending Machine Company of Boston, Mass. It is claimed that this device does not weaken the metal or open seams. This



CAN BE HANDLED BY UNSKILLED WORKMEN

bender, which can be operated by unskilled workmen, will bend a 2-in. (5.08-cm.) pipe to a 90-deg. angle in about one minute. The entire weight with 2-in. head (5.08-cm.) is about 400 lb. (181.4 kg.) and with full complement of seven heads from 3/8-in. to 2-in. (0.9-cm. to 5.08-cm.), the total weight is about 550 lb. (226.8 kg.).

Combination Tool Outfit

A combined drill press, vise, emery wheel and anvil for use in places where space is at a premium has been developed by the Chicago Flexible Shaft Company. The outfit is also equipped with a pipe vise and metal cutter. The entire machine weighs but 90 lb. (40.8 kg.). The jaws of the vise are 4 in. (10.2 cm.) wide and are faced with steel. A 4 1/2-in. (11.4-cm.) opening is provided and the jaws are controlled by a hand wheel which operates as a tool feed when the machine is being used as a drill press. Square shank drills and reams are used by putting them into the upper spindle of the gear train, thus providing three speeds for operating the tools.

Miniature Lamp Decorative Outfit

The Triangle Electro Trading Company of 79 Chambers Street, New York City, is manufacturing an auxiliary outfit of electrically illuminated figures and flowers for use with its eight-light current outfit. Five of the fanciful 3 1/2-volt bulbs are designed for connection in series and take the place of a single 14-volt lamp. The bulbs for use with the miniature outfit may be selected from a various assortment of roses, animals, faces, etc. The equipment is useful for table decorations and for showcase and store-window display.

Trade Publications

MOTOR-GENERATOR SETS.—Julius Andrae & Sons Company, Milwaukee, Wis., has prepared a booklet descriptive of its motor-generator sets.

PIPE BENDER.—A folder descriptive of a pipe bender has been issued by the American Pipe Bending Machine Company of Boston, Mass.

WATER PURIFIER.—The American Utilities Company of St. Joseph, Mich., has prepared a leaflet descriptive of its Barnes electric water purifier.

DISTRIBUTION SYSTEMS.—L. K. Comstock & Company of New York have prepared bulletin No. 5, entitled "The Electrical Distributing System and Who Shall Install It."

BELL-RINGING TRANSFORMERS.—Bulletin No. 11, descriptive of bell-ringing transformers, is being distributed by the A. E. Rittenhouse Company of Honeoye Falls, N. Y.

ADJUSTABLE SPEED MOTORS.—The General Electric Company of Schenectady, N. Y., has prepared bulletin No. 41,021, descriptive of its RF adjustable-speed motors.

GROUND CLAMPS.—The Utility Fittings Company, 812 Walnut Street, Philadelphia, is distributing a resale sheet dated Oct. 1, 1917, descriptive of its approved ground clamps.

OIL PUMPS.—Snow oil pumps are illustrated and described in bulletin No. S-112, prepared by the Worthington Pump & Machinery Corporation, 115 Broadway, New York City.

PANELBOARD CABINETS.—General catalog No. S-2, descriptive of Benjamin Starrett panelboard cabinets, has been issued by the Benjamin Electric Manufacturing Company of Chicago.

INDUSTRIAL TRUCKS.—Karry-Lode industrial trucks and tractors are described in an attractive folder now being distributed by the Karry-Lode Industrial Truck Company, Inc., Long Island City, N. Y.

MOTOR STARTER.—The Machine Products Company of St. Louis, Mo., is distributing a folder descriptive of the Johns type rotary starter for the automatic acceleration of single-phase, polyphase and direct-current motors.

ELECTRIC OVENS.—The Hughes Electric Heating Company, 5660 West Taylor Street, Chicago, has prepared a bulletin descriptive of its electric ovens for bread, cake and pastry baking, boiling, roasting and industrial baking purposes.

DISCONNECTING HANGERS.—Thompson safety disconnecting hangers for use indoors and outdoors are illustrated and described in supplement C to catalog B-16, prepared by the Thompson Electric Company, 5606 Euclid Avenue, Cleveland.

FOREIGN TRADE.—The Bureau of Foreign and Domestic Commerce of the Department of Commerce at Washington has issued bulletin No. 24, "Foreign Trade Notes," which is a reprint from "Commerce Reports" for January-March, 1917. Price, 15 cents.

TOOL OUTFIT.—The Stewart handy worker, a device which comprises drill press, a vise, pipe vise, anvil, metal cutter and a substantial three-speed machine, is illustrated and described in a folder distributed by the Chicago Flexible Shaft Company of Chicago.

ELECTRIC FURNACES.—Up-to-date facts on electric furnaces for the melting and refining of ferrous and non-ferrous metals is the subject of bulletin No. 40, now being distributed by the Industrial Electric Furnace Company, 53 West Jackson Boulevard, Chicago.

ELECTRIC WARE.—Catalog S-C, dated September, 1917, is being distributed by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. This bulletin describes Westinghouse electric heating and cooking appliances for use on alternating-current and direct-current circuits.

BRONZE.—The Titanium Bronze Company, Inc., Niagara Falls, N. Y., has issued a twelve-page booklet pointing out the advantages of titanium aluminum bronze for use in gears, pump valves and for other castings requiring strength, good-wearing qualities and high resistance to shock.

SAFETY PANELS AND CABINETS.—Bulletin No. 1D, descriptive of safety panels and cabinets, has been prepared by the Crouse-Hinds Company of Syracuse, N. Y. Two types of panelboards are listed in this bulletin—type DPS, arranged for Edison

plug fuses in branches, and type EPS panels, arranged for N. E. C. cartridge fuses in the branches.

BALL BEARINGS.—"Wood-Work Precision at High Speed" is the title of a bulletin now being distributed by the S K F Ball Bearing Company of Hartford, Conn. A short article in this bulletin tells why S K F ball bearings are used on wood-working machinery, and a description and history of the S K F ball bearing is added. Only those wood-working machines that are in general use are dealt with, and from this the prospective user can form an idea of the wide range of uses for S K F self-aligning ball bearings.

Trade Notes

GUY R. HASTINGS is now manager of Chicago sales for the National X-Ray Reflector Company, Chicago.

THE LACLEDE - CHRISTY CLAY PRODUCTS COMPANY, St. Louis, Mo., has removed its general office downtown to the Railway Exchange Building.

NORMAN B. HICKOX is the new sales manager of the National X-Ray Reflector Company, Chicago, to succeed Ernest H. Cameron, who has resigned and is now at Seattle, Wash.

THE WARD LEONARD ELECTRIC COMPANY of Mount Vernon, N. Y., is now represented in Cleveland, Ohio, by the Walter P. Ambros Company, in the Arcade, and in Pittsburgh, Pa., by Sperry & Bittner, in the First National Bank Building.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., is having plans prepared for the construction of a new two-story drop-forge factory, about 85 ft. by 100 ft. The company will also build a new one-story and basement substation, 48 ft. by 100 ft.

FORD, BACON & DAVIS, New York City, announce that they are prepared to devote special attention to the appraisal of industrial property for the purpose of war-tax returns, as called for by the war-profits tax section of the revenue law recently enacted by Congress.

THE NUGENT ELECTRICAL SUPPLY COMPANY, New York City, announces that it is established at 7 West Twenty-ninth Street as jobber in electrical supplies. Frank L. Nugent and Walter Williamson of the company have had many years' experience in this line.

A. H. COX & COMPANY, Seattle, Wash., are moving into larger quarters, taking the building which adjoins their present one, 309 First Avenue South, giving a frontage of approximately 60 ft., with a total floor space of seven floors. The engineering departments have likewise been expanded.

THE AUGUST MIETZ CORPORATION, 128 Mott Street, New York City, has recently increased its factory space for the purpose of taking care of the enlarged demand for its oil engines. The company states that it is now in a better position, on account of its increased facilities, to accept orders for larger machines.

HUGH D. BUTLER has been appointed assistant sales manager of the National X-Ray Reflector Company, Chicago, and will devote special attention to large companies whose range is national in scope and to campaign work on special classes of business. Mr. Butler, in addition to this, will direct the architectural and maintenance feature of the company's work.

WALTER S. CRANMER, who for many years was connected with the sales department of the Waverley Company of Indianapolis, Ind., and later with the Woods Motor Vehicle Company of Chicago, has recently been appointed assistant manager of sales of the Philadelphia Storage Battery Company, with headquarters at Philadelphia. Mr. Cranmer for the past few years has been in charge of the sales of this company in Pennsylvania, Delaware and New Jersey.

THE DOMESTIC ENGINEERING COMPANY, Dayton, Ohio, on account of the resignation of President Deeds, to accept a colonel's commission in the regular army, has been undergoing a reorganization of staff. C. S. Kittering was elected president to succeed Colonel Deeds; Alfred P. Sloan, Jr., vice-president; G. B. McCann, treasurer; F. J. Blose, secretary. These officers, with Mr. Kittering as chairman, constitute the Board of Directors with the following: W. A. Chryst, O. L. Harrison, J. B. Hayward, O. Kressler, L. Ruthenburg, W. E. Cromer, F. B. MacNab, Judge B. F. McCann and Ernest Boehme.

New Incorporations

THE BROOKSIDE ELECTRIC COMPANY of Cleveland, Ohio, has been chartered with a capital stock of \$5,000 by Paul Jung and others.

THE NATIONAL ELECTRIC & CONSTRUCTION COMPANY of Mansfield, Ohio, has been chartered with a capital stock of \$10,000 by Frank Mattox and others.

THE TWIN CITIES ELECTRIC & SUPPLY COMPANY of Measha, Wis., has been chartered with a capital stock of \$5,000 by Joseph Hill, Victor M. Gombert and F. W. Gombert.

THE NATIONAL ELECTRIC ADVERTISING COMPANY of Chicago, Ill., has been incorporated with a capital stock of \$2,500 by J. D. Smith, Robert W. Dunn and W. P. Dunn.

THE OPATITE GLASS & ELECTRIC COMPANY of Chicago, Ill., has been incorporated with a capital stock of \$1,000 by L. H. Ekstromer, H. G. Phelps and F. William Rehbock.

THE WORLD ELECTRIC MACHINERY COMPANY of Boston, Mass., has been incorporated with a capital stock of \$25,000. Max Freedman is president and Charles M. Waugh of Cambridge is treasurer.

THE ELECTRIC CONSTRUCTION COMPANY of Racine, Wis., has been incorporated with a capital stock of \$18,000. The incorporators are Charles F. Breitzke, William B. Pierce and others.

THE HENRY J. RUEFF COMPANY of Louisville, Ky., has been chartered by Henry J. Rueff, N. C. Hall and L. A. Hickman. The company is capitalized at \$10,000 and proposes to deal in lighting fixtures and electrical specialties.

THE ELECTRICAL METALS & MANUFACTURING COMPANY of Youngstown, Ohio, has been incorporated with a capital stock of \$150,000 by Frank P. Pyle, Paul H. Stambaugh, William M. Henderson, H. H. Wickham and William Schneider.

THE SANDBACK-GILBERT ELECTRIC COMPANY of New York, N. Y., has been incorporated with a capital stock of \$500 to do a general electrical business. The incorporators are: Samuel Solinsky, William A. Sandback and Charles Gilbert.

THE NORTH MAHONING TOWNSHIP LIGHT, HEAT & POWER COMPANY of Clearfield, Pa., has been incorporated with a capital stock of \$5,000 by W. O. Hoover and associates. The company proposes to operate a power plant in Clearfield County.

THE WEYANT ELECTRICAL COMPANY of New York, N. Y., has been incorporated by William L. Clark, Clyde C. Wallace and William G. Miller, Jr. The company is capitalized at \$5,000 and proposes to do a general electrical engineering business.

THE STANDARD SELF-STARTER COMPANY of New York, N. Y., has been chartered with a capital stock of \$10,000 to manufacture automobile self-starting devices. The incorporators are: B. L. Darrow, J. L. Brulatur and J. J. Blemly, 441 West Thirty-fourth Street, New York.

THE PHYLLIS ELECTRICAL CORPORATION has been chartered by Philip M. Brill of Caldwell, N. J.; N. E. Evans of White Plains, N. Y., and Leo Weil, 878 Kelly Street, the Bronx, New York, N. Y. The company is capitalized at \$2,500 and proposes to do a general electrical contracting business.

THE STANDARD ELECTRIC COMPANY of Indianapolis, Ind., has been incorporated with a capital stock of \$500,000. The company will build a plant at Noblesville, Ind. The directors are: E. C. Apple-gate, president and treasurer; D. H. Duncan, vice-president and factory manager, and Henry Bartlett.

THE YORK ELECTRIC COMPANY of Toronto, Ont., has been incorporated by Dyce W. Saunders, 71 Bay Street; Stanley S. Mills, Paul Home and others. The company is capitalized at \$40,000 and proposes to do a general electrical engineering business and to manufacture electrical and mechanical machinery, equipment, etc.

THE AUTOMATIC ELECTRIC DEVICES COMPANY and the Simplex Controller Company of Cincinnati, Ohio, have been incorporated with a capital stock of \$10,000 and \$5,000 respectively, by Clarence E. Ogden and others. The companies will equip and operate a joint plant to manufacture electric specialties. The offices of the companies are located at 515 Mercantile Library Building, Cincinnati.

New England States

HOULTON, ME.—The Smyrna Mills Electric Light & Power Company, recently organized at Houlton, proposes to supply electricity for lamps and motors in the towns of Smyrna, Oakfield, Merrill and Dyer Brook. The company is capitalized at \$10,000. Peter J. Garcelon of Houlton is president, and Arthur A. Garcelon of Merrill is treasurer.

NORWAY, ME.—The 250-kw. generator in the plant of the Oxford Electric Light & Power Company was wrecked by an explosion recently. Arrangements will be made to secure power temporarily from the power station at South Paris.

RUTLAND, VT.—The Rutland Railway, Light & Power Company has made arrangements with the Staso Milling Company of Fair Haven and Poultny to change its electric service (1400 hp.) in 25-cycle motors to 60-cycle motors. To make this change a transmission line will be erected from Castleton Corners to Hampton, N. Y. The Rutland Company has closed a contract with the F. R. Patch Manufacturing Company for a 335-hp. motor.

ATTLEBORO, MASS.—Plans are being made by the Attleboro Steam & Electric Company to make connection with the electric transmission lines of the Narragansett Electric Lighting Company of Providence to obtain electricity for an emergency supply. The Narragansett company's lines already extends into Seekonk.

MILBURY, MASS.—The Selectmen have granted the petition of the Worcester Suburban Electric Company asking for pole locations in West Milbury. The company is extending its service to that portion of the town.

WESTFIELD, MASS.—The Board of Selectmen has granted the petition of the Turners Falls (Mass.) Power & Electric Company for a franchise to enter the town and supply energy to the Springfield Street Railway Company, through a power station on the Westfield River dike.

ESSEX, CONN.—At the annual town meeting held recently the citizens voted to enter into a contract with the Essex Light & Power Company for lighting the streets with electricity for a period of five years, at \$4,200. The old acetylene gas-lighting plant was dismantled two years ago and since then the streets have been in darkness.

MONTVILLE, CONN.—At a special town meeting held recently it was voted to enter into a contract with the Connecticut Power Company of New London for street lighting. The contract calls for about 75 lamps.

UNCASVILLE, CONN.—Negotiations are under way between the Selectmen and the Connecticut Power Company of New London for lighting some of the principal streets in the villages of Uncasville and Palmertown.

Middle Atlantic States

BINGHAMTON, N. Y.—Preparations are being made by the Hires Condensed Milk Company, 913 Arch Street, Philadelphia, Pa., for the construction of a new plant for the manufacture of tin cans. The plans provide for the erection of a large power plant. Contract for the construction of the proposed plant has been awarded to John L. Lewis, 36 Wall Street, Binghamton. The cost of the entire project is estimated at \$500,000.

BROOKLYN, N. Y.—The contract for construction of a new three-story, reinforced concrete power house at the naval hospital at the Brooklyn navy yard has been awarded to the Whitney Company, 101 Park Avenue, New York, N. Y. The building will be 58 ft. by 107 ft., and will cost about \$100,000.

BUFFALO, N. Y.—The Kelly Island Lime & Transport Company, 110 Hamburg Turnpike, is planning to erect a new transformer station at its works.

NEW YORK, N. Y.—Plans have been prepared for the erection of an addition to the boiler house at the plant of John Huber, at Sixth Avenue and Sixty-second Street, to cost about \$4,000. Brustus Gundlach, 212 Fifth Avenue, is architect.

OGDENSBURG, N. Y.—The St. Lawrence Transmission Company, it is reported, contemplates the erection of a new steel tower electric transmission line from Ogdensburg to Hannawa Falls.

OLEAN, N. Y.—Extensive improvements are contemplated by the Pennsylvania Railroad Company at its local works, including an addition to power house, to cost about \$20,000. Contract for construction of power house has been awarded to the Tiff Construction Company, Buffalo, N. Y.

ROCHESTER, N. Y.—Plans are being

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

prepared for extensions and improvements to the power house of the North East Electric Company, 348 Whitney Street. Joseph Oberlies, Granite Building, Rochester, is architect.

ROCHESTER, N. Y.—The construction of a new power house at Irondequoit, 40 ft. by 80 ft., is under consideration by the Department of Public Works. Plans for the building are being prepared by C. M. Hirschfelder, 62 State Street, Rochester.

SYRACUSE, N. Y.—The Auburn & Syracuse Electric Railway Company has applied to the Public Service Commission for permission to issue \$292,000 in bonds, the proceeds to be used to take up existing obligations, extensions, etc.

BELLEVILLE, N. J.—The Public Service Electric Company has submitted a bid to the Board of Commissioners for lighting Washington Avenue with electric lamps for a period of five years.

HADDONFIELD, N. J.—The Town Commissioners are considering the installation of a new electric-lighting system in various streets in the town, for which plans are being prepared by the Wrightstown Utilities Corporation, which recently acquired the Wrightstown Water Company.

NEWARK, N. J.—Plans are being prepared by the Neuman Hardware Company, 9-17 St. Francis Street, for the construction of a new boiler house, 45 ft. by 60 ft., to cost about \$8,500.

NEWARK, N. J.—Plans have been filed by the Board of Education for the construction of an addition to the boiler plant at the Alexander Street Public School, to cost about \$15,500. Contract has been awarded to the Frederick Fatzler Company, 810 Broad Street, for erection of building.

POMPTON LAKES, N. J.—Arrangements have been completed by the Council for the lease of the Edwin Corning property for the construction of an addition to the municipal electric-light plant. The lease is for a period of 21 years, embodying a provision that the property may be purchased by the borough within ten years. Power in the new addition will be generated by hydraulic engines.

WEST ORANGE, N. J.—Plans, it is reported, have been prepared for the construction of a new power house, about 100 ft. by 100 ft., at the Thomas A. Edison Works on Lakeside Avenue. M. Arthur Wolff is engineer.

BIRDSEBORO, PA.—Preparations are being made by the Reading Railway Company for the installation of new electrically driven pumping machinery in its water works system just south of the city.

CATAWISSA, PA.—The Borough Council has decided to abandon the municipal electric-light plant and enter into a contract with the Columbia & Montour Electric Company of Bloomsburg for electrical service. A 24-hour service, it is expected, will soon be established.

PHILADELPHIA, PA.—The Bellevue Worsted Mills, Wister Street, is contemplating the construction of a new power house, 30 ft. by 40 ft., at its works at Sixteenth and Hunting Park Avenues.

SAYRE, PA.—The Sayre Electric Company, which recently secured a contract to furnish electrical service to the Hart Planing Mills, has completed connections to this plant. The company has also been awarded a renewal of its electric street-lighting contract with the borough of Athens.

TUNKHANNOCK, PA.—The power plant of the Tunkhannock Electric Company was destroyed by fire on Oct. 21, causing a loss of about \$12,000.

LYNCHBURG, VA.—W. K. Barger of Lynchburg, general contractor to erect the Young Men's Christian Association Building in Lynchburg, has awarded the contract for electric wiring to Clifton W. Whitmore of Lynchburg. The cost of the building is estimated at about \$100,000.

NORFOLK, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 19, for furnishing and installing one electric freight elevator in building 16, at the navy yard, Norfolk (Portsmouth), Va. Drawings and specifications (No. 2678) may be obtained upon application to the above bureau or to the commandant of the navy yard named.

ROANOKE, VA.—Arrangements have been made for the installation of an orna-

mental lighting system on Salem Avenue, from Jefferson Street to Commerce Street, to cost about \$3,000. The work will be done by the Roanoke Railway & Electric Company at the expense of the property owners. The city will take over the new system about the first of January and provision will then be made for its maintenance and possibly for its extension toward Market Square.

North Central States

TRAVERSE CITY, MICH.—The upper power plant of the Boardman River Electric Light & Power Company was destroyed by fire on Oct. 20, causing a loss of about \$50,000.

AKRON, OHIO.—Contract, it is reported, will soon be awarded by the Northern Ohio Traction & Light Company for the construction of a train shed and underground subway on North Main Street. F. C. Warner, Hippodrome Annex, Cleveland, is architect.

CLEVELAND, OHIO.—A permit has been granted to the General Electric Company for the erection of a power house at 2242 Flournoy Street, to cost about \$10,000. F. D. Chase is architect.

CLEVELAND, OHIO.—Extension of the ornamental-lighting system in the downtown section to illuminate considerable adjacent territory is under consideration. Extension of the system, which is based on the substitution of high-power incandescent lamps for arc lamps, will extend as far as East Fifty-fifth Street on the East Side and as far as West Fifty-eighth Street west of the river. When the work is completed 1060 ornamental lamps will be in operation instead of 620.

URBANA, OHIO.—Bids will be received by the County Commissioners until Nov. 12 for wiring the court house, sheriff's residence and jail for electric lighting in accordance with plans prepared by C. C. & E. A. Weber of Cincinnati, architects.

ALEXANDRIA, KY.—The grand jury in its report to Circuit Judge Wolff at Alexandria has recommended the installation of a better lighting system at the County Infirmary.

CHICAGO, ILL.—The Gas & Electric Motor Bus Corporation of Chicago has leased a one-story machine shop at Racine and Belden Avenues, which will be used as a repair plant and factory for making spare parts.

MILLSTADT, ILL.—Plans are being prepared by the Fuller-Coult Engineering Company, Chemical Building, St. Louis, Mo., for improvements to the municipal electric-light plant, including the installation of boilers, engine, generator, switchboard and pumps.

MARATHON, WIS.—The Wisconsin Valley Electric Company of Wausau has applied for a franchise to erect electric transmission lines in Marathon to supply electricity for lamps, heaters and motors.

TOMAHAWK, WIS.—The Council has engaged R. W. Richardson of St. Paul, consulting engineer, to prepare plans for improvements to the municipal water-works system, which will include a new pumping station, 20 ft. by 25 ft. and an electrically driven centrifugal pump with a capacity of 300 gal. per minute. The cost is estimated at \$20,000.

WATERTOWN, WIS.—The Washington Cutlery Company, which is erecting an addition to its factory, at a cost of about \$15,000, is contemplating the installation of a new heating and power plant, to cost about \$10,000.

ELY, MINN.—An election has been called for Nov. 6 to vote on the proposal to issue \$180,000 in bonds for municipal improvements, among which is the installation of a new septic system at the municipal power plant, at a cost of \$18,000. The New York Continental Jewell Filtration Company has the contract for the work.

BOYDEN, IOWA.—Steps have been taken by the farmers north of Boyden to organize a company to erect and operate an electric distribution system to supply electricity in that district. The cost of the lines is estimated at \$5,000, of which \$3,000 is already guaranteed. Work will start at once on the construction of the line, which will cover about 11½ miles. Energy to operate the system will be furnished by the Veen Schoten Electric Light Company of Boyden.

BURLINGTON, IOWA.—A movement is under way to extend the ornamental lighting system from Jefferson Street up Third to Columbia Street, a distance of two blocks; also from Jefferson Street to the new bridge on Main Street, a distance of four blocks.

FORT MADISON, IOWA.—Preparations, it is reported, are being made by the Atchison, Topeka & Santa Fe Railroad

Company to build a large power plant at its shops and yards in Shopton.

BETHANY, MO.—Bonds to the amount of \$4,500 have been voted, the proceeds to be used for the installation of an oil engine in the municipal electric-light plant.

FREDERICKTOWN, MO.—At an election held recently the proposal to sell the municipal electric-light plant to the Missouri Public Utilities Company of Cape Girardeau was defeated. An expenditure of a considerable amount of money will be required to put the plant in shape to meet the demands for electrical service, which will be considered by the Council.

KANSAS CITY, MO.—The Kansas City Light & Power Company is reported to have purchased a site (25 acres) on the Missouri River in the northeast section of the city, 1½ miles down the river from the foot of Grand Street, on which it proposes to erect an electric generating station for an ultimate capacity of 250,000 kw. The plans for the initial installation provide for 40,000 kw. The first section of the building will be 225 ft. by 200 ft., for which contract for foundations has been awarded to the Foundation Company, 233 Broadway, New York, N. Y. Contracts for equipment have been awarded as follows: Two 20,000-kw. turbines, to the General Electric Company; two condensing outfits, to the Worthington Pump & Machinery Corporation of New York, N. Y.; six boilers, to the Babcock & Wilcox Company of New York; six underfeed stokers, 16 retorts each, to the Sanford Riley Stoker Company of Worcester, Mass.; fuel economizers with induced-draft fans to the Green Fuel Economizer Company of Matteawan, N. Y.; Sargent & Lundy, 72 West Adams Street, Chicago, Ill., are engineers.

ST. LOUIS, MO.—The contract for the electric work in connection with the erection of convent for the Sisters of Mercy, to cost about \$250,000, has been awarded to the Eclipse Electric Company of St. Louis.

VERSAILLES, MO.—The city of Versailles will rebuild its municipal electric-light plant, recently destroyed by fire.

WILLOW CITY, N. D.—A franchise has been granted to the Minot (N. D.) Electric Company to install and operate an electric-light plant in Willow City, the plant to be ready for operation by Jan. 1.

HIGHMORE, S. D.—At an election held recently the proposal to issue bonds for the purchase of an electric-lighting plant was carried.

SHELTON, NEB.—The town of Shelton has entered into a contract with the Central Power Company of Grand Island for the installation of an ornamental lighting system on Main Street in the business section of the city.

WAYNE, NEB.—Contracts have been placed by the City Council for a new engine and other necessary apparatus to establish a second lighting unit to furnish service to the State Normal School and other consumers using alternating current.

BARNES, KAN.—Bonds to the amount of \$10,000 have been voted for the installation of an electric-lighting system in Barnes. The plans provide for the erection of an electric transmission line to Concordia.

CUBA, KAN.—At a special election to be held Nov. 6 the proposal to issue \$10,000 in bonds for the installation of an electric-lighting system in Cuba will be submitted to the voters. The proposed plans provide for the erection of an electric transmission line into the city by the Concordia Electric Light & Power Company.

Southern States

ASHEVILLE, N. C.—Contracts have been awarded by the Kenilworth Hotel Company to the Carolina Wood Products Company of Asheville and the Krahls Construction Company of Chicago to erect a hotel at Kenilworth, Biltmore, to cost about \$500,000. The plans provide for the installation of a Warren-Webster heating system, to cost \$35,000; electric-lighting, \$35,000, and two Otis elevators, \$6,500. Orders have been placed for everything but electric wiring, lighting fixtures and furniture. For further information address Roscoe A. Marne, Kenilworth, Biltmore.

ANDERSON, S. C.—The North Anderson Promotion Company, recently organized, has purchased the electric-lighting system in North Anderson. Lee G. Holleman, A. S. Farmer and John W. Linley are interested in the company.

HOLLY HILL, S. C.—Steps have been taken by local citizens to organize a company to construct and operate an electric-lighting plant in Holly Hill. The installation of an ice plant is also included in the

project. The company will be incorporated under the name of the Holly Hill Electric Service Company. H. W. Pearce is president and R. G. Carson treasurer.

CALLAHAN, FLA.—The installation of an electric-lighting plant is under consideration by the City Council.

JACKSONVILLE, FLA.—Plans are being considered by the City Commission for the erection of a new 6000-volt cable from the municipal substation to the plant of the Hillier-Sperring-Dunn Company on the South Side. The commission is also considering extension of the electric lighting system to South Jacksonville. New machinery will be installed to increase the output of the plant to 12,000 kw. to supply electricity to the cantonment near the city. The cost of the machinery is estimated at \$65,000.

JACKSON, TENN.—The City Council has awarded the contract for the installation of an ornamental lighting system on 38 blocks. Four iron standards will be erected on each block.

PASCAGOULA, MISS.—The International Shipbuilding Company contemplates the construction of an electric-light plant to supply electricity for its shipyards and for lighting the residences of employees.

JONESVILLE, LA.—Arrangements are being made for the construction of a municipal electric-light plant in Jonesville. Machinery, it is understood, has been purchased.

HAILEYVILLE, OKLA.—The Choctaw Power & Light Company of McAlester has applied for a franchise to supply electricity in Haileyville.

MIAMI, OKLA.—Bonds to the amount of \$45,000 have been issued for improvements to the municipal electric-lighting plant.

STILLWATER, OKLA.—The contract for electric wiring for the new court house at Stillwater has been awarded to McEldowney & Son Electric Company of Oklahoma City. The cost of the building is estimated at \$110,550. The Lisle-Dunning Construction Company of Oklahoma City is general contractor.

BOWIE, TEX.—At an election held recently the proposal to issue \$15,000 in bonds, the proceeds to be used for the construction of an electric-light and power plant, was carried.

DALLAS, TEX.—Contracts have been awarded by the Fred A. Jones Construction Company of Dallas, general contractor, for the building of the Southland Life Insurance Company, as follows: For electrical work to the Cammack Electric Company of Dallas; electric (high-speed) elevators to the Otis Elevator Company, New York; plumbing and heating to the C. Wallace Plumbing Company of Dallas. The cost of the building is estimated at from \$250,000 to \$300,000.

Pacific and Mountain States

OROVILLE, WASH.—The Town Council has passed an ordinance granting the Okanogan Valley Power Company a franchise to erect and operate electric distribution over the streets and alleys in Oroville for a period of 25 years.

PORT ANGELES, WASH.—The Puget Sound Pulp & Power Company, which proposes to build a large paper mill near Port Angeles, has applied to the Commissioners of Mason County for a 50-year franchise to erect and operate electric transmission lines through Mason County.

SEATTLE, WASH.—Plans have been completed by the Puget Sound Traction, Light & Power Company for the substructure for the coal pulverizing plant to be erected at its Western Avenue power station, at a cost of about \$80,000.

TACOMA, WASH.—A substation is being erected at the United States Army station at Camp Lewis. Three 55,000-volt wires will lead into the station. Orders have been received by the construction quartermaster at Camp Lewis for the erection of 175 buildings, at a cost of \$112,000, to house 6200 men. Considerable electrical equipment will be required.

EL SEGUNDO, CAL.—Application has been made by the Southern California Edison Company of Los Angeles for a franchise to supply electricity in El Segundo.

FRESNO, CAL.—The Board of Trustees have granted the petition of the property owners for the formation of a lighting district for the installation of electroliers, to start at G and Fresno North Streets to Kearney Boulevard and on the boulevard to the city limits, one-half mile.

LOS ANGELES, CAL.—The Kleinberger & Edwards Company is planning an elaborate lighting system in its Walnut Park tract in the near future. The plans provide

for the erection of concrete electroliers for which contract has been placed.

MERCED, CAL.—Plans are now under way by the San Joaquin Light & Power Corporation to enlarge its local substation, increasing the output from 1200 to 2400 kw.

PORTOLA, CAL.—Owing to the destruction by fire of the electric-light plant of the Grizzly Electric Company the town is without electrical service. The loss is placed at about \$7,000. The plant, it is understood, will be rebuilt as soon as possible.

SEBASTOPOL, CAL.—The Board of Trustees has accepted the proposal of the Pacific Gas & Electric Company for the installation of a new street-lighting system, to be installed at once.

WOODLAND, CAL.—Steps have been taken by the Farm and Town Club for the installation of additional electroliers on Main Street.

BONNERS FERRY, IDAHO.—The Bonners Ferry Planing Mill, which was recently destroyed by fire, causing a loss of about \$40,000, it is reported, will be rebuilt at once. The plans provide for the installation of a 600-hp. turbine engine directly connected to an engine, with individual motors for various machines in the mill.

BENT, N. M.—The Tularosa Copper Basin Mining Company is planning to enlarge its oil reduction mill and install machinery at its mine in Bent. The company also owns a water power on the Tularosa River, where it proposes to build a hydroelectric plant.

FORT STANTON, N. M.—Bids will be received at the office of the custodian of the United States Sanatorium, Fort Stanton, until Nov. 26 for furnishing one 50-kw., two-wire, 110-volt, direct-current electric generating unit, directly connected. Engine to be single-cylinder, non-condensing, piston-valve type, and generator must be capable of operating with a 40-hp. Skinner engine. Bids are desired preferably for new equipment, but a second-hand outfit in good condition will be considered. For details see Searchlight Section.

Canada

ROSSLAND, B. C.—The West Kootenay Power & Light Company is contemplating the erection of a high-tension transmission line from the end of its boundary system in the vicinity of Greenwood, west as far as Copper Mountain, to furnish energy to the Canada Copper Company. The company will also extend its transmission line to Penticton to supply electricity for industrial purposes.

VANCOUVER, B. C.—The contract for electrical work at the Wallace Shipyards Company's foundry on Industrial Island has been awarded to Mundy, Rowland & Company, Standard Building, Vancouver.

TRURO, N. S.—The Town Council has decided upon the extension of the lighting system on Young Street South, and may also extend it on Brunswick Street.

BRADFORD, ONT.—The ratepayers have approved a by-law authorizing an expenditure of \$15,600 for the installation of a hydroelectric transmission system.

CHAPLEAU, ONT.—Tenders will be received by the Town Clerk of Chapleau until Nov. 15 for one turbine pump of 400 gal. capacity, operated by a 40-hp. motor. Plans and specifications may be seen at the office of the town clerk at Chapleau or at the office of Chipman & Power, engineers, Mail Building, Toronto.

THORNTON, ONT.—The by-law providing for the installation of a hydroelectric power plant has been approved by the ratepayers.

SHAWINIGAN FALLS, QUE.—Work soon be started on the construction of a dam and power house at St. Narcisse, Que., for the Shawinigan Water & Power Company of Shawinigan Falls. The cost of the project is estimated at \$400,000. R. Lindsay of Shawinigan Falls is engineer.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until Nov. 13, for furnishing steel, boiler tubes, steel wire, sheet copper, brass tubing, grommets, cotters, dies, cable clips, etc. Blanks and further information relating to this circular (No. 1178) may be obtained at the above office or at the offices of the assistant purchasing agent, 24 State Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, A. H. Krom, 29 South La Salle St., Chicago. Annual meeting, May 14, 1918.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City. Annual meeting, Jan. 14, 1918.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio. Annual meeting, Pittsburgh, Dec. 27-29, 1917.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary-treasurer, Roy B. Fowles, Pine Bluff, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, George C. Holberton, San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, McKeesport, Pa. Annual convention, September, 1918.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, W. L. Connelly, Gibson, Ind.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, R. B. W. Pirie, 406 Yorkshire Building, Vancouver, B. C.

CALIFORNIA ASSOCIATION OF CONTRACTORS AND DEALERS. Secretary, James W. Redpath, 505 Rialto Bldg., San Francisco, Cal.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, Alan Sullivan, Excelsior Life Building, Toronto, Can.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, F. D. Beardslee, Union Electric Light & Power Co., St. Louis, Mo.

EASTERN NEW YORK SECTION, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF CONNECTICUT. Secretary, George M. Chapman, Waterbury, Conn. Annual meeting, New Haven, Conn., May, 1918.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, J. E. Wilson, 263 Summer Street, Boston, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo. Annual meeting, Jan. 19, 1918.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF PENNSYLVANIA. Secretary, M. G. Sellers, 1518 Sansom St., Phila.

ELECTRICAL DEALERS AND CONTRACTORS' ASSOCIATION OF ONTARIO. Secretary, E. E. Drury, 45 Murray St., Toronto, Can.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, H. B. Crouse, Crouse-Hinds Co., Syracuse, N. Y.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Staveland, Royal Insurance Building, Montreal, Can.

ELECTRICAL CREDIT ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert E. Elliott, 502 Flatiron Building, San Francisco.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago.

ELECTRIC VEHICLE SECTION OF THE N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

FLORIDA ENGINEERING SOCIETY. Secretary J. R. Benton, Gainesville, Fla.

Directory of Electrical Associations

Printed in the First Issue of Each Month

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, L. W. W. Morrow, Norman, Okla. Annual meeting May, 1918, Oklahoma City.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, Dan Carey, Atlanta Builders' Exchange, Atlanta, Ga.

ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, L. B. Van Nuys, Central Electric Co., Peoria, Ill. Annual meeting, Chicago, January, 1918.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, R. H. Abbott, Petersburg, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skillman, Indianapolis, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railway & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 111 Broadway, N. Y. C.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

IOWA SECTION, N. E. L. A. Secretary-treasurer, L. E. Caldwell, Iowa City, Iowa.

JOVIAN ORDER Jupiter (president), Henry J. F. Strickland, Dallas, Tex.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, R. M. Sutton, Wichita.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan. Annual meeting, Kansas City, Kan., Oct. 17-19, 1918.

KENTUCKY ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, F. F. Valinoti. Annual meeting, May, 1918, Louisville, Ky.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 323 Chartres St., New Orleans, La.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Augusta, Me.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Monroe, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, H. E. Young, Minneapolis General Electric Company, Minneapolis, Minn.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, G. M. Jones, 112 South Seventh St., Minneapolis, Minn. Annual convention, Jan., 1918, Minneapolis.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary-treasurer, W. F. Wheeler, Hattiesburg.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass. Annual convention, New York, March, 1918.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, H. C. Brown, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill. Annual meeting June 1, 1918.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, N. Y. C. Annual meeting, June, 1918.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 W. 39th St., N. Y. C.

NORTHWEST SECTION, N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus. Annual meeting, Columbus, Ohio, Nov. 15, 1917.

OREGON ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, J. W. Oberender, 302 Dekum Building, Portland, Ore. Annual meeting, September, 1918.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, Crossley Building, San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 152 Beech St., Yonkers, N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, Inc. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa. Annual meeting, Evanston, Ill., June, 1918.

SOUTH DAKOTA ELECTRICAL POWER ASSOCIATION. Secretary-treasurer Frederick D. Brown, Huron, S. D.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, Forrest E. Baker, 721 First National Bank Building, El Paso, Tex.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, H. S. Ashley, Fort Worth, Tex. Annual meeting, Galveston, Tex., June 15, 1918.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. E. Myers, 3 Gould St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer W. F. Steiglitz, Columbia, S. C. Annual meeting, Charlotte, N. C., April, 1918.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt. Annual meeting, February, 1918.

VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

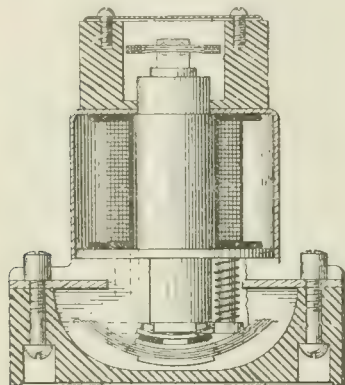
WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 W. Jackson Blvd., Chicago, Ill. Annual meeting, Jan. 29-31, 1918, Memphis, Tenn.

WESTERN SOCIETY OF ENGINEERS. ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis. Annual meeting, March, 1918.

1,243,703. WINDOW HEATER; William C. Burmeister and Edwin N. Smock, Chicago, Ill. App. filed July 21, 1916. Vehicles.

1,243,716. WIRE COILING AND BINDING CLAMP; John Cuthbert, Chicago, Ill. App. filed Feb. 24, 1916. To serve as terminals for electric translating devices and the like.



1,244,085—Switch

1,243,719. REFILLABLE FUSE CARTRIDGE; Jesse T. Dugger, Chattanooga, Tenn. App. filed July 30, 1915. Improvements.

1,243,722. ELECTRIC SWITCH; Clarence T. Evans, Milwaukee, Wis. App. filed April 10, 1914. Provides a power-operated switch with means to prevent accidental operation thereof while released.

1,243,738. ELECTRIC REGULATOR; Gottlob Honold, Stuttgart, Germany. App. filed Aug. 25, 1913. For dynamo-electric machines.

1,243,748. CONNECTOR FOR ELECTRICAL CONDUITS; Adnah McMurtrie, New York, N. Y. App. filed July 3, 1914. May be made of steel, brass or other suitable metal in substantially cylindrical form, split down at least one side and provided near one end with a contracted neck to be inserted in one of the apertures of the outlet box.

1,243,774. ELECTRIC CONDUCTING GROUND ROD; Gerald W. Soengen, Kirkwood, Mo. App. filed Oct. 30, 1916. Consists of a ground rod having an explosive bomb or cartridge at its lower end which is exploded after the rod is driven into the ground to produce a cavity at the lower end of the rod suitable for filling with an absorbent conducting material.

1,243,800. ELECTRICAL FIXTURE; Carl H. Bissell, Syracuse, N. Y. App. filed Feb. 9, 1917. Efficient arrangement for mounting the cover or cap of a conduit outlet box on the box, which cover or cap carries an electrical appliance.

1,243,807. RECTIFIER; Henry E. Burket, Leavenworth, Kan. App. filed June 5, 1916. Embodies both rotary and stationary conductors, said rotary conductors being two or more in number and arranged about a common axis driven by a motor in synchronism with the alternations of the current.

1,243,851. FUSE PLUG; William S. MacLewee, Yardley, Pa. App. filed Sept. 28, 1916. Improvements.

1,243,902. ELECTRIC CONDUIT FITTING; Samuel B. Van Ranst, Syracuse, N. Y. App. filed Feb. 11, 1910. Designed for use for housing fuse cut-outs, the invention relates particularly to a service entrance fitting for use in connection with electric conduits.

1,243,924. VEHICLE SIGNAL; George W. Edmond, El Paso, Tex. App. filed Dec. 1, 1916. Automobiles.

1,243,961. RUBBING POST; Frank F. Miller, Yankton, S. D. App. filed July 13, 1915. One object of the invention is to effect an economy in the use of the oil or other liquid and to permit a limited discharge of the same when an animal rubs against the actuating lever or rubbing bar.

1,243,966. DYNAMO-ELECTRIC MACHINE; Louis C. Nichols, Norwood, Ohio. App. filed Jan. 22, 1915. Projecting-pole type; for cases where it is desirable that the reluctance of the magnetic circuit of a field pole be adjustable.

1,243,976. PROCESS FOR SEPARATION OF GOLD AND SILVER FROM MINERALS; Ricardo Reyes, Mexico City, Mex. App. filed Nov. 9, 1914. Improvement.

Record of Electrical Patents

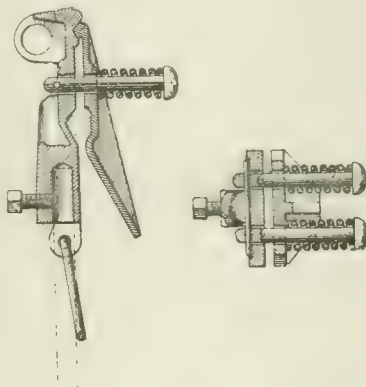
Notes on United States Patents
issued on October 23, 1917

1,244,012. PROCESS OF TREATING LIQUIDS; Frederick R. Bachler, Oxnard, and William B. Newkirk, Los Angeles, Cal. App. filed Dec. 23, 1915. Relates to a process and an apparatus for treating liquids. The principal object of the invention is to provide a process and apparatus especially adapted to purify and decolorize impure sugar solutions.

1,244,013. VIBRATORY BELL; Antonio Bagutti, Turin, Italy. App. filed Nov. 26, 1913. Improvements.

1,244,048. CARBON HOLDER FOR ARC LIGHTS; Joseph Gelb, New York, N. Y. App. filed Feb. 19, 1916. Provides a holder that is arranged so that the carbon holder proper, or socket, can be readily detached from its support or bracket without the necessity of taking the brackets away from the framework of the lamp.

1,244,085. SWITCH; Gerald W. Hart, West Hartford, Conn. App. filed June 15, 1916. Produces a single-coil remote-controlled switch having two controlling circuits, one for opening and the other for closing the coil, and means for breaking each of said controlling circuits after the solenoid has been actuated either to fully close and lock the switch or to release the lock.



1,244,339—Snap Clamp or Grip for
Electrical Conductors

1,244,099. TEST CONNECTOR FOR ELECTRIC WIRES; Arthur Kneisel, Cleveland, Ohio. App. filed Nov. 27, 1911. Consists in mechanically and electrically connecting two or more wires carrying the electric current, such as telephone party-line wires, in an improved manner.

1,244,110. SWITCH; William R. McNary, Detroit, Mich. App. filed Oct. 25, 1916. For use in connection with motor cars.

1,244,118. SYSTEMS OF LIGHTNING CONDUCTORS; George A. Mullen, Woodbury, N. J. App. filed Nov. 6, 1915. Improvements.

1,244,121. METALLIC-VAPOR LAMP; Walther Nernst, Berlin, Germany. App. filed Feb. 2, 1914. In this device that part of the lamp which furnishes illumination during its operation contains, before ignition, gases (or air), which, by reason of the seething and boiling of the metal—for instance, mercury—during said operation, are driven completely out of the illuminating space into an auxiliary chamber forming a part of said space, or in the case of air into the atmosphere, and are prevented from re-entering by the continued boiling of the metal, but when the lamp is extinguished again enter into the illuminating space.

1,244,150. METHOD OF CHANGING RESISTANCE IN A CIRCUIT AND APPARATUS THEREFOR; Ezechiel Weintraub, Boston, Mass. App. filed April 13, 1916. New type of microphone capable of varying a much larger current than has been possible in the past and of accomplishing this variation in better conformity to the sound variations that are to be reproduced.

1,244,164. ELECTRIC CLOCK; Gustav Blumberg and John A. Butkus, Baltimore, Md. App. filed Oct. 13, 1915. Entirely devoid of springs in the time train.

1,244,216. ELECTRON-DISCHARGE APPARATUS AND METHOD OF PREPARATION; Irving Langmuir, Schenectady, N. Y. App. filed June 25, 1917. Improvements.

1,244,217. ELECTRON-DISCHARGE APPARATUS AND METHOD OF OPERATING THE SAME; Irving Langmuir, Schenectady, N. Y. App. filed Oct. 28, 1915. Providing in the envelope a quantity of a vaporizable reagent of low vapor pressure capable of preventing the oxidation of thorium.

1,244,225. CIRCUIT BREAKER; Walter S. Mayer, Providence, R. I. App. filed Sept. 30, 1915. Provides an electromagnet having an armature arranged to trip the bridge arm and open the circuit when abnormal conditions occur on the line.

1,244,244. DIVISION PIECE OR PARTITION FOR A CONTROLLER ARC DEFLECTOR, CIRCUIT BREAKER AND THE LIKE; Walter R. McRae and Richard Russell, Toronto, Ontario, Can. App. filed Sept. 22, 1917. One of the objects of the invention is so to construct the division pieces or partitions that a considerable percentage of the cost of these repairs and the time during which the controller or other electrical apparatus is out of use can be eliminated, and this is attained by making each division piece or partition in two parts.

1,244,255. FOLDER DEVICE FOR WRAPPING MACHINES; William C. Stevens, Akron, Ohio. App. filed May 24, 1915. Improvements.

1,244,332. FIRE ALARM SYSTEM; Harry R. Hughs and Wade C. Hughs, Waihalia, S. C. App. filed Aug. 30, 1916. Automatic.

1,244,334. PROTECTIVE DEVICE FOR VENTILATING FANS; Robert A. Ilg, Chicago, Ill. App. filed March 3, 1914. Improvements.

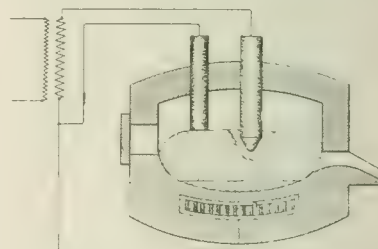
1,244,339. SNAP CLAMP OR GRIP FOR ELECTRICAL CONDUCTORS; Tomlinson F. Johnson, Jr., Atlanta, Ga. App. filed Jan. 22, 1917. Provides a construction which will eliminate binding between the clamping jaws and the bolts which serve as supports for the springs pressing the jaws together.

1,244,358. ARC-LAMP ELECTRODE; William R. Mott, Lakewood, Ohio. App. filed Feb. 28, 1916. Particularly adapted to photographic use.

1,244,359. ARC-LAMP ELECTRODE; William R. Mott, Lakewood, Ohio. App. filed Nov. 6, 1916. Relates to a method of treating a rare-earth metal fluoride containing a certain percentage of combined sulphur trioxide (SO₃) as a sulphate impurity, whereby the resulting material is made advantageous for use in arc-lamp electrodes.

1,244,415. ELECTRIC FURNACE AND METHOD OF OPERATION; William K. Booth, Chicago, Ill. App. filed June 29, 1917. Relates particularly to electric furnaces which operate normally by passing electric current between an upper electrode and a wall or hearth contact, and through the interposed charge which preferably is fused by the arcing of the electric current.

1,244,425. BATTERY TESTER; Emerson L. Clark, Lakewood, Ohio. App. filed Sept. 8, 1914. Testing apparatus which gives an audible signal if the battery current or voltage is up to the standard; otherwise no signal is given.



1,244,415—Electric Furnace and Method
of Operation

1,244,441. AUTO-LIGHT DIMMER; Arthur J. Frascolla, New York, N. Y. App. filed Jan. 26, 1917. Device in which is provided a resistance coil, the construction of the switch permitting the coil to be included in the circuit or eliminated therefrom at will, for the purpose of regulating the brilliancy of the headlights of vehicles or for other purposes.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN

Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, NOVEMBER 10, 1917

No. 19

Opportunity and the Central Station

THE remarkable expansion of business in the industries at this time due to the war, with the accompanying importance of uninterrupted service and the scarcity of coal, has forced industrial plants to adopt central station service on an unparalleled scale. In some quarters this has led to very unusual demands on given central stations, and the emergency has demonstrated probably as never before the fundamental importance of the central station as a factor in the industrial development of the country. In his article on "Central Station Power for the Industries" Professor Clewell takes occasion to emphasize this particular phase of the industrial power problem at the present time and also points out the many corresponding advantages of such service in normal times as well.

The average central station is inclined to view the field of power supply to industrial plants from its own particular point of view, which is concerned with the restrictions which must of necessity be placed on various classes of service, depending on such factors as the starting current and starting conditions, the power factor of the load, the size of the units to be employed, the type and voltages of the motors and the hours of service. Such a viewpoint is likely, however, in itself to overlook the other side of the question, which is related so closely to the organization of the industrial plant and which involves the requirements of the user of the power.

In his analysis of the situation, therefore, Professor Clewell takes occasion to point out the factors in the problem from the standpoint of the industries rather than that of the central station; but it is quite apparent that at the same time this other side of the question is in reality intimately related to the interests of the central station, because to obtain an enlarged hold on this field the central station must not only devote its energies to a study of the ways and means for supplying each special case which arises but must also be in a position to demonstrate to each industry in a convincing manner just why central station power is an advantage in comparison with that from the small isolated plants so often found in conjunction with the industry.

Moreover, while the trend in the purchase of central station power in the past in such typical cases as the machinery building trades has shown a steady increase, it is, as pointed out in the article, unsafe to base conclusions as to this tendency on records even of a very few years past. Present unusual factors brought about by the war have undoubtedly been a chief factor in the recent rapid increase in the demand for central station power. It is, however, an emergency demand for industries which have ex-

panded or have developed as new fields; but—and this is almost equally important—this situation presents an opportunity of tremendous possibilities for demonstrating beyond any doubt whatever to the industries that the central station, as the embodiment of specialized effort in the manufacture of electric power, is capable of furnishing a more efficient and reliable supply than is possible through any other channel.

How to Save the Coal

A FORCEFUL letter from W. W. Nichols which we publish in another column gets down to the very fundamentals of the fuel-saving problem. Here we are, facing a war which optimists think may be over in a year or two and pessimists in a decade, with transportation already somewhat crippled by the necessities of war material, labor making unprecedented demands and scarce under any and all circumstances, vital industries hard pushed for fuel, and the government considering the abolition of luxuries. On the other hand, as Mr. Nichols points out, there is about 10,000,000 hp. in water of which the development is already projected. When developed, he shows that this amount of energy would imply a saving of 8,000,000 tons of coal or about 240,000,000 barrels of oil per annum, with the transfer to other uses necessary to the war of some thousands of locomotives and scores of thousands of railway cars, not to say the concomitant labor of certainly more than half a million men. The one vital thing is that federal legislation should realize the vast store of "white coal" ready for use and no longer lock it up while still desperately striving to mine and transport the coal it would render unnecessary. If this be conservation, let us have no more of it.

Even France, with less than half this water power at its command, is taking hold of the problem of developing it to eke out with transmitted energy the scanty supply of coal left by the invader or brought from friendly countries. The average American, by the way, would be astounded to know of the number of small developments of electric power along the streams of France which were already in operation before the war—streams utilized with a completeness which puts our best efforts to shame. What is to be done for the relief of the fuel situation by the development of water powers needs to be done quickly. Of the 10,000,000 hp. available only a modest proportion could be pushed into service within the next year, but even this war service would be an industrial gain. There is no excuse for not developing the water power of this country, and it is a question which the nation is now asking and we should face.

the legislation at once as a war measure which, in justice, has been long overdue during times of peace.

We have the resources and we want to use them. Depletion of coal reserves and waste of water power are badly mated policies. Legislative impediments to true conservation have spread weariness over the entire country in the past. Lost in a bewilderment of committees and cross-currents of opinion on details, the great principles of conservation which are really vital to our national interest are still waiting for recognition at Washington. Congress can act quickly. Its legislation on the war was put on the statute books after delays that seemed to have no end but were in reality much shorter than the usual requirement of time. The final action on necessary war measures shows that the national legislative body will act when it is conscious of a serious public crisis. It is our place to point out the critical nature of the crisis.

Merging the British Power Networks

WE HAVE from time to time called attention to the efforts made in England to amplify and unify the large power generating systems which have been inaugurated. The value of widely ramifying distributions is, of course, fully appreciated everywhere, but in England, with a relatively small area, with meager water powers and yet with enormous industrial demands, the organization of a comprehensive scheme of power distribution rises to particular importance. A report has just been issued on the interconnection of the Lancashire and Cheshire electricity supply systems which touches on some very important matters, both technical and industrial. In both these regions there is a large amount of transmission from central power stations. The union of the two systems, the unification of their distribution networks and the improvement of their efficiency are matters of vital importance industrially, and the lesson gained from the study of the matter in England is of no small value in helping us meet our conditions here. The technical details of the arrangements are not yet worked out. The constitution of the networks is so far very imperfect, but both of the districts concerned seem to be keenly interested in following up the work to a successful conclusion.

At the present time the majority of electric undertakings in this particular territory are operated by municipal authorities. Some of the largest and best equipped English stations are thus working, and the prices charged for energy for industrial purposes have been made very reasonable. To carry out the complete project of unification it is necessary that some provision should be made by which all the municipal as well as private plants should pull together without too much disturbance of the principles of local self-government and yet in accordance with a well-defined plan. The propositions now brought forward are that throughout the entire territory a joint board representing the local authorities and the interests of private

companies shall be constituted, and that to this board shall be given general authority for regulating certain features of the enterprise. For instance, it would, through the respective local representatives, arrange the running hours of existing stations to obtain the best results; that is, it should have control over the load-dispatching system, so that this system may render the best possible service. The board should also determine the basis of charges to be made between various stations and regulate administrative expenses and charges incurred in proper linkage of the systems in the connected networks. It should have authority, in fact, at least in an advisory way, over the amounts necessary in future extensions, over working arrangements between power companies and local authorities and between various local authorities, and should form sub-committees dealing with special phases of the matter. Much of the proposed work would be done through district boards having the closest possible relations with individual plants and markets.

The constitution of this proposed board is rather interesting. On it the private companies now operating would be represented in proportion to their respective capital outlay and the local authorities would be represented in proportion to the population of the territory served. At present thirty-five authorized distributors and local authorities would be concerned in the united project and the total membership of the resulting board would be ninety. This sounds like a somewhat unwieldy organization, and the importance of powers locally delegated therefore stands out conspicuously. The general scheme of organizing the power transmission supply of two adjacent counties in the fullest possible manner requires no demonstration of its importance. It is the more vital since the power is generated by steam and so much depends on the thorough working out of load distribution. The diversity factor rises to large importance, and on account of the varied industries supplied the load wandering throughout the twenty-four hours becomes an important matter in securing the much-sought-for maximum economy of distribution.

That if successfully carried through the project will increase the efficiency of generation and distribution is quite obvious; but that the numerous enterprises involved can be made to pull harmoniously together even under act of Parliament may be considered a little dubious. It is open to question whether better results would not be obtained by an actual merger of the several properties under private control with government supervision. A practically common ownership with a single responsible administration would seem more likely to get results quickly and efficiently than a town meeting of local authorities. Municipal undertakings have had a fair measure of success in England, far more than has been accorded to them here, yet in an area of two counties there are serious chances for disagreements not easily to be soothed by a majority vote of a board constituted as is now proposed. A far closer union of interests would strike us as necessary to the best operative results.

Experience with Low-Grade Fuels

WE have repeatedly voiced the need of studying furnace conditions with a view to utilizing fuel of minimum cost for the output. War conditions have emphasized the necessity for activity in this respect, and we are glad to be able to give in the current issue some important reports from some of the automatic stoker companies as to their success in burning cheap fuel with existing equipment. The reports show that under the pressure of necessity almost every available kind of low-grade fuel is to a certain extent being utilized, and with good results. The list includes the poorer soft coals, lignite, coke breeze, culm, anthracite screenings, and in fact the refuse of the mines. Several questions come to the front when considering the use of these cheap fuels. Some of them have a fairly high thermal value measured in pound-Fahrenheit units but are inconvenient because of ash, clinkers or moisture. Moreover, considering the fact that every plant has a fixed grate surface, the output of steam is limited by the quality of the fuel, and where a plant is pushed near to its capacity when burning standard steam coal it will come out badly with poor coal even though the latter may be cheap and of very fair thermal value.

Consequently in going to cheap fuel it may be necessary to increase the boiler plant if this can be conveniently done, or to make changes in the furnaces of a somewhat sweeping character. However, in a large number of instances the existing equipment can be used very well. With a little attention to detail existing stokers can be made to handle cheap fuel, and a new installation can be very readily adapted to burning it with first-class results. As to the former case, in some plants a moderate proportion of cheap anthracite mixed with bituminous coal has been found to work perfectly well in the stokers, although ordinarily they are not planned for anthracite. Lignite is being worked successfully, and in favorable locations a good many stokers are being installed for this purpose. Some of the fuel runs as low as 6500 heat units and is still consumed at fair efficiency. In several instances bone coal with ash running up as high as 40 per cent has been dealt with by unchanged stokers with good economy. In one plant the increased consumption in tons was only 25 per cent, and the change released 100 tons of good marketable coal per day. Coke breeze, where it is obtainable from coke ovens or gas houses or by-product plants, seems to be giving favorable results, although from the peculiar consistency of this fuel and the amount of moisture it is likely to accumulate, some

modifications in the stoker mechanism are desirable, particularly in the way of better air supply and special arrangements for pushing along the fuel. In some coals which are apt to clinker moving retort side walls and special forms of air supply have been found desirable. Anthracite screenings can with care be used successfully either by themselves or else mixed with bituminous coal.

The chief difficulty in dealing with all this low-grade fuel, much of which carries a very high percentage of ash, is the danger of forming clinkers on the side walls or grates. To overcome this various devices are used and all of them apparently with a measurable degree of success. Some trouble has been reported with the firebrick in these various experiments, particularly where the arch construction is used, and divers schemes in furnace construction are employed to get around these specific troubles. Each stoker company has its own line of remedies for low-grade fuel troubles, based on its judgment and experience; but the encouraging point of the situation is that in general good results are being reached despite minor difficulties. Each plant has its own problems to solve, depending on the available fuel, the possibility of holding its output without unnecessary increase of furnace capacity, and the chance of readily adapting its stoking apparatus to its changed duty.

A general effort to make the best of the cheap fuel readily attainable will produce admirable results in loosening up the general coal situation. Transportation seems to be the chief difficulty in getting coal supply for various industrial purposes, and it must be remembered that low-grade fuel of whatever kind puts a much stiffer burden on transportation than high-grade fuel, both in weight and bulk, to an extent that is by no means of small consequence. We have heard much recently, for instance, of the use of wood for domestic and other purposes as a substitute for coal. Now, all questions of cost and labor aside, in which the balance is heavily against wood, for a given thermal value wood weighs roughly twice as much and also takes four times as many cars as coal, thereby using up rolling stock and increasing the dead weight to be hauled. It therefore behooves those who are studying the use of low-grade fuel to be guided largely by its availability as well as its character, utilizing locally produced fuel wherever possible. None the less, speaking broadly, a marked degree of success is being reached, and in the aggregate a very large quantity of high-grade coal will be released for long hauls and for purposes where it is peculiarly necessary.

AMONG the articles which will be contained in the next issue of the **ELECTRICAL WORLD** will be one on obtaining the approximate values of harmonics, another on standardization of 33,000-volt outdoor substations, and the third installment of Prof. C. E. Clewell's series on industrial motor applications. The latter will dwell on the method

The Coming Issues

of making and using records of factory circuits, important aspects of circuit standardization, and interrelations between lighting and motor loads. In a future issue of the **ELECTRICAL WORLD** there will be published a discussion by an authority in the jobbing industry on the present credit situation and the outlook for the future.

Symposium on Utilization of Low-Grade Fuels

Advisability of Electric Companies Ascertaining Nearby Sources—Many Forms of Mine Refuse Have Been Burned Successfully—Some of the Problems That Are Involved

OWING to the present high prices and poor delivery of the grades of coal which have been most popular for steam-producing purposes, a number of electrical companies are now using poorer grades of fuel than heretofore. Other companies which cannot afford to reduce their boiler capacity, which would

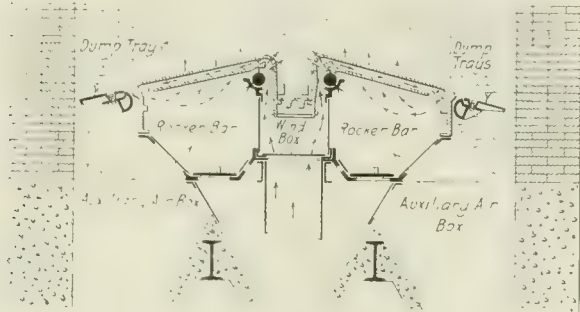


FIG. 1—ROCKING-BAR STOKER IN WHICH FUEL IS FED FROM MIDDLE AND CARRIED TO THE SIDES (COMBUSTION ENGINEERING COMPANY)

necessarily result from using lower-grade fuel, are mixing a large percentage of coke breeze and hard coal screenings with their regular fuel, thereby endeavoring to reduce the consumption of the scarcer fuel and permitting utilization of the more readily obtainable fuels. Still other companies, especially those in England, are considering the practicability of generating gas from coal for boiler firing and either marketing the by-products or disposing of them to some separate concern which will find a sale for them. Whichever method is followed, the companies find it best to co-operate with the mines and railroads in securing coal at times best suited to them, namely, in the summer, providing storage facilities so that coal can be kept until used. Where oil is used it may be necessary to change to powdered coal if the price of oil increases, says one of the electric service companies on the Pacific Coast.

Under present conditions the problem is not so much to secure the largest number of kilowatt-hours per pound of coal as it is to find the fuel that can be utilized without making too many changes in the existing equipment and to provide for the continuous delivery of this fuel. Judging by what the companies heard from are doing, it appears that many other utilities, confronted with the fuel problem, could profit by ascertaining the low grade fuels in their vicinity and if necessary modifying their equipment so that these low grades could be used. If this cannot be done, or is impracticable, the present method of operation could be carefully analyzed to determine where the losses are and how they may be reduced. When it is considered that before the war the average fuel expense was only 0.42 cent per kilowatt-hour in a 5000-kw. plant, while at present it has advanced to 0.67 cent per kilowatt-hour, it should be evident that as much heat as possible should be converted into useful work.

According to reports from electric service companies and manufacturers of stoking apparatus, many types of low-grade fuel are being successfully burned. Among them are the soft coal with high ash content, bone coal, culm, lignite, coke breeze, anthracite screenings, and in fact all mine refuse. Before changing from the grade of coal used at the present time, however, each company should carefully analyze the problems which will be involved in utilizing lower-grade fuel. In this connection it should be pointed out that the steam output developed from a given size of grate will not be as large with a low-grade fuel as with a higher grade, even though the unit cost may be less. Furthermore, the moisture absorbed by low-grade fuels in transit should be taken into consideration, as it may be considerable, 25 per cent increase in weight due to moisture absorption being not unusual. Another problem, and probably the most serious, is that the use of low-grade fuels brings about difficulties in regard to clinkers, draft and fusing of firebrick.

The reports given below indicate what success stoker manufacturers have had in burning low-grade fuel with existing apparatus, and how standard equipment has been modified in some cases where it is necessary.

American Engineering Company.—Ordinarily this company does not install stokers to burn anthracite coal; however, it is being burned successfully where it is being mixed with a relatively large quantity of bituminous coal. A number of installations burn coke breeze from beehive ovens, by-products plants and gas houses. The best results have been obtained with by-product breeze, although this fuel runs somewhat

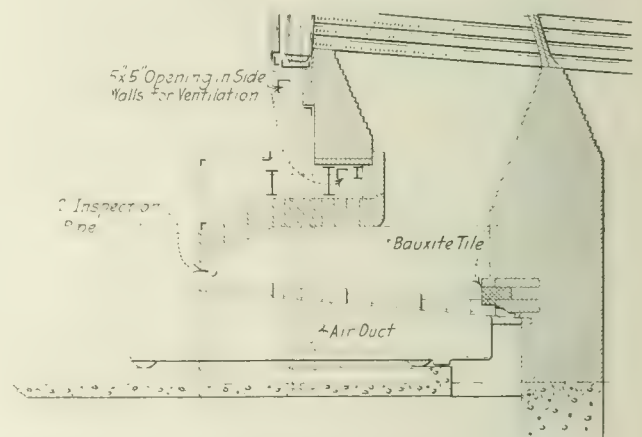


FIG. 2—CHAIN-GRATE STOKER WITH SOME FEATURES OF FURNACE CONSTRUCTION RECOMMENDED BY THE LACLEDE-CHRISTY COMPANY

lower in calorific value and higher in moisture than any other form of breeze. Lignite has been burned and is being burned, a large number of stokers being installed at the present time for burning this fuel. The lignite chiefly used in these stokers ranges in calorific value from 6500 to 9000 B.t.u. This is being burned in large amounts and with relative efficiency.

Bessemer Coal & Coke Company, Russellton, Pa.—This plant used bone coal, which contains 36 to 49 per cent ash and has a heating value ranging from 8000 to 9000 B.t.u. The boilers are set in pairs, with one three-retort stoker serving each battery. No modifications have been made in the construction of the stokers. Previous to installing the stokers eight boilers were required to carry the load and 100 tons of

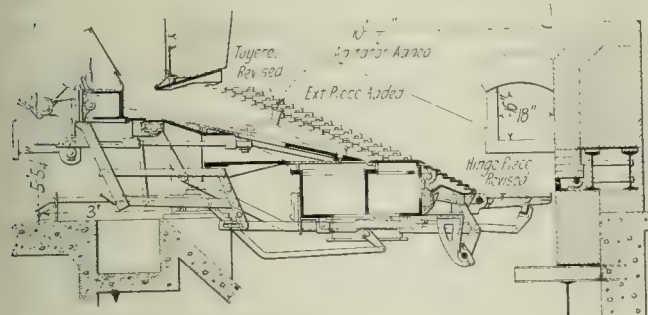


FIG. 3—STANDARD UNDERFEED STOKER WITH EXCEPTION OF COKE-BREEZE PUSHERS (AMERICAN ENGINEERING COMPANY)

marketable coal were consumed per day. After installing the stokers six boilers were sufficient to carry the load and 125 tons of bone coal were consumed per day. This method of operation released considerable marketable coal and increased the mine production by 75 per cent.

Iowa Railway & Light Company.—Iowa coal, containing approximately 30 per cent ash with a heating value of 8500 to 9500 B.t.u., is used almost exclusively in the boiler room of this plant. This fuel is non-coking and quick-burning and its ash has a very low fusing temperature. The stoker is standard except for the addition of a lower-ram extension which is used for maintaining a uniform feed of coal from the mouth of the retort throughout the length of the furnace. In burning this coal it is important that the dumping periods should be regular and not extended too long a period. (Test data in accompanying table.)

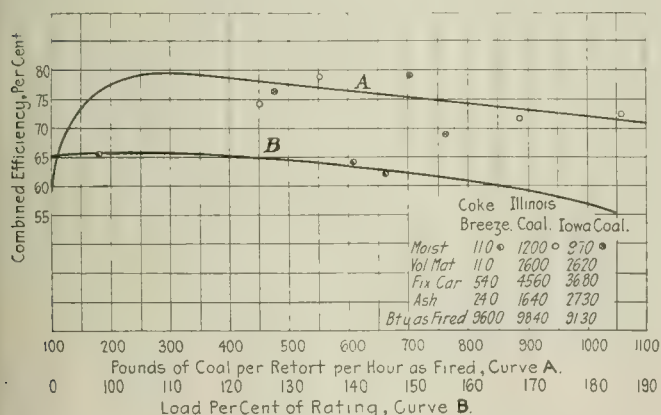


FIG. 4—PERFORMANCE OBTAINED WITH LOW-GRADE FUEL (TAYLOR STOKERS)

United Railways & Light Company, Moline, Ill.—This company is burning Illinois coal of approximately 9500 B.t.u. containing 16 to 20 per cent moisture and about 15 per cent ash. Extremely wide range in the rate of fuel burning is desired, so stokers having relatively large retorts fed by triple plungers are used. These stokers may burn as high as 1500 lb. of coal

per retort, the efficiency obtained being approximately the same at normal rate as with the smaller stokers and much higher at the higher rates of burning. On account of the large grate area, this stoker is particularly adapted to burning low-grade fuel.

American Sheet & Tin Plate Company, Scottdale, Pa.—Coke breeze containing 11 per cent moisture, 24 per cent ash and 9600 B.t.u. is being burned in this

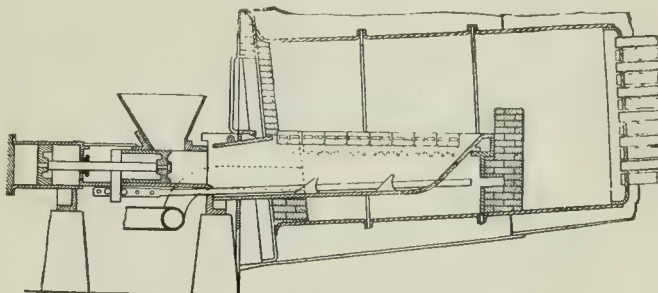


FIG. 5—ANOTHER TYPE OF STOKER ADAPTED TO LOW-GRADE FUEL (UNDERFEED STOKER COMPANY OF AMERICA)

plant, the coke being obtained from beehive ovens. Since the price of this fuel has increased considerably, the tin-plate company has changed to burning ordinary coal. For burning breeze the lower rams of the stokers were replaced by special coke-breeze pushers. The tuyères were also special in that they contained a greater area of air opening than standard types. In addition an arch was employed for hastening the ignition (see table).

Lehigh Coke Company, South Bethlehem, Pa.—In the boiler plant of this company by-product coke breeze which contains 22 per cent moisture, 16 per cent ash and 9552 B.t.u. is being burned successfully. When hand-fired boilers were being employed to burn this fuel only about 70 per cent of boiler rating could be obtained and steam generation had to be discontinued for five to six hours at a time while the fires were being cleaned. With the seven-retort stokers which are now being employed, 120 per cent of boiler rating can be obtained and no time is lost in cleaning. The stoker used is standard except that it is equipped with a lower-ram extension and special tuyères with large air openings. Although the brick work had to be repaired every fifteen or twenty days when hand firing was employed, no brick work repairs have been necessary and there has been no indication that any will be required after six months' operation with underfeed stokers. When this plant is entirely equipped with stokers, it is estimated that the saving in labor expense alone will amount to \$45,000 a year.

Sanford Riley Stoker Company.—Many plants using Riley stokers are burning anthracite screenings in cases of necessity. A mixture of 25 per cent soft coal and 75 per cent screenings will give very fair operating results. At times one plant burns straight anthracite screenings, but this practice would not be recommended except in cases of necessity as the underfeed stoker is designed essentially for the distillation and burning of soft coal. In order to increase the life of the side walls in the furnace and to prevent the adherence of clinkers, air from the chamber under the stoker is taken up to a box in the side walls, from which it is discharged into the furnaces just above the grate but

below the top surface of the fuel bed. Exhaust steam may also be admitted at this point.

In some coal there is a great tendency to form clinkers. This may be prevented by having moving retort sides which keep the fuel bed sliced up and homogeneous at all times. If small clinkers form, the movement of the tuyères will prevent their growing in size and will also keep the fuel bed open and porous so that the air for combustion may find a ready exit.

Illinois Stoker Company.—Certain grades of coal tend to form clinkers if agitated during combustion.

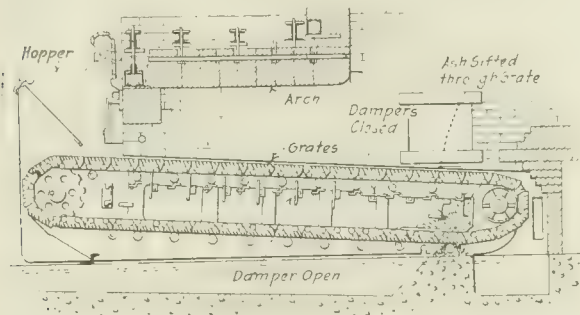


FIG. 6—TRAVELING-GRATE STOKER WITH DAMPERS FOR ADJUSTING AIR PRESSURE UNDER DIFFERENT PORTIONS (ILLINOIS STOKER COMPANY)

To prevent this it is best to use a stoker on which the coal remains undisturbed during the successive steps of burning. The continuous ash-dumping arrangement eliminates the periodic fire cleaning and the attendant loss of load. In order to meet any load conditions that may arise, dampers which are an integral part of the stoker furnished by this company are provided, any one of which may be adjusted independently. With this arrangement the intensity of draft and the quantity of air admitted can be regulated at different parts of the grate. (Test data in accompanying table.)

Underfeed Stoker Company of America.—Unusual success has been obtained in burning bone coal, mine refuse and other fuels that have usually been regarded as practically worthless. At the Spring Valley (Ill.) Coal Company the steam generating plant washed screenings are burned, \$5,000 being saved thereby in the first year. Results and tests at this plant indicate an evaporation of 6.02 lb. of water per pound of coal, from and at 212 deg. Fahr. At the Rochester & Pittsburgh Coal & Iron Company's plant in Luzerne, Pa., bone coal which was formerly thrown on the dump is now utilized. After mining the coal, the lump and nut are picked out and the refuse gone over to separate that which is distinctly slack. The remaining product, known as bone coal, is then crushed for use in the furnaces.

Combustion Engineering Corporation.—Type E stokers are being used successfully to burn bituminous, semi-bituminous and sub-bituminous coals with an ash content up to 25 per cent. In the plant of the Pennsylvania Gas Company 150 to 175 per cent boiler rating is being obtained with coal containing 25 per cent ash. Iowa coal containing about 90 per cent moisture and 23 to 32 per cent ash and 7300 to 9000 B.t.u. is burned quite satisfactorily in the generating station of the Fort Dodge, Des Moines & Southern Railway, Boone, Iowa. As a general rule, however, the Coxe traveling grate stoker would be better for coal of this type. This stoker is in successful use at the present time for burn-

ing refuse anthracite, such as culm, silt and sizes finer than No. 3 buckwheat. This stoker is also capable of burning coke breeze or refuse from by-product coke plants and beehive ovens, breeze with an ash content of 25 per cent being handled successfully.

The principal trouble with burning low-grade fuel is the formation of clinkers on either the side walls or grates. Forged-steel or rolled-steel water boxes placed along the fire line for at least two-thirds of the stoker length will prevent this trouble when burning coal with an ash content as high as 35 or 40 per cent and with combustion rates as high as 30 to 40 lb. per square foot. While exhaust steam will help rot the clinkers and make them easier to remove, such a large quantity is required that it is not always practicable to employ this method. So much trouble has been experienced with firebrick lately that it is believed that firebrick manufacturers are not able to obtain as good clays as before the war. When temperatures as high as 2800 or 2900 deg. are reached, the best firebrick must be used. Brick which will give entire satisfaction in side walls will not necessarily stand up in arch construction, probably due to the fact that at the temperatures obtained the bricks become plastic and compress from the weight of the arch, or possibly the temperature reached is in excess of the temperature at which the brick was burned and hence there is shrinkage. Brick that is high in silica is usually less plastic than clay brick, but the silica causes the brick to spall with any rapid changes of temperature. The suspended type of arch avoids part of these difficulties.

Laclede-Christy Clay Products Company.—The stokers produced by this company are fitted for all fuel mined west of the Indiana-Ohio line. Among the features which should be incorporated in a furnace, according to this company, are the following: High bridge wall with a vertical front face which reflects its heat directly to the incoming fuel near the feed gate; an inclined stoker which permits this reflected heat from the bridge wall to take effect on the incoming fuel; an agitation

RESULTS OBTAINED BURNING ILLINOIS BITUMINOUS SLACK AND SOUTHERN KANSAS SLACK RESPECTIVELY ON ILLINOIS CHAIN GRATES

	Illinois Slack	Kansas Slack
Moisture in coal, per cent	13.06	4.18
Ash and refuse in dry coal, per cent	18.7	16.94
Dry coal per square foot of grate surface per hour, lb.	26.44	15.87
Force of draft over fire, inches of water	0.232	0.12
Horsepower developed, per cent of rating	127.8	92.4
Equivalent evaporation from and at 212 deg. per pound of coal as fired, lb.	7.848	9.11
Calorific value of the dry coal per pound, B.t.u.	11,753	12,565
Efficiency, including grate and based on dry coal, per cent	74.53	74.34

combustion arch so arranged that all of the heat from the most intensely heated parts of the furnace is directly reflected on the incoming fuel, and a vertical flame travels from the most effective part of the fuel bed to the combustion chamber. This company has centered its investigations on the design of the combustion chamber, bridge wall, combustion arch and other features of furnace designs.

Central Station Power for the Industries

Increased Manufacturing Business Due to War, Importance of Uninterrupted Service and Scarcity of Coal Have Forced Industrial Plants to Adopt Central Station Service—Advantages of Such Service in Normal Times

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

SYNOPSIS.—In this article the important question of central station power for the industries is discussed from the viewpoint of the manufacturer as well as that of the central station. From the manufacturer's point of view three phases of the subject are discussed: (a) the limitations to highly efficient power production in the power plant connected with the average factory; (b) relation of fixed charges and load factor to the power cost, and (c) the economic advantages of purchased power because of its greater reliability, because the central station specializes in the manufacture of power, and also because the avoidance of the investment for generating equipment virtually increases the credit of a corporation. The trend in the use of purchased power is discussed briefly with concluding paragraphs on the point of view of the central station to the problem as a whole. The article summarizes the two aspects of the question and hence forms an unusually important discussion both for the manufacturer and for the central station.

TWO viewpoints are suggested by the title of this article—(1) that of the manufacturing plant concerned with the various points in favor of or against the purchase of electric power in comparison with the production of power in its own plant as a part of the industrial equipment; (2) that of the central station concerned with the possibilities from the commercial point of view in the supply of power to industrial establishments as a part of the total output.

It is proposed in the present article to treat more particularly those phases of the question which relate directly to the industries and merely to touch upon the aspects in which the central station is becoming more and more vitally interested. From the first-mentioned point of view three principal items stand out prominently. One relates to the broad question of the limitations to high efficiency in the production of power imposed on the average manufacturing plant by the use of relatively small engines and generators when the power plant is made an adjunct of the establishment. The second involves the distribution of fixed charges for generating equipment over a relatively small kilowatt-hour output with the attending increase in the actual cost of the power. The third includes the various economic advantages to the average factory which usually obtain when power is purchased, thus placing the whole question of the power supply outside of the industry and in the hands of those who make a specialty of power manufacture and distribution.

TREND IN THE USE OF CENTRAL STATION POWER

Before discussing these three phases of the power problem from the standpoint of the industries, reference will be made to the trend in the use of central station power in comparison with the growth of the total power used in such plants.

To illustrate this feature Fig. 1 has been prepared on a basis of available United States Census reports. This chart relates primarily to the use of power in the machinery building trades and thus is limited to one line

of manufacture. However, it constitutes such an important branch of industry that it will serve as a representative case.

Of the total electric horsepower a part is developed by the private generating equipment connected with the various factories and a part is purchased. The ordinates of the lower curve stand for the electric part developed by the factories themselves, and the ordinates between the lower curve and the middle curve show the corresponding part of the total electric power which is purchased. Probably the most interesting and important feature of this chart is the fact that the curves

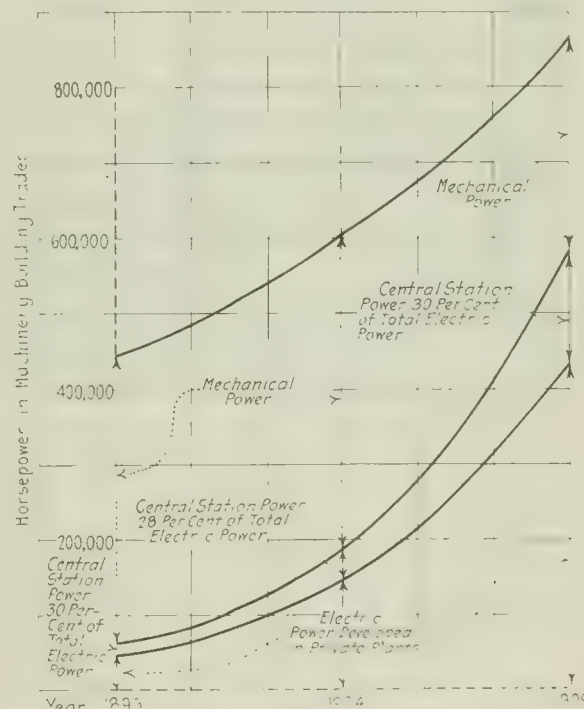


FIG. 1—TREND IN THE USE OF POWER IN THE MACHINERY BUILDING TRADES

show the ratio of purchased to the total electric power to have remained practically constant for the interval of years shown in the chart, notwithstanding the further fact that both the total electric power and the purchased electric power have shown remarkable increases for these ten years.

Conditions since the effects of the European war have been felt in this country are decidedly different from those represented by the census curves, however. In the last three years the central-station load of this country has more than doubled—an achievement that was never dreamed of before. In one case a central station took on 100,000 hp. in load, whereas it never before secured more than 33,000 hp. in a year. Other central station plants were so loaded that they could not take on any more business—all due to the industrial development. Industrial plants have been compelled to

adopt central station power because of the sudden demand for their product, and the rapid growth in business cannot be met by installing or enlarging isolated plants. Furthermore, continuity of service and the scarcity of fuel have made isolated-plant service unattractive and uneconomical.

It is therefore unsafe to draw any conclusions as to the attitude of the manufacturers toward central sta-

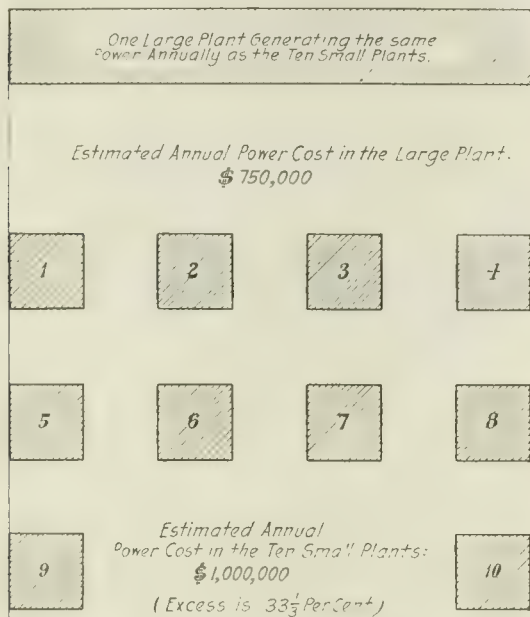


FIG. 2—EXTRA ANNUAL COST REQUIRED WHEN A GIVEN BLOCK OF POWER IS DEVELOPED IN A NUMBER OF SMALL PLANTS RATHER THAN IN ONE LARGE CENTRAL STATION (BASED ON ESTIMATES)

tion power from the census curves other than to point to the wide field still open for the central stations in obtaining a larger share of the business which would be involved not only in the supply of some or all of the power included between the lower curve and the horizontal reference axis but also that part which is still used in mechanical form and represented on this chart by the ordinates between the middle and upper curves.

EFFICIENCY IN POWER GENERATION

One of the fundamental differences between the large central station and the generating plant connected with the average factory lies in the size and consequently the economy of the generators and prime movers employed. During the last thirty years remarkable changes have been effected in the sizes of engines, turbines and generators for use in central stations, the earlier equipment with ratings on the order of a few hundred horsepower or kilowatts having been superseded by single units in the larger stations with ratings in the tens of thousands of kilowatts.

As a result the steam consumption in pounds per kilowatt-hour for the large central stations has decreased from about 25 or 27 down to about 11 1/4 in the interval between 1890 and 1916, while the corresponding figures for the small engines used in manufacturing plants are from about 29 lb. to 59 lb. of steam per kilowatt-hour in 1890 down to 25 lb. to 40 lb. in 1914.¹

¹Based on curves by Prof. Chas. F. Scott, *Electric Journal*, Vol. XII, No. 1, p. 8.

The sizes of the central stations in this interval have increased in the larger centers to such an extent that units of the larger size and economy can be employed. The generating plant connected with the average factory must, however, of necessity usually remain so small that there has been little or no change in the sizes of individual units employed in such cases.

The larger central stations have thus profited in a twofold manner by the experience of the past years—first, by the improvements which have been made in engines and generators of a given size, and, second, by the inherently greater efficiency with which power can be produced in large rather than small units. The average manufacturing plant, on the other hand, in the production of its own electric power has usually profited only by the slightly greater efficiency of modern engines and generators in comparison with the efficiency of older units of the same size.

The preceding figures show at a glance one of the important reasons why the average manufacturing plant is unable to compete with the large central stations on the basis of actual costs for power production. There are, of course, many other reasons for increased economies in the large stations, of which the above data are only illustrative. As an example of the magnitude of these economies Fig. 2 has been drawn to represent graphically on the basis of careful estimates² the extra annual cost required to develop a given block of power in ten small plants rather than in one large central station, the excess in this case amounting to about 33 1/3 per cent.

DEPENDENCE OF KILOWATT-HOUR COSTS ON LOAD FACTOR

The fundamental dependence of power costs on the load factor is strikingly illustrated by Fig. 3. The two curves³ merely emphasize the well-known principle that during periods of business depression a factory with its own small power plant will pay considerably more

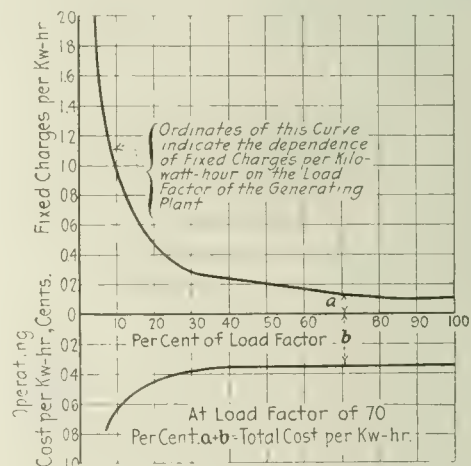


FIG. 3—DEPENDENCE OF FIXED AND OPERATING COSTS ON LOAD FACTOR IN A GIVEN CASE, INDICATING WHY POWER COSTS ARE USUALLY SO HIGH WHEN THE AVERAGE FACTORY HAS ITS OWN SMALL POWER PLANT

for its power than at other more prosperous times when the load factor of the plant is higher.

This is, of course, partly due to the fixed charges, which largely go on independently of the number of

²From a paper by R. F. Hale, *Transactions A. I. E. E.*, Vol. XXIX, p. 131.

³From a paper by H. G. Stott, *Transactions A. I. E. E.*, Vol. XXXII, p. 1646.

hours per day the plant is operated or of the amount of load in terms of the total capacity of the plant, and partly to the fact that certain components of the operation costs, such as the labor item, are largely independent of the load factor and hence form a larger amount per kilowatt-hour output at times of light load than at periods of heavy load.

Hence it may be readily seen that any isolated plant which bases its accounts purely on the coal consumed and on incidental charges connected with operation may arrive at results which are far from accurate unless the actual output for the period considered is known and the fixed charges are added to the operating costs on a basis of this actual output.

There is, however, quite another side to this question aside from the high cost of power per kilowatt-hour in the isolated plant during times of business depression. The normal conditions in prosperous times may be such that the load factor is low, which will mean a relatively

carry this discussion one step further and to consider briefly the economic advantages of central station power even if the costs were equal or somewhat higher than those of an isolated plant connected with the factory.

It must be remembered in this discussion that the power item in the average factory is usually very small in comparison with the total cost of production (on the order of 5 per cent and less), so that even a large saving in the cost of power is not likely to produce more than a minor saving in the total production cost. However, a failure of the power supply for only a few minutes due to inadequacy in the methods or equipment in the isolated power plant is likely to result in a very large loss because the entire plant is temporarily shut down by such an irregularity, or at least that portion which is dependent on power for the operation of machinery. It can easily happen, therefore, that because of unreliability in its power supply



FIG. 4—WITH THE RELATIVELY SMALL UNITS USED IN THE AVERAGE FACTORY THE STEAM CONSUMPTION PER KILOWATT-HOUR IS RELATIVELY HIGH

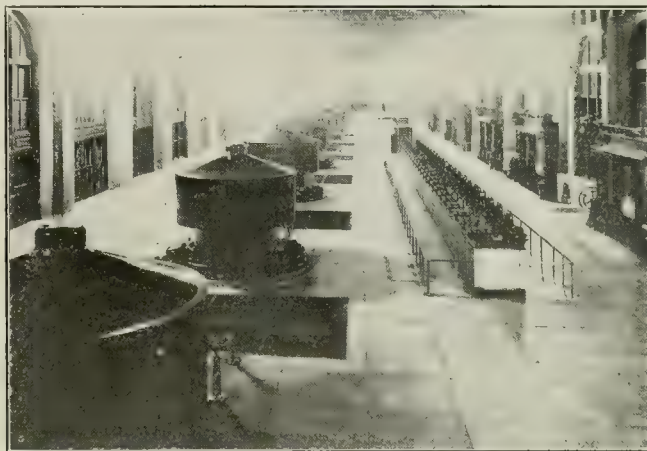


FIG. 5—LARGE UNITS MEAN HIGH EFFICIENCY, AND A HIGH LOAD FACTOR MEANS LOW FIXED CHARGES PER KILOWATT-HOUR OUTPUT

high cost of power at all times, with heavier charges in dull times.

Keeping the facts shown by Fig. 3 in mind, a reference to the table illustrates the unusually low values of load factor which may be experienced in typical industries.* It may be gathered from these data, therefore, that even under normal working conditions the cost of the power supply from an isolated plant is likely to be high when all the components of the total cost are properly proportioned over the actual kilowatt-hour output, and obviously the cost will increase considerably at times when the factory is run with production below normal.

ECONOMIC ADVANTAGES IN THE PURCHASE OF POWER

There is a tendency on the part of the advocates of the isolated plant, and also possibly to some extent on the part of the industries, to discount the differences between the costs of generating their own power and of purchasing from a central station, and even where the difference is admitted in favor of the central station, there is sometimes a feeling that the central station rates are prepared in such a manner as to offset the advantages which it possesses in the manufacture of power on a large scale. It is therefore advisable to

the small isolated plant is the source of far larger losses to the factory than any difference one way or the other which might be found in the total costs of its own power and that from a central station.

This feature of reliability, taken along with that of constancy in voltage under all load conditions so that motor speeds may be maintained up to standard at all times, forms a very marked advantage in favor of purchased power. To this there may be added the fact that to the central station the manufacture of power is the specialized objective. The attention of experts is concentrated on the production of power at a minimum cost and at a maximum of reliability. In the manufacturing organization the lay-out of the plant is based on the manufacture of a definite commodity, and if an isolated power plant is added as a part of the equipment it is necessarily of secondary concern in the minds of those who are in charge of the whole establishment. Of the two cases, it would naturally be presumed that the former would be typical of far more nearly ideal conditions for the realization of economy and reliability in the power production problem than the latter.

Again, it can be shown that a manufacturer, and particularly one who has difficulty in obtaining funds for his organization, should conserve his credit as far as possible in the lay-out of the factory. A. E. Rickards, in a very interesting discussion on the oppor-

*The table is based on data of A. E. Rickards, *Electric Journal*, Vol. XI, No. 4, p. 219.

tunities for central stations,⁶ shows that under the circumstances of difficulty in securing funds the manufacturer who ties up his capital in power plant equipment uses up his credit in what may be termed the non-productive end of the business, this point being amplified in the form of an example which has been considerably abridged and reduced to tabular form in the following:

CASE I.—

\$100,000 (the entire capital) raised by issuing stock.
Estimated result 6 per cent dividend on the stock.

CASE II.—

\$50,000 (half the entire capital) raised by 5 per cent bonds.
5,000 borrowed from bank at 5 per cent.
10,000 credit secured from the people from whom supplies are purchased.
35,000 raised by issuing stock.
Estimated result: \$3,250 required for the interest on bonds and borrowed funds and 9.2 per cent dividend on the stock issued.

The marked advantage of Case II over Case I in the matter of possible dividends on the stock is apparent, this advantage being due partly of course to the amount of credit possessed by the manufacturer. Mr. Rickards

DATA ON FOUNDRY AND MACHINE SHOP INDUSTRY

Case Number	Maximum Horsepower Demand	Per Cent Load Factor	Cost in Cents per Horsepower-Hour	
			Isolated Plant	Central Station
Foundries:				
1	40	24.0	2.50	1.58
2	40	6.8	4.69	2.37
3	50	13.7	4.09	1.91
4	70	30.7	1.80	1.61
5	85	16.0	3.40	1.80
6	300	14.0	2.40	1.69
7	400	23.0	1.20	1.40
Machine shops:				
8	35	19.0	2.20	1.59
9	40	16.0	3.40	1.76
10	50	19.0	3.30	1.89
11	50	19.0	3.90	1.89
12	50	8.5	5.60	2.46
13	100	31.0	2.78	1.60
14	125	56.0	1.30	1.30
15	125	20.0	2.90	1.76
16	125	16.0	2.90	1.77
17	130	13.0	3.50	2.17
18	130	19.0	2.90	1.70
19	200	6.0	4.70	2.18
20	300	16.0	2.40	1.61
21	480	17.0	2.90	2.56
22	1600	14.0	2.00	1.73

points out in this connection that the average corporation can usually borrow from 70 to 80 per cent of its "quick" assets, whereas on buildings and machinery seldom more than 25 per cent of the appraised value can be borrowed. From this it follows that the manufacturer who invests in an isolated power plant is unduly using up his credit, and hence purchased power contributes in such a case to increase (virtually) his credit, as an additional item over and above the economic advantages as previously outlined.

THE CENTRAL STATION POINT OF VIEW

This second phase of the question has been so thoroughly discussed in various papers on the subject that it is the purpose here merely to touch briefly on several of the conclusions which may be reached on a basis of some of this available information. It has been pointed out⁶ that while the central station would prefer to have

no restrictions on any of its customers, an absence of such limitations would tend to impair the quality of the service not only for the manufacturer who has (or may have) relatively undesirable apparatus but likewise for all others on the same circuit. This fundamental requirement of high quality in central station service quite naturally imposes certain restrictions on the sale of power to larger and smaller manufacturing plants.

It is hardly necessary or advisable in an article of this kind to go into the details of the factors which govern these restrictions other than to say that they involve from the standpoint of the central station such items as the starting current and starting conditions, the power factor of the load, the size of units, the starting devices employed, the types and voltages of the motors to be used, and the hours of service. While the enumeration of these items gives a general idea of the nature of the problem, it is of course obvious that each of these items in itself constitutes a subject which calls for careful and extended study in actual practice.

While it may not be entirely clear that the central station is vitally concerned on a comprehensive scale with the motor application field, the impression on the part of central station companies seems to be that ultimately all motor applications will be related closely to the central station activity. Furthermore, it may be stated that the opinion has been advanced that alternating-current distribution is the ultimate for this service, in spite of the fact that at present there are still many objections to alternating-current motors for certain classes of machinery drives.

Steady Motion-Picture Carbons

In motion-picture lamps it has been customary to have the negative carbon somewhat smaller than the positive upper in order to have the consumption of the electrodes approximately equal and secure a stationary focal point. When, however, the electrodes are made in correct proportion to obtain equal burning, the negative is of sufficient size to cause the arc to wander.

Ben Perris of Lakewood, Ohio, shows in patent No. 1,241,740 how not only can the requirement for equal burning be produced with electrodes having a relative cross section of four to one, but, what is more important, by an improvement in the copper plating of the negative carbon electrode all flickering and spattering of copper upon the condenser lenses can be entirely done away with.

It is well known that if a single heavy copper coating is employed the sheath near the negative tip melts and collects in beads on the end. These molten beads have the peculiar property of spattering and flashing suddenly when the arc touches them. This causes the undesirable flicker and projects molten metal onto the glass lens, where it sticks quite firmly. The copper particles must, of course, be removed from the lens; otherwise the transparency will be affected, and this is more or less difficult to do. The formation of molten beads on the negative tip may be entirely eliminated by covering the copper sheath with a second coating of nickel.

⁶In an article entitled "New Opportunities for Central Stations," *Electric Journal*, Vol. XII, No. 1, p. 10.

⁶Valuable discussions on this phase of the central station field are found in a paper by D. B. Rushmore, *Transactions A. I. E. E.*, Vol. XXXIV, p. 695. References are here made to the discussion of R. F. Schuchardt, R. M. Wilson and Harold Goodwin, Jr.

Factors Affecting Selection of Insulators*

Liability to Interruption Dependent on Size of System—Steel Structures Impose Greater Strains on Insulators than Wood—Nature of Load an Important Consideration

BY A. O. AUSTIN

Chief Engineer Ohio Insulator Company

WHILE it is apparent that the state of the art as regards the design and manufacture of insulators has made remarkable progress in the last few years, it should also be evident to any one making a careful study of line operation that conditions affecting the insulator have not been improved but on the other hand have become more severe. With the growth of a system and the consequent increase in hazard for oil switches, transformers or other apparatus, certain types have been discarded, although they may have given very satisfactory operation at the same voltage when the system was smaller. It is seldom, however, that the growth or size of the system receives consideration when it comes to the performance of the insulator or line, where it may be even more important.

The decrease in reliability is so important in many cases that it has necessitated large expenditures in steam auxiliaries, parallel circuits or reconstruction of the line. In other cases reinsulation of the line has been resorted to in order that better service might be established. However, the factors which affect the performance of the insulator or the reliability of a given line are often far more important in producing

engineers will be able to make specifications which cover the essential points and the efforts as applied to the insulator will be far more effective.

It stands to reason that before the knowledge of electrostatics of mechanics can be used to best advantage in designing insulators, it is necessary to determine the line conditions to a considerable extent. The resulting design will then be successful in so far as these conditions have been properly gaged and engineering knowledge has been applied in effecting a good compromise in the design. Although insulators can be built to meet successfully any essential line conditions for a period of years, they at best work upon a narrow margin of safety for some of the stresses to which they are subjected, so it is highly important that the various factors affecting them be considered, as well as their design and manufacture, if the best service is to be obtained from transmission lines.

In any class of engineering work the relation between cost and the result is of prime importance; therefore, if the value of reliability to the system can be determined some basis for the expenditure in the transmission line will be had. The value of reliability is largely determined by the three conditions which follow: (1) Investment depending upon the line; (2) nature of the load; (3) competition.

In considering the investment, it is advisable to remember that the relative cost of the insulator as compared to the remainder of the system is often under 3 or 4 per cent, and that there are only a few systems which could not afford to use more insulation, simply as a matter of good business investment in safeguarding their plants.

As the investment dependent upon the transmission line increases greater expense will be warranted in the transmission line, and it is usually the best policy to use steel construction with ample insulation for the largest lines. It must be remembered, however, that a large expenditure in the line does not necessarily mean reliability, for if steel towers or structures are used in place of wood, the insulator must be very much larger to give the same reliability.

Unless the insulator is sufficiently large, a large investment might readily warrant the use of a wood-pole line to gain greater reliability, as the greater reliability would more than offset the increased depreciation of the wood over steel construction.

NATURE OF THE LOAD AN IMPORTANT CONSIDERATION

The nature of the load, irrespective of the amount of power delivered, often demands the greatest reliability of service, and may be a more important factor in determining the reliability than even the largest investment. Many schemes have been used to increase the reliability of service, such as auxiliary stations and parallel or loop circuits, all of which entail considerable

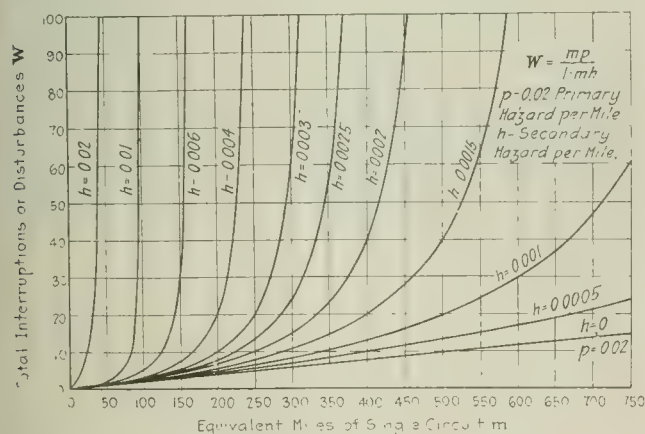


FIG. 1—RELATION BETWEEN TOTAL INTERRUPTIONS AND SIZE OF SYSTEM WITH DIFFERENT SECONDARY HAZARDS

reliability than additional circuits, the reinsulation or the use of a larger size insulator on the system, and should be given careful attention in the construction of a new system or in the operation of an old one.

The lack of knowledge as to line conditions and the exact nature of insulator failures has led to the use of insulator specifications which were based more or less upon arbitrary standards, and it is not surprising that the characteristics in the insulator which are the most important to its successful performance or life for the greater part are not covered by present-day specifications, no matter how rigid. As knowledge of operating conditions and their effect upon the insulator increases

*This subject was more completely discussed before the Toronto Section of the A. I. E. E.

investments. It is well to remember, however, that the reliability of the insulator has been increased to the point where only a momentary interruption, due to spill-over, need be expected, as the best insulators are practically puncture-proof.

Where the service is such that interruptions due to "kick-outs" on the line, although of momentary dura-

Another fact which tends to strengthen this view is that there are many instances where the operators on two systems which have been tied together blame each other for abnormal amounts of trouble which did not occur before combined operation.

For purpose of analysis, trouble has been divided into two classes, primary and secondary. The principal items under primary trouble are: short-circuits produced by lightning; ground wire coming in contact with power wire; mechanical short circuits or other disturbances set up by customers, and insulators that fail under normal line voltage or during a switching operation, or the charging of an arrester with too low a resistance or that following the failure of apparatus. Secondary trouble may include breakdowns of insulators or apparatus due to primary disturbances or switching surges due to cutting out or in the line following a primary disturbance or the failure of apparatus due to primary trouble.

While the operating log of many systems will furnish data as to the primary and secondary interruptions, no application has been made showing the rather startling effect produced by the primary and secondary hazard as the connected mileage increases, so this subject will be discussed next.

Primary failures or disturbances may be regarded as increasing directly as the connected mileage. Thus it follows that

$$a = mp \quad (1)$$

where a = number of primary disturbances or interruptions in a given time T ; m = miles of single circuit or number of insulators, and p = primary hazard or probable number of failures per mile of circuit in time T . The secondary disturbances depend upon other disturbances, and if the probability of one disturbance in producing another is equal to r , the total amount of trouble produced by an interruption or disturbance in terms of r can be found.

Secondary interruptions produce disturbances similar to the primary, so they in turn tend to produce other failures until the effect of the disturbance dies out. For the secondary hazard

$$q = (1r) + (1r)r + [(1r)r]r = r + r^2 + r^3, \text{ etc.} \quad (2)$$

If q equals the total secondary trouble produced by one case of primary trouble, it follows that the total secondary trouble U may be obtained by multiplying this

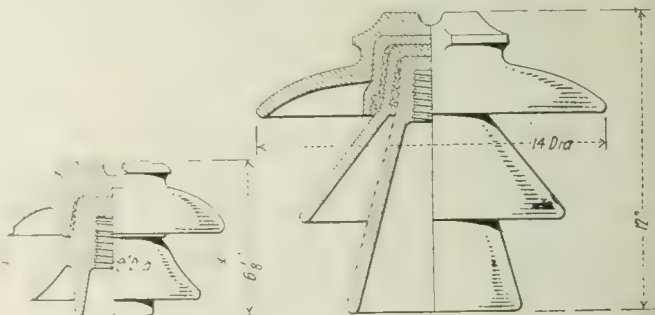


FIG. 3—TWO TYPES OF INSULATORS COMPARED IN TABLE II

quantity by the number of primary interruptions or disturbances for a given time T , hence $U = aq$.

The total line disturbances or interruptions W will be the sum of the primary and secondary disturbances, or $W = a + U = a + aq$. Substituting from (2) $W = a + a(r + r^2 + r^3 \dots) = a + ar + ar^2 + ar^3 \dots ar^{n-1}$. This, however, is a receding geometric series where r is less than 1, which it must be for practical

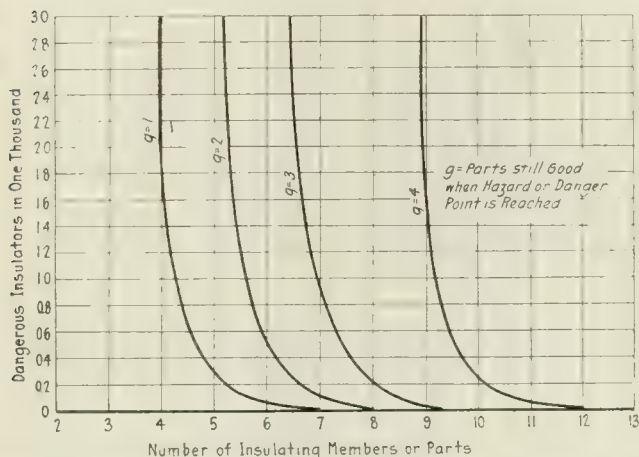


FIG. 2—OPERATING HAZARD WITH DIFFERENT NUMBERS OF PARTS IN INSULATORS DEFECTIVE

tion, cause considerable loss, it is well to bear in mind that even "kick-outs" from lightning can be practically eliminated by using a large insulator on a steel structure or by making the most of a wooden structure equipped with a properly designed insulator about half the size.

Where it is desired to remove even temporary "kick-outs" on the system, this can be accomplished to best advantage by providing one well-insulated circuit rather than parallel circuits of poorer insulation, which is fortunate, as the investment in the first is very much less. A slight increase† in the insulation of a single circuit will increase its reliability so that the insulator hazard may be a negligible quantity.

ANALYSIS OF FACTORS AFFECTING LINE

There are several ways of analyzing the different factors affecting the line, but these will be taken up as general factors affecting the reliability of the line and the insulator, and will be discussed under the following headings: (1) Size of system, (2) construction, (3) method of operation, (4) local conditions, and (5) electrical characteristics of apparatus or line.

By size of the system is meant the miles of system operating from one bus or so connected that a disturbance on one part is felt in the others. A system having small conductors and distributed generating capacity, such that a short-circuit affects only a small portion of the system, hardly comes under the following analysis.

It frequently happens that as a system grows serious trouble seems to start with the addition of a new circuit. Transient phenomena are usually blamed for the trouble, and while this class of disturbance may be a factor in the trouble, it seems that there is reason to believe that there must be other important factors. The fact that some systems operate successfully for a long time without any change in the network, only to have serious trouble which was eliminated upon opening a tie-in line, would indicate that there are other factors.

†Discussed in paper before the Canadian Society at Montreal and the American Institute of Electrical Engineers in December, 1914.

operation, otherwise there would be no stopping trouble once it started. The sum of the progression equals $W = a(r^n - 1)/(r - 1)$, or $a/(1 - r) - ar^n/(1 - r)$. Since r is less than 1, making n large reduces $ar^n/(1 - r)$ to a negligible quantity; hence, for practical purposes $W = a/(1 - r)$. (3)

As the effect of mileage on (a) in (3) is known, it is to be seen if it has any effect upon r before the equation can be used to advantage in studying the effect of connected mileage upon the reliability of the system. Since r represents the probability of one interruption or disturbance starting another, for the system as a whole, it follows that r will vary directly as the number of insulators or miles affected m and with the probability of secondary failure h per mile. Hence

$$r = mh, \quad (4)$$

or substituting values in (3) from (1) and (4) $W = mp/(1 - mh)$. (5)

This equation is of great practical value in determining whether it is advisable to increase or decrease the connected mileage m for the system, as the probable

added to the present, making the connected mileage 300 (482.8 km.).

From the foregoing $W = 10$, $a = 4$, $m = 200$, therefore according to equation (1) $p = 0.02$ and from (6) $h = 0.003$.

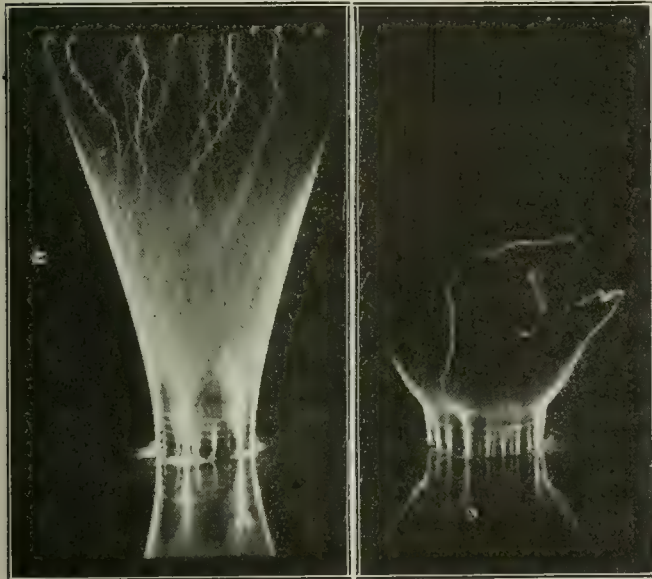
For the divided system $m = 100$, $p = 0.02$, and $h = 0.003$, thus substituting in (5) $W = 2.86$.

For the system operated as a unit with the 100 miles (160.9 km.) additional circuit added $m = 300$, $p = 0.02$, and $h = 0.003$, thus substituting in (5) $W = 60$.

The advantage gained in improved service by splitting up the system can be seen from Table I. The probable increase in interruptions from ten for 200 miles (321.9 km.) of circuit to sixty for 300 miles (482.8 km.) of connected circuit shows why some systems tend to strike an epidemic of trouble when they add more mileage by connecting additional circuits or by tying into another system.

TABLE I—ADVANTAGES FROM SPLITTING UP SYSTEM

	CONNECTED MILEAGE		
	100	200	300
Probable disturbances in given time T	2.86	10	60
Probable trouble compared to 200-mile system (per cent).....	28.6	100	600
Probable trouble compared to 100-mile system (per cent).....	100	350	2100



FIGS. 4 AND 5—SMALL AND LARGE INSULATOR SECTIONS BEING SUBJECTED TO SAME VOLTAGE

amount of line trouble for different lengths of line can usually be computed from data obtained from the usual records. The records on most systems will give the total number of disturbances W , the primary disturbances a and the connected mileage m . It then remains to apply these to equation (5).

From (1) $a = mp$, and since a and m are known, $p = a/m$. The only unknown quantity in the formula (5) is h ; solving for this quantity

$$h = (W - mp)/mW. \quad (6)$$

Since W , m and a or mp can be obtained from the records, h may be determined and formula (5) used to study the effect of changes in the connected mileage.

The following example will show how readily this equation may be applied. A system having 200 miles (321.9 km.) connected circuit has a total of ten interruptions or disturbances in a given time, four of which are primary. The 200 miles (321.9 km.) of circuit is composed of two 100-mile (160.9-km.) circuits operating from the same bus. The service is important and it is desired to determine the relative service where the present system is split into two 100-mile (160.9-km.) circuits and where a 100-mile (160.9-km.) circuit is

The effect of mileage on the above system is shown in Fig. 1 in the curve where $h = 0.003$.

That these values are not due to high or unreasonable values is readily seen, for $p = 0.02$, which means that there are only two primary disturbances for 100 miles (160.9 km.) of circuit, and this is very low for all except the best insulated or constructed systems. The value of $h = 0.003$ is also low for all except new highly insulated systems, for this is equivalent to $100 \times 0.003 = 0.3$ probable failures per disturbance on 100 miles (160.9 km.) of circuit. Where $h = 0.003$, an average of $1 \div 0.3 = 3\frac{1}{3}$ cases of trouble are necessary to cause another failure. There are many lines which start with much lower secondary hazard than this, but soon have a much higher hazard through insulator depreciation. This subject can best be discussed under operation.

The curves in Fig. 1 show the probable number of disturbances or interruptions for several values of secondary hazard (h) and for a primary hazard p of 0.02. The curves show that as the secondary hazard increases the connected mileage which it is practicable to operate becomes decidedly less.

The secondary hazard tends to increase with time, and it is well to bear in mind that a new system may start with no secondary hazard ($h = 0$) so far as the insulators are concerned. Later on, however, the secondary hazard may have increased to $h = 0.001$, in which case a 500-mile (804.7-km.) system would have twenty instead of ten interruptions or the mileage would have to be reduced to 330 to give the same service. If in time the secondary hazard should increase to 0.002 the curve $h = 0.002$ shows that the operation of the 500-mile (804.7-km.) system becomes hopeless. It is further evident, however, that splitting the system into two 250-mile (402.3-km.) sections establishes the same standard of service as at the start.

A consideration of equation $W = mp/(1 - mh)$ is

then a strong argument for keeping down the connected mileage. The inconvenience of splitting up the bus to operate different or parallel circuits independently where the primary hazard p is high or where the secondary hazard has increased will usually pay well for a lowered efficiency as to generating equipment.

If a better operating line is not deemed sufficient to warrant lowering the efficiency of generating apparatus, it must be borne in mind that splitting up the system greatly reduces the hazard to apparatus from short-circuits. Where the system is large the hazard to apparatus cannot be considered lightly, for it amounts to a considerable maintenance charge even on the best apparatus that can be produced. The smaller system will also permit of cheaper apparatus or lower investment on the line for the same standard of service. This reduction in investment will also be aided by a lower operating and maintenance expense, which should be given careful consideration in the laying out of a new system or where maintenance and service are important on an old one.

In Fig. 2 several curves are shown which give the operating hazard with various numbers of parts or sections in the insulator under assumed conditions as regards depreciation and minimum line voltage that will cause trouble. These curves show that there is a very marked decrease in the operating hazard or probability of trouble with a comparatively slight increase in the size of the insulator.

Where a steel structure is used the insulator has to withstand the entire stress, and it has been found that insulators which gave good service on wood structures gave no end of trouble when used for the same voltage on steel structures. This increased trouble was caused chiefly by punctured insulators or by shorts produced by birds. Improved designs and manufactures have made the elimination of the former possible, but the latter is still a matter that deserves very careful consideration, even though the insulators do not puncture.

TABLE II—COMPARISON OF ELECTRICAL PROPERTIES OF INSULATORS SHOWN IN FIG. 3

	TYPE	
	A	B
Test on part (kv.)	80	50, 40, 60
Total test on parts (kv.)	160	150
Assembled test (kv.)	125	120
Dry flashover (kv.)	135	185
Striking distance (in.)	8	14
Test per inch of striking distance (kv.)	20	10.7

An analysis of the modern insulator will show that the hazard due to puncture need not be considered even on a steel structure, at least for a long time.

The comparison of one of the modern insulators with those of a few years ago readily shows how this may be possible. In Fig. 3 are shown a 33-kv. insulator and a 65-kv. insulator of a few years ago. Table II compares their respective electrical properties.

That the small insulator is not deficient in insulation is shown in Fig. 4. The large part in Fig. 4 is much larger than the center in B, Fig. 3, while the small part in multiple is the center of A, Fig. 3. It will be noticed

that the larger part has a lower flashover than the smaller, showing conclusively that the latter is not deficient as to tested strength.

Since the large insulators of a few years ago gave fair service for some time when mounted on a steel structure, it will be seen that the modern insulator with a tested strength of nearly double the value for the protecting air path around the insulator can certainly be depended upon. The small insulator in Fig. 3 has a very low charging current; hence it may be used on a wood structure where the larger would cause digestion or burning.

Although the modern insulator may be made puncture-proof care must be exercised in its use, for there are a number of other troubles on the line which must be guarded against. If the small insulator is mounted on a steel structure or a grounded metal arm, a bird may come too near the tie wire and cause a short circuit. Lightning will also cause the insulator to flash over and produce a short circuit if mounted on the steel structure. On the other hand, if the insulator is mounted on a good wooden structure, the resistance to ground will prevent a power arc "picking up" when a bird comes near the insulator, and as the pole has a low flux-carrying capacity, it carries a considerable voltage during a surge and may prevent the insulator from flashing over.

The remainder of this article will be contained in a subsequent issue of the ELECTRICAL WORLD.

ELECTRIC SERVICE AT CAMP HANCOCK

Augusta-Aiken Railway & Electric Corporation
Furnishes Energy for the Large Cantonment in Georgia

BY N. NESBITT TEAGUE

Augusta-Aiken Railway & Electric Corporation, Augusta, Ga

The electric service for Camp Hancock, Augusta, Ga., is furnished by the Augusta-Aiken Railway & Electric Corporation. The primary service that Camp Hancock will give will be as a mobilization and training camp for the Pennsylvania National Guard. This camp is on a rolling terrain 400 ft. (121.9 m.) above sea level overlooking Augusta.

Part of the site was used by the same troops in 1898. The present camp covers 2000 acres (809.4 hectares). The government does not buy this property but leases it for two years for \$1 through local citizens, who subscribed a fund to buy the crops and property rights of the owners.

This camp is a tented camp and not a cantonment; nevertheless there will be when completed 887 buildings used as storehouses, mess shacks, etc. The construction of the wood buildings is such that the camp may be converted easily into a cantonment later if desired. The plans for occupancy of this site are made for at least a two-year stay.

The artillery range will be near Grovetown, Ga., about 15 miles (24 km.) from Augusta and 12 miles (19.3 km.) from the camp. It will cover 10,000 to 12,000 acres (4046.8 to 4856.2 hectares).

In addition to the camp there will be near this site a remount station and a base hospital. The remount station will be about 6 miles (9.7 km.) west of the

camp, and will require about 100 acres (40.5 hectares). Here 5000 to 10,000 horses will be trained. Two companies of infantry will be stationed here and several hundred men will be employed for the care of the horses. The base hospital will adjoin the camp and will cover 100 acres (40.5 hectares); fifty-eight build-



SUBSTATION IN COURSE OF CONSTRUCTION

ings will be erected and the construction will require 3,500,000 ft. (1,066,802 m.) of lumber, and as a construction job will be about one-third as large as the camp proper. The hospital when completed will have a capacity of 2000 patients according to present plans.

The camp is only a few hundred yards from the city water works. The city has laid a 16-in. (40.6-cm.) water main to the camp where it has been connected with several miles of newly laid water piping. For the additional requirements it has been necessary to install two additional pumps. These two 8-in. (20.3-cm.) Worthington pumps are electrically driven by two 75-hp., 2300-volt motors. The service is the same as that serving the other electric pumps at these water-works. Two separate two-phase, 2300-volt lines are available, thus insuring continuity of service.

Local men, T. O. Brown & Son, have the contract for the general construction on a cost plus percentage basis, under Major Spreckles, United States quartermaster. The electrical work within the camp is being done by a sub-contractor, the Whitney-McNeil Company, the local central station company having nothing to do with the construction of the overhead lines beyond the substation, which is on the boundary of the camp site.

Some idea of the electrical work may be had when it is understood that when finished there will be used 620 25-ft. to 35-ft. (7.6-m. to 10.7-m.) poles, which will carry in part of the 1,288,000 ft. (393,500 m.) of copper and copper-clad wire of sizes Nos. 14, 10, 8, 6, 4 and 2. Standard pole construction is being carried out with six-pin cross-arms.

It is understood that 17½ cents per hour is being paid to laborers on general camp construction and time and a half for overtime, overtime starting at the end of eight hours. Carpenters are being paid 45 cents per hour with time and a half for overtime. The men work at the camp for ten hours per day.

In the railway substation, built to meet the demands made by heavy travel to the camp, the equipment con-

sists of two six-phase, 60-cycle rotaries, six 110-kva., 13,200/430-volt air-cooled transformers, two alternating-current and two direct-current control panels (all General Electric Company), and starting resistances, blower, reactances and equipment. This building was erected in three days, and the foundations and appurtenances were ready for the machines, which were running forty-eight hours after arrival at the station.

The outdoor substation is served by the same 13,200-volt distribution line and transforms energy from three-two-phase, 13,200/2300 volts, for use at the waterworks. As a duplicate line, to insure continuity of service—for 60,000 people in the city and 30,000 at the camp depend on this system for water—there is installed on the left-hand pole a separate two-phase, 2300-volt distribution line with the necessary double-throw switches so that if either of the two lines are cut off for any reason the operator at the waterworks may, by pulling the rope mechanism at the left-hand pole, throw the double-throw, pole-type oil switches and be ready to continue pumping without delay.

The transformers are mounted on two old rails on the ground, and are fused by means of the three G. E. type D17 switches and expulsion fuses. The indoor and outdoor stations are both using Johnson line clamps as "disconnects," so that either may be cut off.

The army camp is situated about 1000 ft. (304.8 m.) from the railway substation, and this required a very short 13,200-volt, three-phase, 60-cycle line. The central station furnished poles and wires up to this substation. All work on the substation past the high-voltage side was done by the contractors for the camp.

As shown herewith, a steel-frame outdoor substation was used designed by the engineers of the central station. In the house near the outdoor substation is a three-panel, 2300-volt, three-phase distribution board. The three transformers are each rated at 200 kva., 60-cycle, three-phase, 13,200/2300 volts.

At this station, operated by enlisted men of the quar-



RAILWAY AND CAMP SUBSTATION

termaster's corps, operators are stationed continually. On the electric construction there were employed from 400 to 500 men. Good material was used and the whole work represents a permanent construction. There will be about 14,000 40-watt lamps in tents and buildings and 125 100-cp., 6.6-amp. street lamps.

ing the amount is started on the day when the barge or car arrived at the dock or siding, while the horizontal line after each new delivery thus represents the time elapsed or periods between deliveries. The heavy part of the horizontal line represents the length of time during which the demurrage charges were accumulating.

The analysis of coal for each delivery may be shown as complete as desired, being indicated horizontally opposite each delivery. In the case illustrated only the heating value, ash and volatile percentage are shown. In the upper part of the chart is a reference curve showing the evaporation per pound of coal. Any other relation, such as boiler efficiency or pounds of coal per kilowatt-hour, which may be of use can also be placed here.

To facilitate using these charts they can be plotted daily on cross-section tracing cloth, and blueprints can be sent from time to time (generally weekly) to the managers and purchasing agent.

INTERLOCK FOR SWITCHES TO PREVENT SHORT CIRCUITS

Consists of a Hard-Wood Rod Extending Up One Side of the Switch Panel and Carrying Seven U-Shaped Lugs That Engage with Switches

The switch-interlocking device illustrated herewith and used in the Colorado School of Mines might be employed in connection with other switching arrangements where it is desired to prevent short circuit. On the system in which it is now being used several different lighting circuits had to be energized and any one of seven sources of energy should be employed, but the loads on these separate sources, owing to the use of electricity for laboratory testing purposes, varied so that provision had to be made for serving any one of the several circuits from any one of the sources of energy.

The old arc-board bus arrangement was adopted, the sources of energy being connected with horizontal buses running back of the switch lips, while the lighting circuits were connected with vertical buses running back of the switch hinges. The interlocking device consists of a hard-wood rod extending up one side of the switch panel and carrying U-shaped lugs, one for each switch position. Some of these lugs are shown in the half-tone at A and B.

From the arrangement shown it can be seen that if an attempt is made to close switch *S* when *T* is closed,

lug *A* will intervene, thus preventing paralleling two sources of energy which may have different characteristics. The only way in which the switch can be closed is to throw back the handle *H* far enough to allow the switch to enter the U-notch in the lug. This can only be done by simultaneously opening the switches *S* and *T* or any other switch in that line which may be closed at the same time.

The original plan called for a steel rod or an iron pipe covered by an insulating tube, but the design was not approved by the Underwriters, so the hard-wood rod was substituted. It has proved to be very satisfactory, although not so strong as it should be. The spring holds the rod in the normal position, shown in the illustration, except when it is thrown back by the handle *H*.

The effectiveness of this interlocking arrangement is indicated by the fact that not a single instance of trouble has occurred in the six years that the board has been in use, notwithstanding the changing personnel of the operating force.

This scheme was devised by William J. Hazard, Colorado School of Mines, Golden, Col.

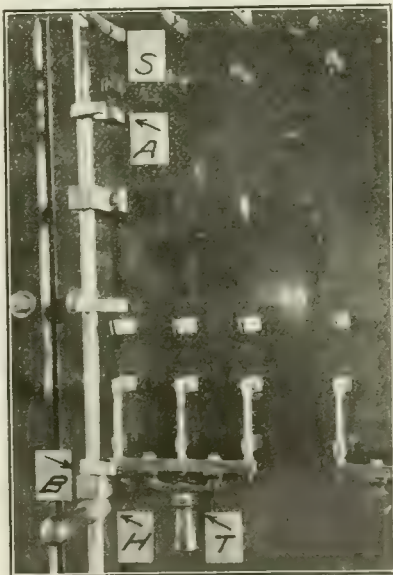
SAVING COAL BY MAKING USE OF CONDENSING WATER

Economic Gain by Using Same Water for Circulating Water in Condenser and for Make-Up to Feed-Water Heaters

An unusual but simple combination of feed-water and condensing-water equipment is employed in the plant of the Bloomington & Normal (Ill.) Railway & Light Company. The station carries a heavy steam-heating load in addition to its electric load and for this reason is mainly operated non-condensing. Most of the units are reciprocating engines. There is, however, one 600-kw. turbine which operates condensing since the engines use enough steam to supply the heating system at practically all times.

On account of the steam-heating system's requirements the plant needs considerable boiler-feed water. This is secured from a deep well by means of a 70-hp. motor-driven pump delivering about 600 gal. (2271 l.) per minute. The water from this well is received at 52 deg. Fahr. (11.1 deg. C.) the year round. As it comes from the well it goes to the condenser under the 600-kw. turbine as circulating water. It comes from the condenser at about 100 deg. Fahr. (37.8 deg. C.) and is then delivered to a 30,000-gal. (113,560-l.) temporary storage tank by a steam-driven pump. From this tank it flows by gravity to two 2500-hp. open-type feed-water heaters and is delivered to the boilers.

Since the water would have to be pumped for feed water in any event, the plan of using it as circulating water to give greater efficiency to the turbine and permitting it to pick up some heat on its way to the feed-water heaters effects an appreciable economic gain. D. G. Wallace, operating engineer for the Bloomington company, stated that the gain amounted to 1 lb. (0.435 kg.) of coal per kilowatt-hour generated by the 600-kw. turbine. This would amount to a saving of over 3.5 tons (3.17 t.) of coal a day with the turbine running at 50 per cent load factor.



INTERLOCKING DEVICE FOR SWITCHES

CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

ECONOMIES IN MONTHLY BILLS AND RECEIPTS

**Opportunity Not Only to Effect Savings but Also
to Lessen the Burden on the Already
Swamped Post Office**

The necessity of practicing economies, even the penny-saving kind, is daily becoming more apparent to the electric lighting utilities of the country. Every expenditure is now being carefully watched to see if it might not be made smaller or abandoned, at least under these abnormal conditions. The savings thus effected benefit the public through steadier rates.

Expenses have risen in every department and have as a result reduced the net earnings of many properties even where the gross showed a substantial increase over the previous year. One of the latest increases to take place is that in post card and letter postage. This does not affect the monthly billing expense of a large number of properties because they operate almost entirely within the local post office zone. All properties, however, serving more than one locality, where these outside communities do not come within the local post office delivery, will feel this increase.

Already steps are being taken to minimize the expense of delivery of monthly bills. Not only does the question of postage enter but also that of stationery, which has increased considerably in price. A number of central stations have begun to deliver bills without envelopes by boys or girls, one company using the local boy scouts. Another practice that has been suggested is that companies serving many localities mail their bills, if they do not wish to discontinue mailing, in the locality in which the customer resides.

In some places meter readers are now employed as collectors, collecting the bills as the meters are read. In one place the meter readers make their readings one week and the following week they deliver the bills and make collections.

In the matter of receipted bills practically the same opportunity for savings obtains. Many properties have discontinued returning receipts unless requested, and many others no longer send receipts where bills have been paid by check. Here there is a visible labor saving in addition. The clerical service involved is alone greater than is generally realized. There is a further element involved, namely, the salutary effect on the post office. Under the operation of the selective draft a number of post office employees have been called for military service and more are waiting their call. Furthermore, the volume of mail has been increasing. Consequently any action that will lighten the excessive burden under which the postal officials are now staggering will mean just so much better service in the prompt delivery of the other mail.

In this connection is mentioned a movement among industrial concerns which is equally applicable to util-

ities—that to discontinue during the war the practice of sending to customers greetings at Christmas and New Year's. The savings that will be effected and the benefit to the post office are apparent.

One thing is certain—taxes will be heavier next year than ever, and in order that the utilities may pay their share, including both federal and local, and keep their heads above water, they must practice almost every apparent economy. Under existing conditions of higher costs the utilities are faced with the necessity of providing for these higher taxes, and savings here and there, both large and small, must contribute. Economies trifling in themselves will be found in the aggregate abundantly worth while, for here as elsewhere "every little helps."

ELECTROMAGNETIC HOIST SAVES TIME AND LABOR

**By Its Use Hydrant Factory at Holyoke, Mass.,
Cuts Unloading Cost for Iron Pipe from
\$1.50 to 20 Cents per Ton**

By the use of the electromagnetic hoist illustrated in Fig. 1 the Holyoke (Mass.) Valve & Hydrant Company has reduced the time of unloading pipe from the

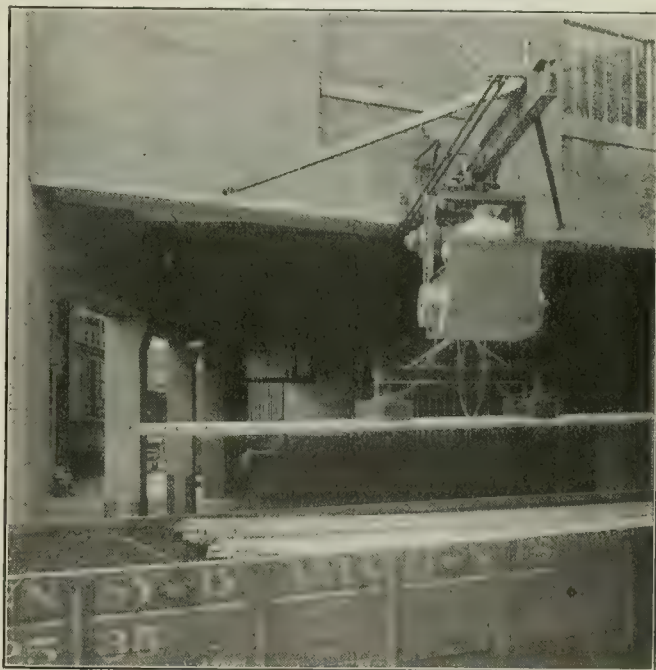


FIG. 1—ELECTROMAGNETIC HOIST AT PLANT OF HOLYOKE
VALVE & HYDRANT COMPANY

car from a former time of six to seven hours to three hours, including placing the pipe in the storage racks shown in Fig. 2. The hoist has a rating of 1 ton (0.9 t.), a lift of 22 ft. (6.7 m.), and runs on a monorail structure extending through the plant. Its horizontal

speed is 350 ft. (106 m.) per minute, and the hoisting speed is 40 ft. (12 m.) per minute. From the railroad side track to the nearest bin a run of about 80 ft. (24 m.) is required, and the average travel to the bins is 125 ft. (38 m.). The monorail extends through the

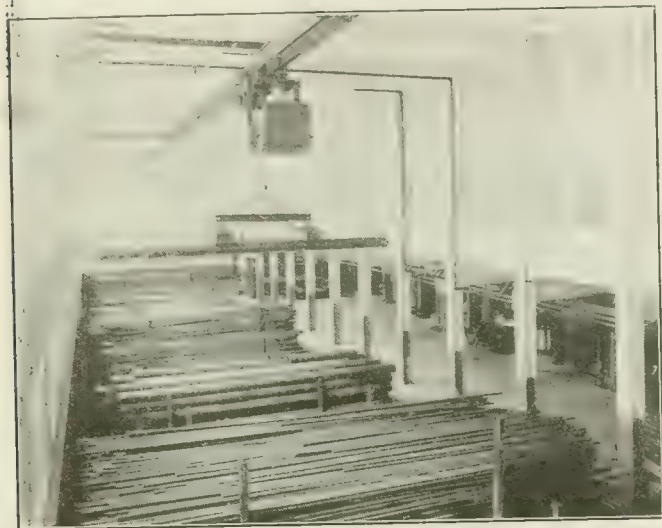


FIG. 2—ELECTROMAGNETIC HOIST READY FOR LOADING TRUCKS FROM STOREHOUSE

plant to a shipping platform (Fig. 3), at which deliveries can be made as required directly to the waiting motor trucks.

The hoist, which was built by the Shepard Electric Train & Hoist Company of Montour Falls, N. Y., is equipped with two 4-hp., 220-volt Sprague direct-current motors, energy being supplied from the local alternating-current power circuits through a 7-kw. General Electric motor-generator set receiving energy at 550 volts. The electromagnets, which are attached to a pair of channel irons bolted back to back as shown,



FIG. 3—ELECTROMAGNETIC HOIST LOADING AUTO-TRUCK AT SHIPPING PLATFORM

weigh 500 lb. (226.7 kg.) each and were built by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. These are operated in parallel and are 14 in by 20 in. (35.5 cm. by 50.8 cm.) in face, taking 1.9 amp. each at 220 volts. The connecting bar is about 5 ft.

(1.5 m.) long and weighs 99 lb. (50 kg.), so that the combined dead weight of the bar and magnets without load is about 1100 lb. (498 kg.). When the hoist is not in service the bracket shown on the outside of the building in Fig. 1, from which the traveler depends, is lifted on hinges out of the way of passing trains on the side track.

The electromagnetic hoist is used about two hours a day. Purchased at a 1916 price of \$2,500, it has saved the labor of two men and cut the cost of unloading from car to shed from \$1.50 to 20 cents per ton. From 8 tons to 10 tons (7.2 t. to 9 t.) per hour can be loaded into trucks from the storehouse. This storehouse, with the hoist in position for work, is shown in Fig. 2.

ROUTINE NECESSARY FOR GRANTING SERVICE

Simple and Easily Understood Forms for Contracts,
Deposits and Guarantees and Their Method
of Application

BY H. W. DERR

Contract Agent the Pittsfield (Mass.) Electric Company

In dealing with the public the idea should be borne in mind to make it as easy as possible for all to do business with the utility. As the first business transac-

PITTSFIELD ELECTRIC CO.	Pittsfield, Mass.,	191
	For Value Received of the PITTSFIELD ELECTRIC CO;	
	do hereby guarantee to said Company the payment of all bills which the said Company may	
	have against	for Electric Current consumed by said
	at No. _____	
Street, in said Pittsfield.		

FIG. 1—FORM OF GUARANTEE THAT HAS BEEN FOUND A BETTER SAFEGUARD THAN ASKING A DEPOSIT

tion between the customer and the lighting company is his signature on the application for electric service, the application, naturally, should be made as simple and easy to understand as possible, so that any one entirely unfamiliar with the numerous electrical terms can understand it.

The application shown on the opposite page (Fig. 2) is a simple one that the writer uses and it seems to answer all legal requirements. Only three times has it been necessary to test the legality of this form. In two of these cases the company was successful, and in the third the delinquent failed before suit could be instituted. All of which goes to show that the real value of the application is to get the correct name and address of the subscriber, and the simpler this form can be made the fewer questions will arise as to the legal value of this document.

The application for service when received is given to a clerk whose duty it is to see that a card is filled out properly, from which a record is made and sent to the meter department for the installation of the meter and a record given to the accounting department. This card is then filed alphabetically, so that it can be referred to in case of a change of address or other question, and a geographical index is then compiled from these records.

When it is difficult for a customer to get in touch with the company officials service is installed and the details are arranged later. The good will and favorable publicity obtained by being anxious to serve greatly

Name

No. A

Address

Formerly occupied by

_____ hereby make application to the PITTSFIELD ELECTRIC COMPANY for electric service at premises of above address, occupied by _____ as a _____ and agree to pay for same promptly at regular rates and according to rules of said Company, and also to be responsible for all regular charges for the service until forty-eight hours after notice has been duly given at office of Company to discontinue service.

It is further agreed that duly authorized agents of said Company shall have free access to the service main, meter and connections at all reasonable hours for testing and repairing, and may also upon _____ failure to comply with any of the rules of the Company, discontinue the service and remove the meter

Signed

By _____

CUSTOMER'S RECORD FOR NEW BUSINESS DEPT.

ACCOUNT ENTERED DATE

BY

DEPOSIT No. \$

CREDIT RATING

Card to go to Bookkeeper and Filed.

Job Ticket to Install Read

Amp. Meter Made Out by

Date

FIG. 2—FRONT AND BACK OF APPLICATION FORM

offset the small loss which accrues from bad accounts in this connection.

In a great many cases the commercial department and the meter department work to each other's advantage. When a request for service is made by telephone and an application is necessary, the meter department can in a great many cases secure the application and deposit at a great deal less expense than the commercial department, thus doing away with the necessity of two trips for the sake of a technicality.

Should a customer refuse to sign the regular form of application containing the rules and conditions of the company, it is a rule that service should immediately be discontinued, because a public service corporation cannot afford to make special cases with any individual or group. If a rule is right, the customer will quickly see it; if it is wrong, it must be changed sooner or later.

As it is necessary to maintain a department to handle meters, all work in connection with meters is left to this department; that is, it is held responsible for all readings from incoming and outgoing customers.

The Pittsfield company finds it advisable to ask every new customer to make before installation a small de-

posit, equal to one month's bill, because of the large number of the so-called shifting population. The deposit receipt, like the application, has been made as simple as possible so as to avoid confusion. It has been the writer's practice to make this out in triplicate, the original copy going to the customer, one copy to the accounting department, and the third copy being kept by the salesman for reference. Fig. 3 shows a copy of the deposit receipt, which has been found to be most successful.

As long as the payment of a deposit is required, no credit investigation is made, provided, of course, that the customer continues paying his bills promptly. As the deposit asked for is in most cases so small, it is kept by the company as long as the customer continues to take service.

The service is discontinued immediately in the event of the customer vacating the premises, thereby giving the meter department a correct and accurate list of all meters in service and the accounting department a correct and accurate list of customers. These methods have been found to be advisable because they enable the company to clean up the ragged ends which cause so much detail and annoyance.

Should a customer wish to take out new service when he already has an outstanding bill he is asked to pay up this outstanding bill before new service is granted. The legal ruling, however, is that if a customer wishes to pay in advance for any new service, a public service corporation will not be permitted to refuse to give him this service.

When a customer leaves town with his electric light bill in arrears and his address is known to the company, this information is forwarded to the electric light company from which he would take service. When a customer discontinues his service his deposit is returned to him upon presentation of the deposit receipt. In the event of a customer losing his deposit receipt he is required to sign an affidavit stating that this receipt has been lost and relinquishing all claim to it. Stress also is given to the necessity of keeping these receipts and returning them at the closing of the account.

In a great many cases it has been found advisable to have some responsible party guarantee an account.

PITTSFIELD ELECTRIC COMPANY

No. 291 A

OFFICE OF THE
PITTSFIELD ELECTRIC CO.

191

Received from

No. Street

Dollars, as security for the payment of debts which may be contracted with this Company, which amount is to be refunded in final settlement, the bills meanwhile to be paid regularly, as rendered. This receipt is not transferable, and should be returned to this office upon ceasing to use electric current, on removal, or when another party takes the place. Four per cent. on the above amount paid annually.

PITTSFIELD ELECTRIC CO.

\$ By

FIG. 3—DEPOSIT RECEIPT ISSUED TO CUSTOMER

These guarantees are entirely acceptable, and it has been found that they have a greater tendency to lead to satisfactory accounts than any deposit which could be obtained. Fig. 1 is a copy of the company's form of guarantee.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

PREVENTING ELECTROLYSIS OF IRON IN CONCRETE

Investigation Indicates that Anode Corrosion May Be Materially Decreased by Coating Metal with a Porous Film of Paint

BY W. A. DEL MAR AND D. C. WOODBURY

IF AN iron bar be set in a block of concrete in the presence of an electrolyte and made one of the electrodes of an electrolysis test unit, some interesting phenomena will be revealed by observing the apparent electrical resistance* of the unit. When the iron bar is made the anode the original resistance is usually low, but rises and reaches in the course of a few months at least fifty times the original value, as shown in Fig. 1. When the iron bar is the cathode or is subjected to an alternating current, so that little or no corrosion occurs, the electrical resistance remains small and practically constant.

The question naturally arises: Where is this high resistance located and what causes it? Various theories have been advanced, which are briefly summarized as follows:

- (1) Location—surface of cathode. Cause—polarization.
- (2) Location—free electrolyte outside the concrete

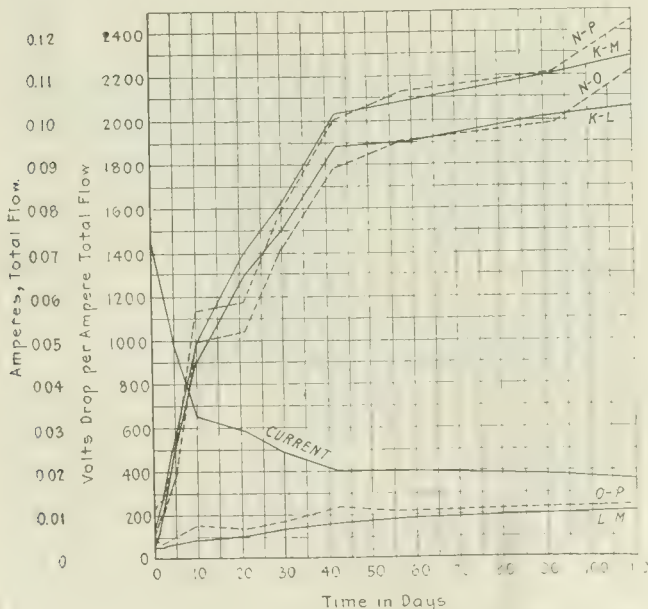


FIG. 1—RESULTS OF TESTS MADE WITH SET-UP SHOWN IN FIG. 2

block. Cause—exhaustion of conducting ions in the water.

- (3) Location—surface of concrete block. Cause—Clogging of pores of concrete by chalk.

*Throughout this article the word "resistance" will be used to designate the volt ÷ ampere ratio, regardless of whether it is true resistance or back electromotive force.

- (4) Location—restrained electrolyte in the concrete block. Cause—exhaustion of ions, or drying by endosmose.

- (5) Location—concrete. Cause—chemical deterioration of the concrete.

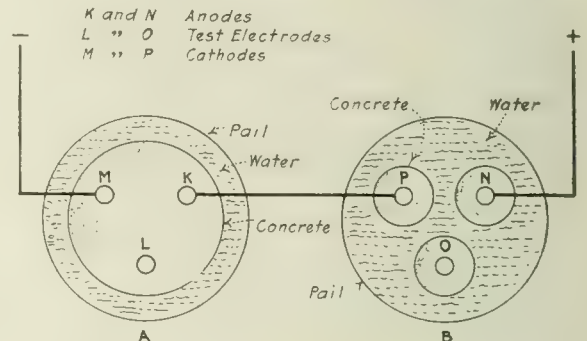


FIG. 2—ARRANGEMENT OF ELECTRODES FOR MAKING ELECTROLYSIS TESTS

- (6) Location—surface of anode. Cause—film of non-conducting rust.

To determine which of these theories, if any, is correct the following tests were made by the authors: Two electrolysis units were prepared, one consisting of three iron bars set in a single block of concrete supported on porcelain insulators in a tin pail containing water, and the other consisting of three iron bars, each set in a separate block, each block being supported on porcelain insulators in a tin pail of water, as shown diagrammatically in Fig. 2. New York City (Croton) water was used. The electrodes were spaced the same in both units, so that the only difference between the units was in the method of surrounding the electrodes with concrete. Voltage was applied almost continuously for 120 days and periodic current and voltage readings were taken.

The location of the high resistance was determined by a process of elimination which is described below, the paragraph numbers referring to the theories advanced above. (1) It could not have been at the surface of the cathode, because the cathode resistances O-P and L-M (Fig. 2) were small and practically constant. (2) It could not have been in the free electrolyte outside the concrete block, because the rise of resistance occurred in both test units and there was no free electrolyte in the circuit of unit A. (3) It could not have been at the surface of the block, because the circuit in test unit A did not cross the surface of the concrete. (4) It could not have been the restrained electrolyte in the concrete block, because if so the cathode resistances L-M and O-P would have been substantially the same as the resistances K-M, K-L, N-P and N-O, which was not the case. (5) It could not have been the concrete block

itself for the same reasons. (6) The resistance, therefore, must have been located at or near the surface of the anode.

The primary cause of the rise of resistance was the corrosion of the iron, as proved by the following observations: Block *KLM* cracked at *K* five days after voltage was first applied, and block *N* on the eighth day, both *K* and *H* being anodes. When the units were broken at the conclusion of the test both iron bars were found to be greatly corroded. Cathodes *P* and *M* were clean and bright. The concrete around *P* was in perfect condition, but that around *M* was slightly softened. Test electrodes *L* and *O* were only slightly rusted and the concrete was in good condition. There was no trace of chalk in the body of the concrete block *N* and only a small amount at the surface and in the crack.

During the course of the test the current was stopped for a short time and resistance measurements were made immediately upon its restoration. It was found that the apparent resistance had fallen considerably and required time to regain its former value. If the increased resistance were due to the film of rust, which remained intact during the short stoppage of current, why should the resistance have fallen? The answer is to be found in the phenomenon known as endosmose or electric osmosis, which is briefly described as follows:

An electric current flowing through a porous partition filled with conducting liquid causes a flow of the liquid through the partition. The direction of flow of the liquid is the same as that of the current, *i.e.*, from the anode to the cathode in an electrolytic cell. The iron rust in the test units under consideration acts as a porous partition, and while current is flowing moisture is driven from the iron-bar anode, keeping the rust film dry. Upon stoppage of the current moisture enters into the rust, lowering its resistance. Upon reapplication of the current the moisture is gradually expelled from the rust and the resistance rises until the rust is dry, when a steady condition is again attained.

This action was demonstrated visually by filling the bend of a glass U-tube with iron rust and shifting a column of water in one branch of the tube to the other and back again by passing current between electrodes, first in one direction and then in the other. A current of 0.05 amp. moved about 1 cu. cm. of water in four hours through 10 cm. of rust in a tube 7 mm. inside diameter. Upon reversal of the current the water was shifted back to the other branch of the U-tube. The rust near the anode became absolutely dry and the moisture was gradually driven out of all the rust except that near the cathode surface.

Tests with painted iron bars showed that when a current was passed through it a film of paint underwent a change in resistance like a film of rust. That this was due to endosmose was proved by making a painted iron bar the cathode in a water bath and observing the formation of water bubbles under the paint film. Such bubbles were not formed when the painted bar was made the anode. This proved that water could be forced through the paint by endosmose.

(a) An iron anode, in water or any moist medium, accumulates a film of rust which acts as a porous cell and becomes dry by endosmose, thereby removing the electrolyte and reducing the current, the net effect being to protect the iron from further rapid electrolytic corrosion.

(b) Corrosion does not take place according to Faraday's law, because a large part of the energy of the current is used in the osmotic transportation of water through the rust, thereby lowering the so-called efficiency of corrosion.

(c) Anode corrosion may be decreased by coating the iron with a porous film of paint which is kept dry by endosmose. Hence protective paints should be highly insulating, as endosmose cannot take place through conducting partitions.

The authors wish to acknowledge the co-operation of A. E. Ellis and C. B. Martin in making this research.

Lamps and Lighting

Code of Lighting.—Continuation of an article discussing the illumination of factories, mills and other workplaces. Among the subjects discussed are using the shop forces, distribution of expense and yearly appropriations, reflectors and their effort on efficiency, avoiding dark spots, comparison of glass and metal reflectors; reflector maintenance; two ways to secure side lights, advantage of mounting lamps high, maintenance of lamps and wiring, and a method of inspection and maintenance.—*Proceedings of Engineers' Club of Philadelphia*, September, 1917.

Generation, Transmission and Distribution

Overhead-Line Specifications for Crossings.—The specifications which were adopted Feb. 27, 1917, and which went into effect in June, 1917, apply to the overhead conductors of any utility in Pennsylvania crossing over the right-of-way of any other utility, be it a communication, transmission or transportation company. The specifications were prepared at the request of the Public Service Commission of Pennsylvania under the direction of its chief engineer by a joint committee representing the different classes of utilities concerned. They are as far as possible complete for all types of conductors and cover definitely the general requirements at the points of crossings without stating the type of construction in such specific detail as to limit it to any particular method. The specifications are divided into nine sections. Section 1 covers definitions and sets forth classifications. Section 2 covers the construction of power lines up to 5000 volts crossing communication circuits and power lines up to 7500 volts when crossing power lines of other utilities. Section 3 covers the construction of power lines of more than 5000 volts crossing over communication lines and of power lines of more than 7500 volts when crossing over power lines of other utilities. Section 4 covers the construction where one line is built parallel to an existing line but on separate support and is so placed in reference to it that one line will be wholly or in part over the other. Section 5 covers construction and communication lines where crossing over railroads, and is based on the specifications for wire crossings adopted by the Association of Railway Telegraph Superintendents. Section 6 covers the construction lines of all voltages where crossing over railroads. Section 7 covers the construction of overhead lines crossing under railroad bridges. Section 8 covers underground construction at points of crossing with railroads. The appendices include tables for use in connection with sections 2 and 5; specifications for wooden poles; sag curves for use in connection

with sections 3 and 6; suggested methods of conductor attachment for use in connection with sections 3, 6 and 7; methods of calculating strength of double cross-arms for use in sections 3 and 6; allowable working unit stresses for use with sections 3 and 6; short-span construction; methods of tying conductors to insulators for use in section 5; suggested methods of under-bridge attachments for use with section 7; calculations of a typical crossing of power line over railroad; wooden-pole construction in which crossing poles cannot be side guyed, and miscellaneous tables covering minimum clearances, minimum separation of conductors, wind and ice loads, and permissible loading for chestnut, Western cedar and Western white-cedar poles.—*General Order No. 13*, Pennsylvania Public Service Commission.

A Comparative Study of Dams in Hydroelectric Construction.—E. MAYNARD and P. LÉVY-SALVADOR.—The authors, recognizing the difficulty and expense involved in erecting the great dams necessary in hydroelectric installations in mountainous country, have investigated in an exhaustive manner the comparative advantages of stone, reinforced concrete, metallic and mixed dams. Their conclusion is that it is not possible to select a material that will always be the best. A separate comparison must be made for each case to determine the most desirable plan to adopt.—*Revue Gén. de l'Elec.*, Sept. 15, 22 and 29, 1917.

Wires, Wiring and Conduits

Electric Code.—Rules adopted by the Industrial Board, Pennsylvania Department of Labor and Industry, covering methods for installing protective grounding of circuit equipment and lightning arresters for stations, lines and utilization equipment. These rules became effective July 1, 1917.—*Journal of Engineers' Club* (Philadelphia), October, 1917.

Units, Measurements and Instruments

True Temperature Scale of Tungsten and Its Emissive Powers at Incandescent Temperatures.—A. G. WORTHING.—This paper describes a method of determining the emissive power of a substance at incandescent temperatures and also a method for determin-

TABLE I—PREVIOUS DATA CORRECTED TO NEW TEMPERATURE SCALE

T in deg. K.	Watts Cm. X Deg.	$10^{-8} \times \frac{k}{\lambda T}$ in C.G.S. Units	Microvolts Degree	Watts Cm. ²	$\frac{dT}{dE}$
1500	1.01	2.80	.....	5.7	5.21
1700	1.07	3.06	.....	10.8	5.06
1900	1.12	3.29	-20	18.8	4.93
2100	1.17	3.50	-24	30.6	4.81
2300	1.21	3.69	-28	47.2	4.70
2500	1.25	3.87	.....	69.7	4.60
2700	1.29	4.02	.....	98.9	4.50

ing the wave lengths to which brightness, temperature and emissive power measurements made with the aid of colored glass pyrometer screens are to be ascribed. The emissive power of tungsten at 0.467μ and 0.665μ as a function of the temperature has been determined for temperatures up to 3200 deg. K. In the latter also

is given the relation between the true temperatures and the brightness temperature at 0.665μ for tungsten. From the consideration of these and other data, 3675 deg. K. has been selected as the most probable value of the melting point of tungsten. Previous data on the thermal conductivity and on the Thompson effect have been recomputed on the basis of a new temperature scale and the radiation intensity has been determined

TABLE II—TEMPERATURE RELATIONS FOR TUNGSTEN ON BASIS OF $C_2 = 14,350\mu \times \text{DEG.}$ AND $\text{Tau} = 1336 \text{ DEG. K.}$

S at $\lambda = 0.665\mu$	ϵ at $\lambda = 0.665\mu$	$T - S$	$\frac{\Delta T \text{ in Case } \Delta \epsilon}{\epsilon} = +0.01$
1200	0.457	56	-0.7
1400	0.451	76	1.0
1600	0.446	102	1.3
1800	0.440	132	1.7
2000	0.434	168	2.2
2200	0.428	208	2.7
2400	0.422	254	3.3
2600	0.416	306	3.9
2800	0.410	366	4.6
3000	0.403	433	5.4
3176*	0.398	498	6.2

*Melting point.

as the function of the temperature.—*Physical Review*, October, 1917.

Telegraphy, Telephony and Signals

Coupling Coefficient of Two Coaxial Flat Spiral Coils.—P. BAILLIE.—Formulas are developed for calculating the coupling coefficient of two coaxial flat spiral coils such as are being used extensively to form the tuning and coupling inductances in wireless apparatus. Curves are given from which the constants and the mutual induction coefficient of two circles in the formula may be obtained graphically.—*London Electrician*, Sept. 21, 1917.

Miscellaneous

Temperature Variation of the Electrical Conductivity of Mica.—H. H. POOLE.—A description of experiments made to determine the variation of electrical conductivity of mica with temperature. Results of the test confirmed the formula $C = aXe^{b\sigma}$, in which C is the current density, X the potential gradient and a and b are constant. For one sample tested the constant a was approximately proportional to the sixteenth power of the absolute temperature over a temperature range of 0 deg. C. to 47 deg. C. and b was independent of the temperature. For another example a was proportional to the 15.47th power of the absolute temperature from 50 deg. C. to 229 deg. C. and b was independent of the temperature. Although the values of a were widely different in the two cases, the values of b were almost identical. The fact that b is independent of the temperature does not agree well with the suggestion that the exponential term is due to a distribution of electronic energy in accordance with Maxwell's law. It also appears from the observation that the electric constant does not vary much up to 230 deg. C.—*London Philos. Magazine and Journal of Science*, September, 1917.

Water Power and the National Emergency

To the Editor of ELECTRICAL WORLD:

Sir: Your editorial entitled "The Penalty of Sloth," published Sept. 29 last, not only admirably states the case but constitutes a sharp commentary on the legislative dilatoriness sometimes found in our country, so many of whose citizens have made it great in industrial enterprise largely because the nation's inventive genius has been encouraged and has developed to an unequalled degree. This requires a vision unfortunately too often lacking where it is needed—one of the results perhaps of our proneness to delegate our law-making to the legal fraternity, for is it not a fact that the mental processes of a profession trained to rely on precedent must fail in the imagination that dreams of exploitation of new fields?

Again referring to your review of the situation, does not its logic carry the conviction that Congress could properly at this time push to completion, as war emergency measures, the legislative plans affecting water-power development so long in the making? There is seen to be no inconsistency in such a course when we reflect on its possibilities, a few of which should be driven home by reiteration.

Approximately 10,000,000 water horsepower has been projected in an engineering way, and this awaits only federal legislation to materialize soon, if the circumstances repeatedly described by high authority are correctly comprehended. What does this mean? It means the saving of 8,000,000 tons of coal (the equivalent of 240,000,000 barrels of oil) per annum and the transfer to other fields of imperative war demands of 168,000 railway cars, 6000 locomotives and 738,000 men—in round numbers, based on conservative estimates prepared by competent engineers of unquestioned standing.

Furthermore, we are distinctly derelict in failing to follow the example set by our sister republic—France—which, under conditions infinitely more restrictive than any which have yet afflicted us on account of this war, suffering for three years past from the most frightful invasion of history and called upon to oppose the brutal assaults of an extraordinarily powerful enemy with every able-bodied male citizen, either at the front or in war-supply factories, deems the development to-day of its waterpower a matter of prime importance. Very recently the appointment of an Under Secretary of State to push the development of French waterpower was strongly advocated, and otherwise there is evidence of an acute interest in this enterprise truly edifying. France in this way seeks to serve an end the importance of which is brought home to us by the present trying circumstances of our daily life, imposed on us by the exigencies of our high democratic aim.

Under normal conditions conservation of exhaustible fuel by inexhaustible means and a constructive utilization of the human effort thus released in other

Readers' Views and Comments

important enterprises would be creditable to our national intelligence and highly advantageous to our national welfare. The present frightfully abnormal conditions, which have disorganized every phase of our national endeavor, should show clearly wherein we have failed to make full and wise use of our unbounded natural resources, the neglect of which constitutes an inexcusable and wanton extravagance easily prevented if conditions were as they would be under a far-sighted and patriotically wise governmental regulation.

W. W. NICHOLS,
Chairman American Industrial Commission to France.
New York.

The Use of Kirchhoff's Laws

To the Editor of ELECTRICAL WORLD:

Sir: To separate from all the equations furnished by Kirchhoff's laws those that are independent is a problem which has probably confronted every one who has had occasion to solve a complicated circuit. The purpose of this letter is to show that the two laws are necessary and sufficient, and at the same time to point out a way of avoiding unnecessary equations.

In our discussion we will assume that all resistances which are connected merely in series are considered as one, so that at each junction point we shall have at least three wires. Let R_1, R_2, R_3, \dots be given resistances and E_1, E_2, E_3, \dots given emfs. Let it be required to find the corresponding currents I_1, I_2, I_3, \dots . Then the laws may be stated as follows:

- (1) $\sum I = 0$ for every junction point,
- (2) $\sum IR = \sum E$ for every closed path.

An equation may fail to be useful either by becoming an identity or by being derivable from other equations.

Suppose that the first equation becomes an identity, i.e., $\sum I = 0$ for any set of values of I 's whatever. This can take place only when the equation has a form $I_s - I_s = 0$ or, in other words, when only two wires are joined at the point. But by our assumption such points are not to be considered.

Suppose, further, that the second equation becomes an identity, i.e., $\sum IR = \sum E$ constant for any set of values of I 's whatever. This can be true only when each R is equal to zero, which is impossible. Hence, equations furnished by Kirchhoff's laws cannot become identities.

Suppose now that the equation (2) can be derived from (1), or vice versa. This necessitates that in the second equation $\sum E = 0$ and all R 's are equal to each other. Our equations can then be written:

- (1) $\sum I = 0$
- (2) $\sum IR = R \sum I = 0$

For these equations to be equivalent, for each I_p in the first equation there must be an identical I_p in the second, and vice versa. In this case the portion of the circuit under consideration will consist of a series of loops of equal resistance joined at one point. It is easy to see that exactly half of the signs of I 's in the first equation will differ from those in the second. Consequently the two equations cannot be equivalent. Therefore the equations furnished by one law are independent of those furnished by the other.

Let the number of I 's (equal to the number of R 's) be N , and the number of junction points P . Then, the number of independent equations furnished by the first law is $P - 1$, because any $P - 1$ points can be taken in such an order that each equation will contain at least one unknown not contained in the others. The last point will, of course, give no independent equation.

$P - 1$ is always less than N , hence the necessity of the second law.

Now, if the second law be applied to a closed path passing through each junction point once and only once, then it will be easy to write all the other equations so that each of them includes one and only one unknown not contained in any of the previous equations. The number of the unknowns in the first equation of this type being P , the total number of the independent equations obtained by thus applying the second law will be $1 + (N - P)$, which together with $P - 1$ equations furnished by the first law gives the necessary N equations. B. PODOLSKY.
Southern California Telephone Company, Los Angeles, Cal.

Logarithmic Notation

To the Editor of ELECTRICAL WORLD:

Sir: Would it not be generally advantageous to adopt a common system for indicating whether a logarithm is to base 10 or base e ? Some textbooks give "log x " as being "log _{e} x " and specify the base for other systems, as for example "log₁₀ x ." On the other hand, other books call "log x " the common log, or log₁₀, and specify "log _{e} x " when the hyperbolic logarithm is meant. It appears to the writer that as such a beautifully simple system is in use to distinguish between the trigonometric functions—i. e., "sin x ," "tan x ," etc., for circular functions, and "sinh x ," "tanh x ," or "Sinh x ," "Tanh x ," as used by some writers, to indicate hyperbolic functions—it should be a fairly simple matter to distinguish between the two generally used systems of logarithms in some similar manner. For instance, "log x " or log _{e} x would indicate "log₁₀ x ," and "logh x " would indicate "log _{e} x ," or the "hyperbolic logarithm of x ." The notation I suggest would be very convenient for typewriting, and I should imagine rather more convenient for printing, than the system of indices now in use. It would further remove the confusion due to the different usages of various authors as noted above.

Preston, Idaho. F. M. GILLESPIE.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

REGULATION OF SIGN

LIGHTING IS NEARER

No Effort Is Being Exerted by Washington Authorities to Do Away with All of Such Illuminations—Conservation the Aim

It became known in Washington on Wednesday afternoon that the Fuel Administration intended to issue within a day or two the rules and regulations which will govern electric sign lighting in the United States for some time to come. Dr. Garfield, the administrator, stated to the Washington representative of the *ELECTRICAL WORLD* that the Fuel Administration has not been wholly in sympathy with statements made to it in behalf of electric lighting companies, such as that it requires but 7 tons of coal each night to carry on the electrical sign lighting for the city of Chicago. He said he had been told, for instance, that it requires but $2\frac{3}{4}$ tons of coal each night to accomplish the sign lighting for the city of New York. Dr. Garfield expressed himself as frankly incredulous of these statements.

A committee has been working on the rules and regulations for some time. There is no disposition on the part of the Fuel Administration to do away with sign lighting. The effort has been toward conservation, and the conservation division of the Fuel Administration has received from engineers in the industry diagrams showing that the peak load in electricity comes about 6 o'clock in the evening, when most lights are turned on, when factories have not entirely closed down and when urban railways are most heavily loaded. These advices had been adopted by the Fuel Administration. For this reason it was believed that a method of conservation would be the beginning of sign lighting at about 8 o'clock in the evening instead of earlier as heretofore.

It is expected in Washington that another priority order, governing the use of open-top flat cars for the shipment of coal, will be put in force soon. The coming order, according to statements made at the transportation priority office, will limit the coal supply to plants manufacturing so-called non-essentials. No information is obtainable as to the order in which the non-essentials will be graded. One official of the government volunteered the opinion, for instance, that the manufacturer of pianos would come away down in the list, and there is reason to believe that all other luxuries will share that fate. There is no reason, however, for anxiety on the part of important industries using electricity, according to statements made in Washington.

The Washington representative of the *ELECTRICAL WORLD* reports that the country will probably receive shortly the announcement that the following policy has been decided upon in regard to the supply of coal, so far as both the priority transportation board and the Fuel Administration are concerned:

The railroads of the country will be supplied first. The fleet and auxiliary warships will be supplied second

The public utilities will be supplied third, with a conservation of sign lighting along the lines indicated above. Steel plants manufacturing munitions of war will be supplied fourth. Domestic users will be supplied fifth, with a conservative effort directed toward starting plants later at night than they have heretofore been started—in the case of apartment houses, for instance, starting both lighting plants and steam heating plants at a later hour than has been the custom during the winter months.

A committee representing the motion-picture industry conferred during the week with the Fuel Administration, declaring the belief that a very large amount of electricity is being wasted which could be saved by suggested readjustments.

SIGN OWNERS URGE

A COMPROMISE PLAN

Broadway Property Holders, Trying to Save the Greatest White Way, Suggest Limitation of Energy Supply

A memorandum submitted to Dr. Garfield, the Fuel Administrator, by the Broadway Association of New York suggests a compromise plan of dealing with electric signs. It says in part:

The passage of the daylight saving bill (which has been passed by the Senate but not by the House) would bring about a saving, as stated by one of the officers of the Daylight Saving Association, of about \$50,000,000 in coal annually.

It is suggested that if it is absolutely essential that exterior lighting be reduced, a consumer be only permitted to use $\frac{66}{100}$ of the amount of any energy that he may have used for exterior lighting during the preceding year, and that no new exterior lighting be permitted until April 1, 1918, at which time this order could then be reissued or conditions could be reviewed as they were at that time. This, however, is not to refer to any alteration of existing exterior lighting installations, as such changes on exterior lighting are necessary from time to time so long as the total consumption of energy does not exceed $\frac{66}{100}$ of the prior year's consumption. This would permit the following alternatives at the option of the consumer:

That a consumer reduce the number of lamps used for such exterior lighting, or that he may reduce the wattage of the lamps used, or that he may reduce the number of hours that the lamps be burned. This arrangement would be so elastic as to meet the requirement of nearly all users.

If even more drastic action is necessary, it is suggested that kerosene be permitted to be used for exterior illumination.

It is suggested that the question be borne in mind that if the income of the public utilities companies be reduced to too great an extent it may not be possible for them to continue manufacturing at existing rates, and that application might be necessary to have the rates raised; if this is so the increased cost to a consumer should be borne in mind.

Any great darkening of thoroughfares would drive people from the thoroughfares into interiors, and the increased use of houses or interiors would cause increased consumption of energy in houses or interiors.

ACTION ON SIGN LIGHTING BY NATIONAL COMMITTEE

Hearty Support Is Pledged to the National Authorities in Carrying Out Any Plan Which They Consider to Be Necessary

The National Committee on Gas and Electric Service, at a meeting held in Washington on Nov. 1, passed the accompanying resolution on electric sign lighting.

COMPANIES SUPPORT FUEL ECONOMY

Whereas, under the extraordinary conditions arising out of the state of war, the public is visually impressed by the apparent waste of fuel which it believes to be involved in the lighting of the electric display signs, so conspicuous a feature of the life of our larger cities, notwithstanding the fact that, even in the aggregate throughout the country, this service requires the consumption of an inconsiderable percentage of the total coal required for the operation of electric power plants generating electrical energy; and

Whereas the continued use of such electric signs apparently renders more difficult of consummation the efforts being made by the national authorities to urge the public to conserve and economize in the consumption of all the necessities of life and the elimination of all waste and extravagance, real and apparent, in the use of the commodities essential to our nation and its allies in the successful prosecution of the war; and

Whereas exterior display lighting of the different kinds is of varying degrees of necessity and importance to the general public and to the business communities in which it is operated, depending upon the immediate purpose which it serves, and

Whereas, if and when the national authorities decide that the time has arrived when it shall appear to them to be necessary in the national interest and for the purpose of impressing on the people the importance of avoiding all waste and extravagance to call public attention to the necessity of practicing economy in the use of fuel in industries, in the factory and in the homes of the people, they should then issue a pronouncement to the people of the United States requesting them, under the supervision and direction of the proper state and municipal authorities, to limit the use and operation of advertising, billboard and display signs, exterior publicity lighting and special ornamental street lighting of every kind to that which is important and necessary for the convenience and safety of the public and for the proper conduct of the various business and commercial enterprises in the respective communities, and to render effective their co-operation in this work, be it therefore,

Resolved, that the public utility companies throughout the United States, through their organization, the National Committee on Gas and Electric Service of the Council of National Defense, representing the gas companies—both natural and artificial—the electric light and power companies, the waterworks companies and the central steam-heating companies throughout the country, pledge their hearty support and co-operation to the national authorities in carrying out any plan or regulation for the saving of fuel, gas, oil or electricity which the national authorities in the public interest may consider it necessary to adopt as a war measure.

The committee also had a conference with Dr. Harry A. Garfield, the Fuel Administrator of the federal government.

ELECTIONS NOT CENTERED ON PUBLIC UTILITY ISSUES

Tammany Wins Four-Cornered Fight in New York City—Massachusetts Administration Sustained, Notwithstanding Attack on Higher Fares

Campaigns which ended in the elections on Tuesday of this week appear to have had no marked general significance affecting public utilities, although in some local cases there was a slight angle which was of interest.

In New York City the Tammany candidates won in a four-cornered fight in which the issues were confused.

One of the planks in the Tammany platform was public ownership of utilities, but this did not become an active issue during the campaign.

In Massachusetts the electorate sustained the war administration of Governor McCall by a majority of nearly 100,000. Mr. Mansfield, the defeated candidate for Governor, failed utterly in an attempt to gain favorable decision by attacking among other things the 6-cent electric railway fare developments under the present régime.

Business houses in general in Chicago breathed a sigh of relief when the election returns on Nov. 7 showed total defeat of all Socialist candidates for position as judges of the Superior Court. There was, however, no very great fear at any time that the Socialist ticket would succeed in a big way. In some individual cases the Socialist candidates have been active against public utilities, and the success of these individuals would of course have been viewed with apprehension. In general, however, the fear of Chicago business houses seemed to be based on the fact that the Socialist candidates were inexperienced, while on the fusion ticket the candidates were mostly sitting judges. War-time economy showed itself in the bond issue elections, the one-million-dollar good roads issue being the only one carried.

CLASSIFICATION PLAN OF ILLUMINATING ENGINEERS

In Keeping with the General Policy, the Illuminating Engineering Society Will Make Personal Classification—Non-Members Included

In accordance with the general policy of engineering societies in making a classification of members, the Illuminating Engineering Society is asking for information of the experience and availability of each member for service of either a military or a civilian nature.

A letter from Clarence L. Law, the general secretary, says that the classification and the index to be prepared therefrom will prove of sufficient value during the war to justify the expense incurred and will probably prove of increasing value after peace has been declared in taking care of the readjustments in the industries of the country and providing for the employment of engineers in such a way that the services of each man will be utilized to the best advantage of both the engineers and the country.

The society is also making a classification of non-members so that all men qualified to hold positions in the arts or sciences of illuminating engineering may be similarly recorded.

PRIORITY IN POWER REQUIRED IN OHIO CITY

Canton Business Men Seek Modification of Government Order That War Industries Be Given the Greater Part of Energy Supply

Following a conference of seventy-five business men at Canton, Ohio, last week, a delegation went to Washington in an attempt to secure modification of a priority order which requires the Central Power Company to furnish the greater part of its energy to the United Alloy Steel Company and the Timkin Roller Bearing Company, which are making war materials. These men declared that a number of factories will be compelled to close if they do not secure the service they need from the central station.

General Manager F. H. Golding of the Central Power Company informed the business men that the station had been practically commandeered by the government and that he can do nothing unless a modification of the order is secured. The rating of the station is 17,000 kw., while the two plants mentioned require 12,200 kw. daily, leaving but 4800 kw. for other purposes. Should the draft upon the station be heavier, it is probable that some of the lighting service would have to be dispensed with for the time.

Recently the Mayor of Canton confiscated about 300 tons of coal belonging to the Central Power Company. This was the last of a large storage supply created by the company about two years ago at a point three miles from its plant.

FOR COUNTRY-WIDE COAL CONSERVATION

"Reconsider the Advantage of Buying Heat and Power from a Specialized Plant That Makes Nothing Else"

A country-wide coal conservation movement has been started by the committee on coal conservation of the Chamber of Commerce of the United States. This committee is composed of:

Ernest T. Trigg, chairman, president Philadelphia Chamber of Commerce, vice-president John Lucas & Company, paint manufacturers.

Lester P. Breckenridge, professor of mechanical engineering, Sheffield Scientific School, Yale University.

Thomas E. Donnelley, president R. R. Donnelley & Sons Company, printers, Chicago.

P. H. Gadsden, president Consolidated Railway & Lighting Company, Charleston, S. C.

Ira N. Hollis, president Worcester Polytechnic Institute, president American Society of Engineers and chairman Engineering Council.

Frank H. Johnston, president City Coal & Wood Company, New Britain, Conn.

John S. Lawrence, textile manufacturer, Boston.

John W. Lieb, vice-president New York Edison Company, president National Electric Light Association.

John F. McGee, member Minnesota Commission of Public Safety, Minneapolis.

Charles E. Wales, retired coal operator and distributor, Minneapolis.

To owners and managers of power plants the committee says:

Costs of production have more attention to-day than ever before. The cost of coal for generation of power has in many instances not had the same consideration as other

costs, because coal has been cheap and obtainable in abundance. Cheap coal and cheap labor sometimes made it apparently economical in dollars and cents to install and run an inefficient plant.

Coal has now become expensive. It is hard to obtain. Efficiency in its use and avoidance of waste have become of first importance, since without power other materials cannot be utilized.

These conditions make it imperative for every owner or manager of a power plant to examine into the cost of the power his establishment uses, the economy with which it is generated and applied, and the increase in efficiency that is possible. Some of the steps that an owner or manager should take are to:

Reconsider the advantage of buying heat and power from a specialized plant that makes nothing else and can afford the investment and supervision that gets a maximum of value out of each pound of coal (in some localities hydroelectric power may be available).

Find the nearest source of coal that will meet the requirements, even if it does take a little more trouble to use it. The tax on the transportation system will thus be reduced so far as haulage by rail is shortened. Coal is mined in twenty-six states, and these states extend practically across the continent and from the northern to the southern borders.

Give to the power plant and its personnel recognition and encouragement such as is due an expert and important department, thus getting new effort and attention to offset the extra attention and care needed with coal inferior in grade and preparation to the coal formerly available.

Seek to increase skill and proficiency in the men who handle the coal. A fireman at a hand-fired boiler shovels 3 to 10 tons of coal a day—or as great a value in material as many skilled men in other departments.

Put the fuel-using equipment into as perfect condition as possible. Provide at hand-fired plants an ample firing floor with a good surface, together with a smooth-bottomed coal car if it can be used; eliminate leaks in the boiler setting; see that fire-doors fit properly, replace defective grate bars, make sure that smoke connections are clean and tight; if mechanical stokers are used, see that they are in good repair and that directions for using them are being followed; in general, make the plant and the fire-room of such character that an efficient man will stay on the job.

Install simple and convenient means by which the fire-room force may see results. Scales for weighing fuel and ash, meters for measuring water fed to the boiler, and devices for determining the quality of flue gases, the draft over the fire, etc., can be made to interest the men in the fire room and show the actual results of efforts to economize. Convenient means for operating the flue damper must be installed.

Endeavor to run boilers in service at their capacity. If efficiency is increased, one or more boilers in a battery may be dropped.

Provide water that is free from scale by using, when necessary, water-treating devices if the plant is large, and special feed-water heaters in small plants.

Reduce loss of heat after it is generated. See that boiler services and steam pipes are properly covered. The simplest and most inexpensive covering will reduce loss by 80 per cent. In the engine room cut out useless steam lines have valves properly set, reduce the small auxiliary pumps etc., to a minimum, provide the repairs the engineer has been asking.

Obtain expert advice. Good steam engineers are familiar with well-tried ways of reducing both consumption of coal and consumption of heat. Their advice should be obtained in all practical cases. This is not a time for radical innovations but for utilizing tried experience.

One pound of coal per hour has yielded a horsepower per hour. That is the record of present possibility. It cannot be attained by every plant. But the fact that at present the average attainment throughout the country is but one-third or one-fourth of this record is indicative of the possible savings that can be made if the care and attention which the power plant deserves are actually given to it.

The suggestions which have been given above are typical of the points about which every owner and manager of a power plant should assure himself. The applicability of

any general suggestions will vary with nearly every plant. Most users of coal can join in promoting efficiency of coal. Railways have made real progress in firing locomotives; they can often go farther. Gas works can generally effect further saving by using careful technical direction. Manufacturing plants of every degree can show great results in the aggregate.

The Bureau of Mines, on behalf of the federal government, has gathered a great deal of information about the use of coal and has expert advice to give regarding means of economy. Some of the publications in which the Bureau of Mines has embodied the results of its experiments and made practical suggestions based upon expert observations and conclusions of its staff and other engineers are indicated in the attached list. [This list comprises a number of suggestive technical papers.—EDS.] In many instances state agencies, too, have data and suggestions which are to be had for the asking.

ACUTE COAL SHORTAGE STILL THREATENS OHIO

In Order to Keep Municipal Plant in Cleveland in Operation City Confiscates Four Carloads of Coal

While most Ohio industrial and utility plants have been kept in operation in the last week, coal has been so scarce that many were continually in danger of being closed down. Owing to the fact that mines were ordered to ship all coal to dealers for domestic purposes on Oct. 29, the regular supply for steam purposes, heretofore shipped on Mondays, was eliminated.

In order to keep the municipal light plant in Cleveland in operation, Mayor Harry L. Davis confiscated four cars of coal on the New York Central Railroad tracks at East Fifty-fifth Street, that city, on Nov. 2. It was consigned to the American Steel & Wire Company. This is the first time for some weeks that the municipal plant has been entirely without coal.

On Oct. 31 Charles Wood, general manager Ada Heat, Light & Water Company, Ada, notified the authorities that unless coal was received at once the plant would have to suspend operations. As further complaints have not been noted, it is probable that at least a small supply has been furnished.

The central station furnishing Tiffin with energy (the Ohio Light & Power Company) had trouble on Oct. 31 because of coal shortage and at times the town was in darkness. On the following day some of the factories in that city were closed, as debris floating in the stream after a freshet forced the discontinuance of operation until the trouble was remedied.

In Toledo the coal supply has been very short, but so far railroad and light plants have been kept in full operation. A survey of the city needs for industrial purposes has been made and an attempt will be made to secure a sufficient amount of coal for all plants through the State coal administration, of which Attorney Homer H. Johnson of Cleveland is the head.

The suspension of all sign and surplus street lighting is being discussed in Cleveland. In an interview on Nov. 3 Coal Administrator Johnson said that no step has been taken toward this end, but he believes that it will come to that point before long. This would result in saving quite an amount of fuel, he said, although it would disturb central station business for a time. He believes, further, that it may be necessary to stop production of non-essentials where fuel is required.

MAINE CONSOLIDATION WILL EFFECT ECONOMY

Proposed Merger of Electric Companies Will Avoid Two Taxes on the Same Income and Promote Economic Advantages

To avoid paying two war taxes on the same income and also two franchise taxes, as well as to secure economic advantages resulting from centralization of corporate organization, a petition was filed recently with the Maine Public Utilities Commission by the Gould Electric Company of Presque Isle and the Maine & New Brunswick Electric Power Company. The petitioners sought to consolidate the Maine property of the Maine & New Brunswick company into the Gould company.

H. T. Powers, for the Maine & New Brunswick company, stated that \$90,000, or 90 per cent of its income, is derived from Maine, the balance being obtained from small plants in New Brunswick. All the electricity used is generated in New Brunswick. About 128 miles (206 km.) of transmission line are in service in Maine, eleven companies and municipalities being supplied at wholesale. The company owns a distribution plant in Presque Isle, and the Aroostook Valley Railroad is supplied with power from this system. The property of the company in Maine is valued at \$600,000. It is estimated that, after paying 1.5 cents per kilowatt-hour for energy, the present Maine income will provide a 5 per cent dividend on the capital stock after making allowance for operating expenses. About 3,200,000 kw.-hr. will be furnished by the New Brunswick company, at about \$48,000; operating expenses will be about \$12,000; maintenance of transmission lines \$3,000, insurance and taxes \$3,000.

War and income taxes in Canada are larger for a given volume of net earnings than in Maine. It is proposed to issue \$600,000 stock, and if the commission allows the Maine property of the system to be taken over extra income and war taxes amounting to \$16,000 will be saved. On these terms it is figured that the property will show a surplus in Maine operations of \$2,000 per year. New towns are being taken on, and every distribution plant is being extended.

A. R. Gould of Presque Isle, general manager of the Maine & New Brunswick company, described the pioneer development of the property, the principal plant being at Aroostook Falls, just over the Canadian border.

Energy is generated at 11,000 volts and delivered at this pressure to Fort Fairfield; from there to Houlton, 45 miles (72.4 km.) a 33,000-volt line is in service. Farm power is supplied from the Presque Isle distribution system, the lines running 5 or 6 miles (8 km. to 10 km.) into the country. A larger proportion of residents take electric service in the Presque Isle district than in adjacent parts of Maine. Business increase has been better in 1917 so far than a year ago.

Mr. Gould said that although the present is the driest period the plant has experienced, about 4000 hp. is running to waste. The capacity of the principal generating plant is about 3000 hp. as at present developed, but there is some demand, notably at Van Buren, for power for pulp-mill service. An immediate market of 1000 hp. additional could be utilized if storage should be created on the river. The value of the property of the company in New Brunswick is about \$500,000.

WAR SERVICE COMMITTEES FOR ELECTRICAL MANUFACTURERS

Member Organizations in the Electrical Manufacturers' Council Appoint Committees to Co-operate with Government

At a meeting of the Electrical Manufacturers' Council in New York on Nov. 2 steps were taken to assure the appointment of war service committees by the member organizations—the Associated Manufacturers of Electrical Supplies, the Electrical Manufacturers' Club and the Electric Power Club. This action is in accordance with a request made to the Chamber of Commerce of the United States by Director W. S. Gifford of the Council of National Defense. It will make closer the co-operation between the government and electrical manufacturers on war matters.

SAFETY ORGANIZATION THAT GREATLY REDUCES ACCIDENTS

Plan Which Has Been Found Thorough and Practical by a Long Island Company, and Some of the Results Obtained

An outline of the safety organization of the New York & Queens County Railway Company of New York and statistical results which show its efficiency are given below, the information being extracted from a report sent by W. P. Strickland, general inspector of the company, to Charles B. Scott, secretary of the committee on safety rules and accident prevention of the N. E. L. A. The plan has been found to be thorough and practical.

The company has a centralized safety bureau which makes constant inspections of the entire system. A schedule is maintained whereby every man attends a "safety first" lecture and first-aid and resuscitation drill once a month. The first-aid and resuscitation drills are actual demonstrations, every man participating, thus insuring full and proper instruction. "National Safety Council" matter and other accident prevention suggestions, including pictures, are placed on the bulletin boards weekly, many of the warning signs posted by the company appearing in several languages.

At the monthly drills all rules are reviewed and prizes are given quarterly for the best suggestion as to how to prevent accidents. Each superintendent, foreman and acting foreman is supplied with a copy of "Safety Engineering," and the plan of voting on the

best article under the heading, "The Man on the Job," as well as discussion of all articles, is encouraged.

A comparative statement of accidents is distributed monthly among the several divisions. This records the number of accidents that occurred in a department during a given month and the percentage of accidents based upon the number of employees in the department. The record also includes a tabulation headed by the division with the highest percentage of safety, as well as a comparison with the previous year.

A "safety committee," composed of the superintendents and the heads of all departments, meets at regular intervals to act upon suggestions sent in by the employees and discuss safety construction.

Every suggestion is acted upon promptly. After the suggestions are voted upon by a safety committee a letter of acknowledgment is sent by the treasurer to each person who submitted one. This evidence of the company's appreciation "boosts" the interest in safety and has stimulated the work among the employees.

In the last three years accidents have been reduced 49 per cent. During the first ten months of 1917 the reduction in accidents was from 40 to 50 per cent more than the corresponding period of 1916, indicating the increased precautions taken as result of the work.

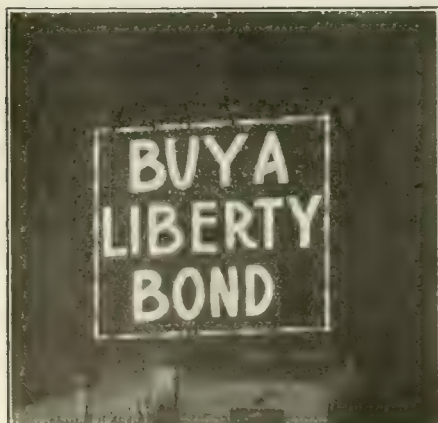
In the accompanying table is given a summary of the accident report of the company for three years ended December 31, 1916.

	1914	1915	1916
Average percentage of annual gross earnings expended for accident costs.....	0.0081	0.0076	0.0054
Average percentage of annual payroll expended for accident costs.....	0.0227	0.0217	0.0183
Total number of fatal accidents.....	6	1	1
Number of employees (average).....	472	544	553
Percentage of decrease in accidents to employees from year 1913.....	11	32	49

ELECTRIC SIGNS FOR THE LIBERTY LOAN

Advertising the Second National Bond War Issue to the Crowds in Broadway Districts, New York

In the issue of the ELECTRICAL WORLD for Oct. 6 one of the signs donated to the government to advertise the second Liberty Loan was illustrated. Three other signs which were used for the same purpose are illustrated herewith, the Budweiser sign and also two donated by the O. J. Gude Company, the wreath and eagle. All were in or near Broadway, New York.



TAX ON EXCESS PROFITS UNDER WAR REVENUE ACT

**Commissioner of Internal Revenue Roper Invites
Associated Manufacturers of Electrical Sup-
plies to Make Suggestions to Board**

In a letter to the Associated Manufacturers of Electrical Supplies Daniel C. Roper, Commissioner of Internal Revenue of the Treasury Department, Washington, directs the attention of that organization to the excess profits provisions of the war revenue act.

Mr. Roper says that the Secretary of the Treasury desires to administer these provisions in a manner that will accomplish the full purpose of the law and cause as little inconvenience as possible to the business interests of the country. To this end the Secretary has created an excess profits advisory board to analyze the law and to digest and consider in connection with plans for its administration the suggestions received from those who will be required to pay the taxes. Mr. Roper adds:

You are respectfully invited to submit to the Bureau of Internal Revenue any suggestion you may desire to offer with respect to the interpretation, application or administration of the excess profits provisions of the new law. You are particularly requested to outline the method of computing "invested capital," under Sections 204, 207 and 208 of the excess profits tax law, which will be most practicable and accurate for those engaged in the industry which you represent. You may find it advisable to refer this matter to several sub-committees of your association, in which case it is hoped that you will act as a clearing house for the purpose of eliminating duplicate suggestions from your line of industry and in assisting to keep the work of the advisory board within proper compass.

In this invitation you are being given an opportunity to render a valuable service to your country. I shall thank you for submitting your suggestions in the form of a memorandum at the earliest possible date.

The association will take steps to meet the request.

REWARDS FOR EFFICIENCY AND REDUCTION IN RATES

**Indiana Public Service Commission Finds Opportunity to Apply the Plan of Sliding Scale
Stimulation to Skillful Operation**

The Indiana Public Service Commission has inaugurated a practical policy of rate regulation of public utilities from which large results are expected. The commission, in deciding the rate case of the Hydroelectric Light & Power Company, which supplies Connersville, East Connersville and other towns near by, applied a system of rate control which has been tried in Oxford, England, and some other European cities. It is based on the general theory that for every step forward in plant economy, plant efficiency and resulting rate reduction to the company's customers the investment returns to the stockholders of the company are automatically increased, thus placing the highest possible business premium on good management.

E. I. Lewis, chairman of the Indiana commission, who has been seeking a utility rate case among those that have come before the commission as an experimental possibility for the "Oxford system," said that he believes the Connersville case presents an ideal case for the experiment. Gov. James P. Goodrich, whose deep

study of the utility-control problem has continued for years, is anxious to see the immediate application of the new scheme of rate control, and the experiment undoubtedly will be watched with the deepest interest by utility experts throughout the United States.

The Connersville company is the successor to the Light, Heat & Power Company and to the Hydroelectric Light & Power Company, which were merged into the present company on Jan. 1, 1917. By petition which was filed later the commission was asked to promulgate a rate basis for the new company, which would be based on reasonable and just underlying principles. The commission has determined to try the new system of "rate reward control" on this plant. The Connersville plant is considered an ideal plant for the trial of the new scheme because of its lack of bond issues and other complicating conditions.

PROMOTING INTERNATIONAL STANDARDIZATION MOVEMENT

**H. M. Hobart in London as Delegate of Standards
Committee of the American Institute of
Electrical Engineers**

H. M. Hobart is in London as a delegate of the standards committee of the American Institute of Electrical Engineers to confer with the British Engineering Standards Committee. He will confer with the panel committee on rating of electrical machinery, of which Sir Richard Glazebrook is chairman.

Sir John Wolfe Barry, chairman of the British Engineering Standards Committee, and Sir John Snell, chairman of the sectional electrical committee, welcomed Mr. Hobart on Oct. 17, the first day of the rating conference. It was announced in London that the presence of Mr. Hobart in London would afford an opportunity for consultation in regard to the standardization of electrical apparatus generally, in connection with which much work is being carried out by various panels of the committee, especially in respect of motor starters, ships' fittings, fuses, instruments and instrument transformers, under the direction of C. H. Wordingham.

As on the previous occasion at the rating conference, the Canadian national committee of the International Electrotechnical Commission has invited A. P. Trotter to represent it.

The visit of Mr. Hobart to London means the third conference to be held in the last few years between the representatives of the English and American standardization committees. In February, 1915, Mr. Hobart and C. E. Skinner went to England. In June, 1916, C. le Maistre, secretary of the British committee, returned the visit by coming to this country.

In its work the American committee has been in very close contact with the British committee in the entire field of electrical standardization. In all essential features the rules in England and in this country are almost equivalent. No really vital differences remain. The two committees are now simply taking advantage of the experience of each other to promote international standardization. The very cordial relations existing between the two committees and the large measure of success which has attended the previous conferences are conspicuous developments for the international standardization movement.

VALUATION TOTALS FOR THE CLEVELAND COMPANY

Ohio Commission Announces Figure of \$19,600,000,
Whereas Company Contended for \$24,400,000
and City Demanded Only \$11,900,000

The contest between the city of Cleveland and the Cleveland Electric Illuminating Company on rates has resulted in what might be called a draw, according to the ruling of the Ohio Public Utilities Commission, issued on Nov. 2. This ruling places the valuation of company property at \$19,661,242, which is too high to permit the 3-cent rate provided for in the city ordinance passed two years ago. The next duty of the commission in this case is to fix the rate on the basis of the ruling. It may not be as high as at present, since the company contended that the proper value of the property is \$24,489,644, but neither can it be as low as the city demanded, since its contention was for a valuation of \$11,913,016.

Under the ruling the physical property is valued at \$14,809,500 and intangibles at \$4,851,742. As the valuation is of July 1, 1914, the commission will add the amount expended in extensions and improvements since that time to secure the proper basis for the present rate for service. Including items other than those of property for electrical purposes and property not used and useful, the order gives the entire valuation of the company property as \$21,428,987.

The commission tentative valuation was \$20,820,062, but the cost of financing and a few other items, amounting in round numbers to \$1,034,660, were dropped from the valuation. The city contended that intangible values to the amount of \$6,087,158 should be deducted, but the commission did not agree with arguments to this effect.

One feature of the ruling was the allowance of \$1,112,070 for attaching business, which the city attorneys contended is opposed to a decision of the Supreme Court some time ago. They also argued that city consumers should not pay rates based on the value of property used to supply East Cleveland, Lakewood, Rocky River and other suburbs. These

things, it is understood, the commission did not take into consideration, because they place limitations that are too narrow for the best interests of all.

The company has asked the commission for the privilege of issuing \$3,500,000 bonds, and at the same time it requests the cancellation of its right to issue \$1,039,000 common stock, which was granted some time ago.

REUNION AT DEDICATION OF THE EDISON TABLET

Twenty-two of Those Who Worked with the
Inventor in Pearl Street Station Are
Gathered Together

As stated in the Oct. 20 issue of the ELECTRICAL WORLD, a large bronze tablet commemorating the thirty-fifth anniversary of the establishment of electric lighting in New York City was dedicated at the Electrical Exposition on Oct. 18.

A feature of the exercises was the gathering of twenty-two of those who worked with Edison in establishing the central station at 257 Pearl Street, where the tablet is to be placed later. All cheered enthusiastically when it was announced that Edison was too busy helping to win the war to have time to attend the event.

Among the central station pioneers who gathered at the reunion were Dr. William J. Hammer, Dr. Schuyler S. Wheeler, E. A. Harley, H. A. Campbell, Joseph Lee, A. T. Brown, O. J. P. Lang, A. F. Gilbert, W. J. Brown, J. F. Atkins, T. T. Wooley, John Acheson, Wilson S. Howell, Richard Darlington, Thomas Brown, W. T. Dempsey, Mrs. Nellie Curran, Andrew Brown, John W. Lieb and Arthur Williams.

The old Pearl Street building, which has been reconstructed, is now occupied by Mangus, Maybee & Renard, dealers in oils. In erecting the tablet the American Scenic and Historic Preservation Society and the New York Edison Company have co-operated, the Scenic society being interested because of the historic importance of the event and the Edison company because the company of 1882 was the parent of the present organization.



CENTRAL STATION PIONEERS AT EDISON REUNION

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Injuries to Fellow-Employee When Electric Mine Hoist Dropped.—An engineer whose duty was to operate a mine hoist carrying miners to and from a lower level was as to such miners a vice-principal for whose acts the operator was liable, the Supreme Court of Utah held (167 P. 675). It is therefore not objectionable to charge both the mine owner and a hoist operator with negligence resulting in injury to a miner by the dropping of the hoist. An engineer whose duty was to operate a mine hoist carrying miners to and from a lower level was not, as to a miner injured by the negligent dropping of the cage, a fellow-servant. It is negligence as a matter of law for an electrically operated hoist cage in a mine to be dropped 110 ft., without brake or clutch, with such force as to injure a miner therein, though the case is not strictly one of *res ipsa loquitur*.

Shutting Off Service for Non-payment.—An injunction is the proper remedy to prevent the shutting off of water by a water company where the consumer denies in good faith the amount of the charge, the Court of Appeals of Maryland held (101 A. 771). Although a water company may adopt a rule that water may be shut off for non-payment thereof, it cannot arbitrarily shut off the consumer's supply where the amount claimed is a matter of just dispute. The Public Service Commission is not invested by law with power to determine controversies between defendant water company and plaintiff consumer as to correctness of the bills rendered. Although it be conceded that the commission has jurisdiction in cases involving the correctness of charges for water, it cannot deprive a court of equity of its original jurisdiction to grant an injunction for refusal to supply water.

Water Rights During Withdrawal of Grants.—Under a statute providing that whenever, by priority of possession, rights to use of water have vested and accrued and are recognized by the local customs, laws and decisions of courts the possessors and owners of such vested rights shall be maintained and protected in the same, and the right-of-way for the construction of ditches and canals for the purposes specified is acknowledged and confirmed, a locator for water rights acquires no title against the United States till the work is completed; so that before that time, the lands affected being temporarily withdrawn by executive order of the Secretary of the Interior, and Congress having before the vacation of the orders of withdrawal granted the

lands and rights to a city, all rights thereto of the appropriator were lost, the Supreme Court of California held in Silver Lake Power & Irrigation Company versus the city of Los Angeles (167 P. 697).

Commission Jurisdiction Over Municipally Operated Utility.—Under its charter, authorizing it to construct or purchase waterworks and reservoirs or to grant to any person or corporation a franchise or permission for the construction of waterworks, including the right to use the streets, etc., a city council passed an ordinance providing that plaintiff should construct and maintain a water plant in consideration of a payment of \$12,000 by the city and a lease of the plant for twenty years. The ordinance required the city to acquire land for a reservoir site and right-of-way thereto, as well as rights-of-way for all water mains, and allowed plaintiff during the twenty-year period to charge fixed water rates. The laws declare that the intention of the Legislature should be pursued, if possible. The law confers on the Public Service Commission authority over every public utility, but declares that no plant owned or operated by a municipality shall be deemed a public utility. The Supreme Court of Oregon held (167 P. 791) that the water plant was owned by the city, which had dominion over it, as title to the reservoir and rights-of-way was taken in the name of the city and the mains were laid in the streets, which by the charter were declared to belong to the city in fee, and hence the Public Utility Commission had no jurisdiction to supervise the rates.

Recovery Under Workmen's Compensation Act.—Under the workmen's compensation act, providing that whenever an injury for which compensation is payable shall have been sustained under circumstances creating in some other person than the employer a legal liability the injured employee may proceed both against the employer and such other person but shall not collect from both, the collection of compensation by a telephone lineman from his employer did not estop him from recovering damages from defendant city for injuries due to its failure to insulate electric wires, the act simply preventing plaintiff from collecting from the city more than the excess over the sum he had collected from the employer, it was held by the Court of Appeals of Kentucky (1975 W. 449). Where the lineman had recovered for injuries from his employer the employer was a necessary party in a suit for damages against the city for its failure to insulate its electric wires, in view of the workmen's compensation act, giving the employer the right to recover from a negligent third party the amount of indemnity he had paid the employee under the act. In a suit by a lineman injured by contact with electric wires of the city the award and other proceedings against the company employer under the workmen's compensation act were wholly immaterial to the questions involved.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Competition Opposed in New York.—Denying the application of the Lawrence Park Heat, Light & Power Company, Bronxville, for authority to compete with the Westchester Lighting Company, the New York Public Service Commission, Second District, holds that to allow competitive lighting systems would be in deliberate disregard of the law and settled policy of the State and would impose a condition from which the public might in the end be a heavy sufferer. The Lawrence company sought to furnish the business section of that village with electricity and thus compete with the Westchester Lighting Company. Originally the Lawrence company was only intended to light buildings owned by the members of a family that owns the light company. The Lawrence interests constructed new buildings, stores, residences and business blocks, and served these properties with electricity from their own plant, in some cases ejecting the Westchester Lighting Company from these buildings and the tenants' places. This, Commissioner Emmet states, represented to the Westchester Lighting Company a considerable loss of business which it had confidently expected to get. Since the Lawrence company was in a position to take this business over without seeking any public franchises, there was nothing the Westchester Lighting Company could do to prevent it. In August, 1916, the village granted the Lawrence company certain franchises. A street-lighting system involved the placing of wires underground, but under conditions the Westchester Lighting Company could not accept. The Lawrence company accepted the lighting contract. In a case of this kind, Commissioner Emmet says: "The question arises whether or not the circumstances are such as to require a rigid enforcement of what is now conceded to be the settled attitude of New York State toward wasteful competition between public utility companies." Commissioner Emmet points out that in the great majority of cases in years gone by competition between utility companies operating in a single field had produced very bad results from the points of view both of the public and the competing companies. "It was recognized that this kind of competition," Commissioner Emmet writes, "almost invariably resulted in the partial or complete crippling of enterprises which were subject to it, with the inevitable result that utility companies generally were not giving anything like as good service to the people as they might reasonably be expected to give under happier and saner conditions."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Increase in Rates in Kentucky.—The Kentucky Public Service Company, Bowling Green, Ky., has asked for an increase in rates for electricity and gas, due to the advance in operating costs.

Galena Company Establishes New Output Record.—During the week ended Oct. 20 the Interstate Light & Power Company, the Galena (Ill.) division of the Northern States Power Company, reached its largest single day's output of electrical energy, amounting to 116,000 kw.-hr.

Engineering Courses in Brown University.—The division of engineering of Brown University is beginning this year to inaugurate a revised course in engineering whereby the studies are closely the same for three years, the greater part of the specializing being reserved until the senior year.

Notes Sold by Chicago Company.—The Public Service Company of Northern Illinois has sold \$1,500,000 two-year 6 per cent notes to Lee, Higginson & Company and Halsey, Stuart & Company, Chicago. The notes, which are secured by \$2,000,000 first and refunding 5 per cent bonds, will be offered at about 97½ to yield 7½ per cent. They will be redeemable at 100½ if redeemed before April 1, 1919, and at 100 on and after that date.

Building Costs.—Building costs compiled by Russell B. Smith, civil engineer, co-operating with the Dow Service Daily Building Reports, show that the advance in electric wiring cost is less than in other items. According to the compilation building costs to-day, instead of being from 50 to 60 per cent above the costs before this country went to war, are not more than 30.7 per cent over costs ruling in 1914-15, when the building at the southwest corner of Thirty-eighth Street and Madison Avenue, New York, was estimated on. The actual gains in construction, separated into their various departments, show architectural terra cotta to have advanced 27.7 per cent; boiler stacks, 229.5; electrical wiring, 25.4; carpenter work, 5.1; elevators, 87.6; excavation, 29; exterior limestone, 30.4; fireproofing, 53; glass and glazing, 125; granite, 37.8; hardware, 31.4; heating, 132.7; interior marble, 20; mail chute, 10; masonry, 22; metal doors, 25; ornamental iron, 77.7; painting, 128.5; plastering, 22.5; plumbing, 41.2; plumbing fixtures, 35; roofing and sheet metal, 31.5; sprinklers, 129.4; stair treads (asphalt), 29; steel erection, 25; steel fabrication, 172.7; tile wainscoting and floors, 30.9; waterproofing, 5; windows (kalamein), 50.7. The total

increase in cost of building on the Eastern seaboard, therefore, including labor, is 30.7 per cent.

Minneapolis Company Publication Keeps Men in Government Service Posted.—The Minneapolis General Electric Company has begun publication of a four-page newspaper, *The Advance*, intended exclusively for employees and including especially those who are now in various cantonments and at the front. T. H. Kettle is editor.

Electrical Engineering in North Carolina State College.—Prof. William Hand Browne, Jr., professor of electrical engineering in the North Carolina State College of Agriculture and Engineering, West Raleigh, N. C., writes to the *ELECTRICAL WORLD* that the work in physics has been separated from that in electrical engineering and the department of physics is now under Prof. Charles M. Heck, who has been associate professor of physics at the college for some years.

Examination for Mechanical Draftsman.—The United States Civil Service Commission announces an open competitive examination for a male mechanical draftsman. Vacancies in the Panama Canal service or other branches of the service requiring similar qualifications will be filled from these examinations unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer or promotion. It is desired to secure the services of draftsmen capable of handling original design work on power plants, locomotives, steam shovels, etc. Mechanical draftsmen for the Panama Canal service are divided into two classes, depending upon qualifications. Competitors are urged to state clearly and completely their education and practical experience. Applicants should apply for Form 2118, stating the title of the examination desired, to the Civil Service Commission. Applications must be filed by Nov. 27, 1917.

Operating Conditions in General Gas & Electric Company.—President W. S. Barstow of the General Gas & Electric Company in a letter to stockholders says: "Substantial progress has been made in securing better rates, and in the solution of other operating problems. Financial needs have been taken care of so far as lies in our power, but in common with other similar companies, we face the new problem of inability to sell securities, and therefore are obliged to meet the necessary construction requirements through earnings or short-time financing. The resumption of full dividends on the cumulative preferred stock will depend upon two things: first, the restoration of normal financial conditions, so that securities may be sold to take care of the construction needs of the companies controlled, permitting distribution of earnings; second, improvement in the net earnings of the various properties controlled. Gross earnings are increasing, however, and new construction completed and under way as well as economies recently introduced will, we believe, result in an increase in net earnings."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Radio Club of America.—Dr. H. O. Taylor read a paper on "Thermocouples in Electrical Measuring Instruments," and Charles G. Kahant a paper on "Radio Frequency Instruments," at a meeting of the Radio Club of America in New York City on Oct. 27.

Institute of Radio Engineers.—"Some Aspects of Radio-Telephony in Japan" is the title of a paper presented by Eitaro Yokoyama, engineer of the Ministry of Communications, Tokio, Japan, at a meeting of the Institute of Radio Engineers held on Nov. 7 in New York City.

New Haven Section of the A. S. M. E.—The New Haven branch of the American Society of Mechanical Engineers will hold two sessions on Nov. 14. At the afternoon session papers will be read on the "Conservation of Fuel," and in the evening an address will be given by President Ira N. Hollis.

Council of the American Society of Mechanical Engineers.—On Nov. 16, in Chicago, the council of the American Society of Mechanical Engineers will meet. On this same date Major Peter J. Junkersfeld, member of the society, will address the Chicago Section on "Cantonment Construction."

San Francisco Electrical Development and Jovian League.—At the Oct. 24 meeting of the league Mrs. Robert J. Burdette made an address on "Food Conservation." The new officers of the league elected for the ensuing year are: President, Robert Sibley; vice-president, C. R. Fisher; second vice-president, H. C. Reid. W. S. Berry and E. O. Shreve were elected new members of the executive committee.

Schedule of Monthly Meetings of the Chicago Section, I. E. S.—The following is the schedule for the monthly meetings of the Chicago Section of the Illuminating Engineering Society for the coming season: Nov. 15, Prof. Francis C. Caldwell on "Preferred Proportions in Combining General and Localized Lighting"; Dec. 13, Arthur H. Ford on "Automobile Headlight Lamp Filaments and Measurements"; Jan. 17, W. A. Durgin on "Balancing the Light Beam"; Feb. 21, M. Luckiesh, on "The Lighting Art—Its Practice and Possibilities in Interiors"; March 21, Dr. Morton G. Lloyd on "The Relation of the Bureau of Standards to Illuminating Engineering"; April 18, Frederick J. Pearson on "Mistakes in Engineering as Applied to Illumination"; May 27, F. A. Vaughn on "Regulation of Street Series Lamps in Practice"; June 13, Charles A. Luther on "The Training of a Lighting Salesman."

H. A. Orr, manager for the Southern Public Utilities Company for the Anderson (S. C.) district, was elected president of the Southeastern Section of the National Electric Light Association at its recent annual meeting. Mr. Orr was born at Anderson, S. C., in December, 1876. He attended the Alabama Polytechnic Institute, taking a special course in electrical and mechanical engineering. His experience in the electrical field includes two years with the Stanley Electric Manufacturing Company, Pittsfield, Mass., in the test-

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

William S. Richard has been appointed electrical engineer of the Fort Wayne & Northern Indiana Traction Company, succeeding E. S. Myers in that post.

J. F. Law of Portland, Ore., has been appointed district manager of the electric service company at Lewiston, Idaho, succeeding W. M. Wood, now at the Portland office.

L. J. Moore, formerly chief load dispatcher of the San Joaquin Light & Power Corporation, Fresno, Cal., has been promoted to electrical engineer for the company, succeeding A. S. Kalenborn, who has resigned.

A. S. Kalenborn has resigned as electrical engineer for the San Joaquin Light & Power Corporation to become electrical engineer and superintendent of power for the Cerro de Pasco Mining Company at Cerro de Pasco, Peru.

Claude C. Brown, formerly in the steam department of the Pacific Gas & Electric Company, has become power engineer for the Hawaiian Sugar Refinery Company at Crockett, Cal., in charge of steam and electric operation and construction.

Alfred Sweeney, assistant to the general manager of the Cumberland County Power & Light Company, Portland, Me., has been elected assistant general manager. Although this is only a slight change in title, Mr. Sweeney's authority is considerably increased. Mr. Sweeney was graduated from Pratt Institute, Brooklyn, N. Y., in 1904. He entered the employ of the Lambertville Heat, Light & Power Company, Lambertville, N. J., as electrician, and was sent from there to Florence, S. C., to hold a similar position with the Florence Electric Light Company, which was under the same control. Later he went to Norfolk, Va., to work in the track and power departments of the Norfolk & Portsmouth Traction Company, and in 1908 he entered the employ of the Lewiston, Augusta & Waterville Street Railway at Lewiston, Me. The following year he was made superintendent of track, and in 1911 assistant to the general manager. In 1912 the Lewiston, Augusta & Waterville Street Railway was purchased by the Cumberland County Power & Light Company of Portland, Me., and the companies, together with the Portland Railroad, came under common control under one management. Mr. Sweeney continued until the present time in the position of assistant to the general manager of the combined companies, which afterward included the York County Power Company and the Westbrook Electric Company.

H. W. Magruder, manager of the Liberal (Kan.) Light, Ice & Power Company, which was taken over by the Commonwealth Light & Power Company on Nov. 1, has been retained as manager under the new ownership. In addition to the Liberal property, he will have direct charge of the two Dalhart properties of the company. Mr. Magruder is a former president of the Kansas Public Service Association. Mr. Magruder was born at Ebina, Mo., in 1880 and received his education in the schools of Pratt, Kan. When a young



H. A. ORR

ing and engineering department, and four years with the Anderson Water, Light & Power Company as engineer, after which he went with the General Electric Company in November, 1902, as manager of the new power department for the Atlanta (Ga.) district. There he did pioneer work in the electrification of cotton mills. In 1906 he left the General Electric Company to become president and treasurer of the Savannah River Power Company at Anderson, S. C., which company he organized and built. Three years later he was elected president and treasurer of the Anderson Water, Light & Power Company, and he remained at the head of these two companies until their purchase and consolidation with the Southern Public Utilities Company, when he assumed the duties of the position he now holds.

Leo F. Chambers has been appointed accountant for the Mankato (Minn.) division of the Northern States Power Company, succeeding O. T. McLean, resigned.

R. B. MacDonald, formerly general manager of the Fort Dodge (Iowa) Gas & Electric Company, has been made general manager of the People's Power Company, which operates in Moline, Rock Island, East Moline and surrounding towns.

George W. Milliken, local manager of the La Junta (Col.) division of the Arkansas Valley Railway, Light & Power Company, has been re-elected president of the La Junta Industrial Association, which office he has held for the last year.



H. W. MAGRUDER

man he went into the government railway mail service and later financed the electric plant at Liberal, of which he was made president. He has remained in that position ever since.

B. C. Condit, formerly chief engineer with the Southwestern Electric Company at Portland, Ore., is supervisor of electrical construction and equipment for the Crown-Willamette paper and pulp plant on the British Columbia coast.

Obituary

Oliver H. Hughes, chairman of the Ohio Public Utilities Commission, died in Columbus on Oct. 29 after an illness of several days. Mr. Hughes was appointed a member of the Ohio Railroad Commission in 1905, continuing as a member of its successor, the Public Utilities Commission, until 1915, when he resigned. Last January he was re-appointed.

Guy Edward Mitchell, for the last three years manager of the Westfield (Mass.) municipal lighting plant, died on Oct. 18 in his home in Westfield at the age of forty-eight. He had been ill for about two weeks with pneumonia. Mr. Mitchell was born March 11, 1869, at Lowell, Mass. After attending the Lowell schools he went to the Massachusetts Institute of Technology and was graduated as a mechanical engineer in 1891. He had a long and varied experience as a draftsman and in construction and electrical work of many kinds.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

APPARENT SHORTAGE IN LAMPS ONLY TEMPORARY

Investigation Reveals Larger than Normal Stocks of Standard Sizes, but a Shortage in Automobile Lamps Running Up to 50 per Cent

Reports of a shortage in lamps in certain sections of the country, particularly in the New England States and the Pacific Northwest, have led to a careful investigation by the ELECTRICAL WORLD. It appears that there is no valid reason for this unless it is transportation difficulties, and if stocks in the hands of the trade have been exhausted, as advices state, it is only a temporary condition and will soon right itself. An inquiry at one of the larger lamp works brought out the statement that normal business is so heavy that no reserve stock in standard sizes can be accumulated. The demand for automobile lamps has increased abnormally, and on this type makers have not caught up with the arrears.

On the Ford type—18-cp., 9-volt, 16½ bulb—it is impossible to fill requirements at the present time. There is an admitted shortage of 50 per cent, which, it was stated, rules the same with all the licensed manufacturers. On standard sizes of lamps there is also a 25 per cent increase in the specifications of jobbers and dealers over last year. In the New England territory and the Southwest the demand for lamps of 110 to 115 voltage, 25 and 40 watt, is such that the factory in question is unable to keep abreast of the sales. On these sizes it is not filling 100 per cent of orders—far from it. Normally for the last quarter shipments are 80 per cent, but 60 per cent is now about the average. The last quarter is always the busiest portion of the year. The stock of lamps on hand is on the whole the largest it ever has been and deliveries are being made in from three to four weeks. In some sizes deliveries can be made immediately, in others the delays vary, with carbon lamps on a four-month schedule.

Another manufacturer reports a very large stock in all its many warehouses in the standard sizes. One of its Eastern warehouses, in fact, asked that shipments be discontinued for a time as there was no more storage room available and the street was being utilized.

As a matter of fact, the lamp factories are in a strong position considering conditions, and stocks are relatively as ample as last year. Sign and high-voltage lamps are in liberal supply. The call for miniature lamps is so abnormal that orders are taken care of on percentage basis, and this condition will prevail for some time. The government has only requisitioned carbon miniatures, and no tungstens of any size are affected by the order. The prohibition of lead in the manufacture of either bulbs or lamps is in no way acknowledged at this plant. While the quantity of the metal in the glass is so small as to appear almost infinitesimal, the base of the lamp contains 80 per cent lead, and it was stated lamps cannot be made without it. Owing to the war some chemicals coming from Germany were shut off completely, but with lively work on the part of American chemists a domestic product was evolved, so that the glass-bulb factories will be independent of Europe for all future time.

If there is an apparent shortage in 25, 40, 50 and 60-watt lamps, it is ascribed to the acute pressure for these sizes at the army cantonments and naval bases. In the Pacific Northwest, owing to the enlarged shipyards and the increased number of lumber camps, in which the operations are not only greatly expanded but work is being carried on continuously, the stock of lamps in the hands of the local trade has doubtless been exhausted; but the manufacturers state that there is no reason for uneasiness. The shortage

is temporary only. The method of keeping up stock with jobbers and dealers is such that any serious curtailments, as in these cases, are quickly looked after and the remedy applied.

In carbon lamps the situation is peculiar. It is held that there is no excuse for the employment of these lamps at all, even from an economic standpoint. When the cost of energy is low and the breakage is great, as in steel mills, mines, etc., possibly the carbon lamp may be used to advantage; otherwise the tungsten type should be recommended always by the dealer to the consumer. Nevertheless, the increase in the demand for carbons has been in a greater proportion than the regular average. In 1916 the increase over 1915 was 50 per cent, and 1917 shows another 50 per cent increase over 1916. The demand for carbon lamps is not considered a true increase. According to the same authority, there is no sound excuse for the employment of carbon lamps, excepting possibly in the cases mentioned. They should be replaced by tungstens.

It is held that, generally speaking, the trade is rather reluctant or indifferent to the advantages of tungsten lamps over carbons from an economical point of view. The public should be better informed and educated on this point, declares this manufacturer, and steps are being taken to overcome the wrong idea that tungsten lamps are more expensive to maintain or more delicate to handle than the carbons. There is a willingness to provide for additional productive capacity for the future, but none to use the plant expansion for turning out carbon lamps. This type is reckoned obsolete, with the smaller factories discontinuing their manufacture altogether, making tungsten lamps exclusively.

To sum up, outside of automobile lamps and headlights for automobiles, which have almost wholly superseded acetylene lamps, and on which the factories are unable to keep up with orders, even with the substantial increases of product, the supply is satisfactory. The trade is advised that in placing orders requirements should be anticipated as much as possible, at least three weeks in advance. Labor conditions, raw material and freight congestions should all be considered, in justice to the manufacturer. Agents, jobbers and dealers ought to know and should see that the records of the different types of lamps are properly assorted. So far no hoarding is reported, and the factories are prepared to prevent it if such an emergency arises.

MOVEMENT TO DISPENSE WITH TRADE HOLIDAY CARDS

The Savings Thus Effected Are to Be Devoted to Red Cross or Other Relief Funds Where They Will Be of Real Service

Even if not for business, certainly for patriotic reasons, in conserving the supply of materials and utilizing labor to the best advantage, many economies are finding their way into commerce. One of the latest, a movement started in Chicago, is to dispense with Christmas and New Year's business greetings this year.

Ordinarily several hundreds of thousands of dollars are spent each year by business houses and manufacturers in these seasonable greetings. The Chicago firms with which the idea originated of breaking the custom this year have decided to contribute the money that they would ordinarily spend in this manner to the Red Cross or other relief organizations where it will do real service.

The saving in labor and materials if a sufficient number of organizations take the matter up will be considerable in

addition to lightening the burden on the post office. In this latter case the requirements of the National Army have reduced the number of employees seriously. Any way in which the burden on this smaller force can be lessened, especially at a time when the holiday rush is on, will help the delivery of more important mail.

ELECTRICAL TOYS SELL BETTER THAN EVER NOW

An Advance in Price of from 33 to 60 per Cent,
According to the Materials Used, Is the
Announcement Made for 1918

Buying of electrical toys of various descriptions during the current season is in advance of that recorded in previous years. The larger orders were booked months ago and the goods delivered, and present orders are of the filling-in description. Manufacturers at the present time are busy preparing their new catalogs, which will be issued in time for the regular opening of the market in January. Road men are out in the trade looking for business on next year's account, and also to close the pre-holiday sales. An advance, effective Jan. 1, 1918, of from 33 per cent to 60 per cent, according to the material used in the various specialties, is also announced for the coming season. The electric range still continues a popular seller. Among the latest novelties is a steel-armored car, with revolving turret and the usual appurtenances of the real war article, operated either in connection with an electric train or singly.

Another arrival in the toy field is an improved, low-priced toy transformer, while a two-speed motor is a recent improvement in toy motors. Dolls, bears and animals with flashlight eyes are of many varieties and strong sellers. In fact, the expansion of the electric toy field is proceeding rapidly, and along lines of notable progression. Tree-lighting effects are normal as to sale and mechanical status. Deliveries are fairly good if shippers are favored with cars, and prices on staples will depend, for mechanical devices at least, on conditions in the metal market. Some firms have sufficient metal stock now on hand to fill their requirements for two years ahead.

METAL MARKET SITUATION

Changes Are Not Radical, with Aluminum a Shade
Lower, Tin and Lead Advancing

No great difference has been noted in the metal market during the past week. Copper is officially at a nominal figure, but none can be had except at a stiff premium, and there are indications of a scarcity of the metal for several months ahead. Tin has gone up four points, aluminum is under last week's figure, and heavy lead is up.

The metal market still continues to cause uneasiness in every branch of the trade, with no definite dates for deliveries.

NEW YORK METAL MARKET PRICES

	Oct. 29			Nov. 5		
	£	s	d	£	s	d
Copper:						
London, standard spot.....	110	0	0	110	0	0
Prime Lake	Govt. price	23.50		Govt. price	23.50	
Electrolytic	Govt. price	23.50		Govt. price	23.50	
Casting	Govt. price	23.50		Govt. price	23.50	
Wire base	29.00	to	31.00*	30.00	to	31.00
Lead, trust price.....	5.50			6.00		
Nickel, ingot	50.00			50.00		
Sheet zinc, f.o.b. smelter.....	19.00			19.00		
Spelter, spot	7.80			7.67½		
Tin, Straits	64.50			68.00		
Aluminum, 98 to 99 per cent..	34.00	to	36.00	33.00	to	35.00

OLD METALS

Heavy copper and wire.....	22.00	to	22.50	21.50	to	22.50
Brass, heavy	14.00	to	16.00	14.00	to	16.00
Brass, light	10.50	to	11.00	10.50	to	11.00
Lead, heavy	4.75	to	4.87½	5.00	to	5.25
Zinc, old scrap	5.00	to	5.50	5.00	to	5.50

*Nominal

THE WEEK IN TRADE

LABOR disturbances, particularly in the Northwest, are probably of the greatest significance at the present time. With winter approaching fast, labor unrest can be expected to grow because domestic expenses become heavier. In the East there have been many indications of a growing uneasiness on the part of labor.

The government's exercise of priority rights is being experienced in almost all lines, and consequently deliveries on private contracts are more uncertain than they were. In addition, the transportation facilities of the country are becoming taxed to the point where congestion again prevails on shipments in certain directions.

Prices generally are stable and collections and credits good.

NEW YORK

Transportation problems are becoming more and more pressing, and as a result deliveries to the Eastern seaboard are becoming worse. In certain lines, particularly conduit, this situation is somewhat alarming. In certain of the building lines relief is being sought through full-car shipments. Where there is not enough to fill a car co-operation is sought among non-competing lines going to the same place. There is no evidence of a general adoption of this plan as yet by the electrical industry.

Demand, except for building materials, is being maintained, and prices show no change. Credits are receiving more than usual scrutiny, although collections are large.

CONDUIT.—For a year deliveries of interior conduit have been an uncertain quantity, if not altogether negligible, if the reports of the sales offices in this territory may be followed. It is emphatically stated that not only is conduit scarce but none is to be had, government embargoe blocking deliveries. Prices are as high as they can go without upsetting all trade buying.

MOTORS.—In sizes up to 25 hp. deliveries are often made out of stock, with the demand falling off. The larger sizes are still far behind, and the date of probable shipment is a matter of negotiation in all contracts for apparatus of this size. The demand for motors of all sizes has varied within the last year or more, different industrial groups coming into the market from time to time with their requirements. Further changes in this respect are being figured on for the future, so much so that houses in this line describe their position as radically different from that normally occupied by them.

COLLECTIONS AND CREDITS.—Jobbers' collections are reported as slow on contractors' accounts. This is owing to the uncertainty of merchandise deliveries. As contractors cannot get their money until the "job" is completed, the hold-up of an order for special requirements to meet the situation acts as a natural deterrent in liquidating bills. The smaller jobbers are charged with speculating on market possibilities in certain lines, and being woefully disappointed by an unexpected drop in prices, and are therefore not in a happy frame of mind regarding their indebtedness. The Moral Risk Club, a membership of eleven jobbers in New York City, acts as an informal clearance house for collections and credits, and the reciprocal exchange of information is both interesting and valuable to its members. Among the manufacturers collections are firm, with credits reckoned on anything but an inflated basis.

REFLECTORS.—There is no change in prices. Stocks in the hands of distributors and jobbing houses vary according to the foresight of these houses. Deliveries are as good as could be expected, all factors being considered.

FREIGHTS.—Not only are freights causing embarrassments for every branch of the trade, but the performances of the express companies are no better, if they are not worse. Deliveries to dealers and contractors cannot be promised on a guaranteed basis, and conditions are expected to get worse rather than better owing to the anticipated military commandeering of transportation facilities.

FUSES.—With jobbers stock is reported as satisfactory, and deliveries are of a fair average. This is occasioned by the factories catching up with orders. Sales are more or less subject to the pressure of competition, with a trade increase of fully 50 per cent over last year at this time. Top prices prevail, with no relief in sight.

HOLLOW WARE.—Percolators, chafing dishes, etc., are not in such full supply as could be wished. Deliveries are back thirty days, with prices stationary. No change is anticipated.

LIGHT FIXTURES.—A tendency to advance prices is acknowledged, though no recent change has occurred. This is caused by the uneasiness observable in the metal market. Deliveries from factory to jobbers are not complained of especially, but pending labor troubles are making for uncertain shipping and price conditions.

CHICAGO

There is reassurance in the monthly review of business for November issued by the National Bank of the Republic, Chicago, because it indicates a belief that business in general has come through the period of uncertainty.

One thing that is noticeable among the jobbers is that stocks which heretofore were maintained above normal are now characterized as "just ordinary." All speculative holdings have been sold. There is not much change in the volume of business. In some quarters a slight falling off for the week was noted. Prices are very steady and have been for two weeks. Credits and collections are about normal.

SHIPMENTS.—No appreciable trouble has been experienced by trade in getting shipments from factories where the factories can ship. Railroad embargoes have not interfered.

SOCKETS.—Ordinary stocks are being carried by jobbers. The shortage reported in the East has not been felt in the Middle West as yet, possibly owing to the fact that jobbers have not been buying many sockets lately.

WIRING DEVICES.—Of this class of supplies conduit continues to be the feature. It is very difficult to get because of government activities.

LAMPS.—The chronic delivery situation still prevails to some extent, although 25, 40 and 60-watt sizes are easing up somewhat. Surprise is expressed that price advances have not already been made and the fact that new contract forms are out is taken to mean that "there is something in the air."

COPPER WIRE.—Most jobbers are selling rubber-covered wire on a 34-cent or 35-cent base. The market has apparently been swinging between 34 cents and 37 cents, but when discounts are considered it is shown that wire is pretty steady around 34 cents.

MOTORS.—When present stocks, of which there are a few, are depleted the Chicago motor market bids fair to get into a worse state than it is at present. Deliveries from factories run from two months to refusal to quote.

WASHING MACHINES AND VACUUM CLEANERS.—While sales are holding up well locally the impression prevails that "time payment appliances" are not as popular as they were a few months ago.

HEATING DEVICES AND HOLLOW WARE.—Christmas trade is picking up. The snow in Chicago made buyers think. In two weeks some jobbers look to see Christmas buying by dealers in full swing.

BOSTON

Business activity continues practically unabated in the electrical trade. Jobbers are very busy and report a healthy trade in appliances. Motors are still in large demand, and prices show no change, barring variations affected by delivery conditions. Labor is getting scarcer and some disturbing demands are being received here and there. The production of war craft has been impeded by a strike still in progress at the Fore River plant, and there is no change in the strike situation in the New England repair and dis-

tributing plant of the Western Electric Company. The State Board of Arbitration issued a finding against the company a few days ago relative to the cause of the disturbance, but as yet the company has made no public statement as to its case. The lamp situation, for the present, appears to be getting no worse. A slight increase in building operations is noted, but not enough to affect the electrical market to any great extent. Collections are about the same as last week and deliveries are, if anything, poorer. Contractors are feeling the adverse effect of high wages paid for government and related work. One prominent contracting engineer said this week that the government should fix the price of labor as well as the price of materials, thus stabilizing the man market.

APPLIANCES.—A brisk trade is reported, following a slight lull three or four weeks ago. One central station has just sold \$7,000 in vacuum cleaners, the campaign covering but a few weeks. Continued warm weather has slowed down the demand for electric radiators to a point where undersales are reported in some quarters. Washing machines are moving well and there is a noticeable industrial demand for flashlights. One of the largest central stations reports that the advances of the year in high-class percolators and chafing dishes have, temporarily at least, been reflected in a decreased volume of sales. Fixtures are moving rather slowly, owing in part to the frequent turn-over in illuminating styles for commercial installations. The outlook is good for a substantial business in portable lamps, this trade having begun to develop materially.

MOTORS.—Eight months' delivery is still quoted on motors of over 100-hp. rating by one large dealer, and in general the motor situation shows little change. The government is exerting its priority powers without compunction. On a recent order covering nearly 800 hp. in motor units for government service the first delivery will be made in two months, and thereafter at least one motor per week will be shipped. The demand is too great to allow much factory stock accumulation. No price changes are in sight.

AUTOMATIC TIME SWITCHES.—Demand is increasing and deliveries are lengthening somewhat. Popular appreciation of the value and reliability of this class of equipment as a labor-saving device is growing.

ELECTRIC RANGES.—Substantial orders are being handled for industrial plant service. Naval requirements are very pressing. Deliveries are fairly good on standard equipment in stock sizes.

LAMPS.—At the moment the supply of lamps is fairly plentiful. It cannot be denied that there is a shortage in some makes and sizes, but the manufacturers are alive to the situation and are doing much to supply the demand on a fairly steady basis. Hoarding of lamps is under the ban at present. The prospects are that the shortage will increase before winter is over. In some cases fair-sized local stocks are being manipulated, at least temporarily.

GLASSWARE.—Long deliveries and uncertain shipments are reported on glassware of highest grade from foreign makers.

WIRE AND CABLE.—The government is said to be taking about 85 to 90 per cent of the wire production of the country. This naturally is disorganizing deliveries, and customers not occupied immediately in war service are seriously handicapped. There is a general disposition to recognize the justice of the government's needs. The wire market is a little soft, on account of the federal price fixation, but little opportunity exists to take advantage of this situation, on account of the uncertainty of deliveries.

MOTOR-DRIVEN BLOWERS.—The industrial demand is about 100 per cent above normal and the government demand most vigorous.

COAL-HANDLING MACHINERY.—Inquiries are numerous, deliveries fair and prices reasonably stable.

ATLANTA

The number of building permits shows a substantial increase over last week for the Southeastern section. Residence building in Atlanta also is showing a marked improvement. The construction of apartment houses has

taken another spurt and a number of high-class structures are contemplated. Activity in apartment house building this year has increased the volume of fixture sales materially, and the outlook appears very good for this demand to remain steady for some time.

Building operations in Atlanta during the past year have steadily increased as reflected in the report from the building inspector's office setting forth a comparison of the valuation of building permits issued for the first ten months this year and those for the same period of 1916. The permits thus far issued this year list building valuations for work already under way at \$4,478,139, compared to \$3,159,450 for the first ten months last year, the increase thus being \$1,318,689. A number of new buildings that have been formally approved by the building inspector and which have just started have not been listed in the permit valuation, and for this reason permits for the month of October do not show up so well as they should. But the heavy increase in total valuation for the year as a whole is the indication that promotes optimism in building and electrical circles of the city.

STAMPED-STEEL BOXES.—Demand has been above normal, with probably the exception of Atlanta, where these boxes always have to be used on nearly all jobs in the city limits where work is being done under city inspection. One manufacturer is offering lots at an approximate shade of 5 per cent under the market.

RIGID CONDUIT.—The market is comparatively steady for both the white and black. Shipments are being made in four weeks, which indicates a slight improvement for this section.

TEXTILE APPARATUS.—The volume of business in this line has shown a considerable decrease lately compared with the earlier months of this year. This condition is to be expected, however, as a number of underlying conditions affect this class of apparatus. The main factor is that the large hydroelectric companies in the Southeast supplying energy in large blocks have about reached the point where all surplus energy is contracted for, and they are unable to take on any more business at this time. Then, too, extensions of considerable distances are very costly at present, while a year ago money was much easier and labor and material more reasonable. Furthermore, no new mills are being built, and the shipment on turbines and motors is very discouraging, not to mention the difficulty of securing coal, regardless of price.

ARMORED-STEEL CONDUCTOR.—More activity is noted in this class of goods for the past week. The price remains firm and stocks are holding up well.

TRANSFORMERS.—One manufacturer reports an advance of 10 per cent on the 2300-volt distributing type up to 200 kva. This advance will not affect present transformer contracts, however. Manufacturers also report an improvement in shipments on ratings up to 100 kva.

SEATTLE

The sales of electrical equipment and machinery to shipyards and allied industries show a slight increase over last week, due to the active resumption of work following strikes in both steel and wooden concerns. Sales were about the same in volume as during the weeks preceding the strike.

Sewing machines, washing machines and heaters are moving particularly well. Dealers have planned for and expect a heavy holiday business in practical energy-consuming devices which relieve the labor of the home.

Automobile lamps are moving well, but stocks are low. Floodlamp sales are increasing, and stocks are in a satisfactory condition.

The sales of farm lighting outfits exceed the expectations of the most optimistic, and results of the recent campaign are not yet completely known.

Prices show no noticeable changes. Stocks along some very important lines are exceedingly low, particularly for ¾-in. conduit, the kind the government especially needs; lamps, in the larger sizes particularly; rubber-covered wire and the larger-size motors. These shortages are expected to continue.

The car situation in Washington is reported a little better, on account of combined shipments, cars being loaded to capacity. Through the efforts of the railroads and commissions the Oregon situation is reported about the same, with no decided improvement indicated.

Building operations in the Northwest, long dormant, have received a slight impetus during the week with the announcement of the immediate construction of seven cantonment buildings at the three forts at the mouth of the Columbia River in Oregon, and 150 residences in Charleston, Wash., for the employees at the Bremerton Navy Yard. Big construction, however, in the cities of the Northwest is at a standstill. The local labor situation is chaotic as never before in the history of this section.

More than ordinary discretion is being exercised in placing credits. Especially is this true with small wooden shipbuilding concerns which give the slightest indications of improper or inadequate financing. Because of the scarcity of materials, particularly those used by shipyards—namely, conduit, larger sizes of wire, lamps, motors and the like—dealers naturally prefer and elect to do business with firms of unquestioned credit. There is no necessity for dealers to take chances when the risk is recognized. The placing of credits with the smaller machine shops, lumber mills and like industrial enterprises is being scrutinized closely. A slight preference is being shown establishments which are not dependent upon government contracts for their being and successful operation. Collections are easy and satisfactory, with the exception of government accounts, which are necessarily more or less slow because of routine. However, good government contracts, provided that the concerns have ample financial backing, entitle their holders to unlimited credit.

A strike of approximately 1300 union electrical workers and telephone operators in the employ of the Pacific Telephone & Telegraph Company in Seattle for increased wages and recognition of the operators' union was declared Oct. 31 at midnight.

SAN FRANCISCO

The inactivity in building construction has diverted effort into new fields. The attention of contractors, and to a certain extent of dealers as well, is just now upon the industrial lighting field, which is the most active. Night shifts are being put on in many plants and much improvement of the lighting systems has resulted. The demand for floodlighting equipment is also heavy, and the large number of factories increasing their output creates a steadily growing business in transformers, motors, wire, conduits, sockets, outlets, switches, etc.

The car shortage, which has grown daily more acute in California, has reached a stage where it is bound to hurt the electrical trade, not only in delaying shipments, but because of losses that depress business conditions generally. It is reported, for example, that in one community 2000 carloads of table grapes spoiled this year because freight cars were not available for getting them to market.

CREDITS AND COLLECTIONS.—With the contractors finding employment on industrial work and the rural fields in prosperous condition, collections are generally in a very satisfactory condition. There have been no failures to shake confidence, and credits are holding up even better than had been expected.

FLASHLIGHTS.—An unusually heavy demand for flashlights has been notable in recent weeks. It is believed that this is largely due to buying for men who are going into the National Army training camps.

STORAGE BATTERIES.—The demand for batteries is growing rapidly. Orders are coming from builders of tractors for government use, from shipbuilding firms and from a large number of automobile owners who want a better grade of battery than that supplied on some new cars.

CONDUIT AND SOCKETS.—Stocks are fair and an active demand is being handled satisfactorily. Delivery is quoted for ninety days.

WIRE.—Stocks of weatherproof are still low, but the condition is improving somewhat in most other lines.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor	
No. & S. Size	List, per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor	
No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor	
Less than coil.....	+10% to list net
Coil to 1000 ft.....	—10% to \$59.17
Less than coil.....	+10% to list net
Coil to 1000 ft.....	—10% to \$68.87

Twin-Conductor	
Less than coil.....	+10% to list net
Coil to 1000 ft.....	—10% to \$105.00
Less than coil.....	+10% to list net
Coil to 1000 ft.....	—10% to \$130.95

DISCOUNT—CHICAGO

Single-Conductor	
Less than coil.....	+10%
Coil to 1000 ft.....	—10%

Twin-Conductor	
Less than coil.....	+10%
Coil to 1000 ft.....	—10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10% to list net
1/5 to std. pkg.....	15% to 20%
Std. pkg.....	28% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+20% to 12%
1/5 to std. pkg.....	List to 20%
Std. pkg.....	28% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.31 to .32
Barrel lots.....	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 30.....	.35	.35
50 to barrel.....	.31 to .3175	.32 to .3275
Barrel lots.....	.28 to .2875	.29 to .2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. Per Coil	List, Per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2 double strip.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp. \$75.00	\$63.75 to \$69.75
3/8-in. d. stp. 75.00 to 82.50	68.25 to 75.00
1/2-in. s. stp. 100.00	85.00 to 93.00
1/2-in. d. stp. 100.00 to 110.00	91.00 to 100.00

NET PER 1000 FT.—CHICAGO

Less Than Coil	Coil to 100 Ft.
3/8-in. single strip.....	\$75.00 \$63.75
3/8-in. double strip.....	75.75 71.27
1/2-in. single strip.....	100.00 85.00
1/2-in. double strip.....	105.00 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
5/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
3/4.....	.15	2.....	.55
1.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—		
\$25.00-\$55.00	\$20.50-\$24.75	\$20.00-\$22.00
1/4-in.—		
\$28.00-\$60.00	\$22.50-\$27.00	\$22.00-\$24.00

NET PRICE 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—		
\$36.69-\$55.00	\$27.50	\$24.75
1/4-in.—		
\$40.00-\$60.00	\$30.00	\$27.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/4
3/8.....	.08 1/2
1/2.....	.08 3/4
3/4.....	.11 1/4
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List	Elbows, List
1/4.....	\$0.05 \$0.19
3/8.....	.06 .19
1/2.....	.07 .19
3/4.....	.10 .25
1.....	.13 .37
1 1/4.....	.17 .45
1 1/2.....	.21 .60
2.....	.28 1.10
2 1/2.....	.40 1.80
3.....	.60 4.80

DISCOUNT—NEW YORK

Less than 2500 lb.....	1/4 in. to 1/2 in. 4% to 6%	3/4 in. to 3 in. 7% to 9%
2500 to 5000 lb.....	6% to 8%	9% to 11%
(For galvanized deduct six points from above discounts.)		

DISCOUNT—CHICAGO

Less than 2500 lb.....	1/4 in. to 1/2 in. 3.4% to 4.8%	3/4 in. to 3 in. 6.4% to 6.8%
2500-5000 lb.....	6.4% to 7.8%	8.4% to 9.8%
(For galvanized deduct six points from above discounts.)		

FLATIRONS

NEW YORK

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

CHICAGO

List.....	\$5.00 to \$6.00
Discount.....	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK.

	Per 100 Net
Less than 1/5 std. pkg.	\$5.00 to \$5.75
1/5 to std. pkg.	4.50
Standard package, 500. List, each,	\$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500. List, each,	\$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B	100	\$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulbs, 3 1/2 in., frosted:		
15-watt—G	25	.50
25-watt—G	25	.50
40-watt—G	25	.50
Round bulbs, 3 in., frosted:		
60-watt—G	30	.72
Round bulbs, 4 in., frosted:		
100-watt—G	35	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$30.00 to \$33.98
Coil to 1000 ft.	25.50 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$36.24 to \$36.56
Coil to 1000 ft.	27.18 to 27.42

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	\$20.00 to \$29.00
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CHICAGO

Net per 100	\$19.25 to \$25.75
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OUTLET BOXES

Nos.	List, per 100
101—A, A1 1/2, 4 S.C., 6200, 320.	\$30.00
102—B.A., 6200 S.E., 300, AX, 1 1/2, 4 S.	30.00
103—C.A., 9, 4R, B 1 1/2	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list.	25%	32%
\$10.00 to \$50.00 list.	42%	40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list.	40%	37%
\$10.00 to \$50.00 list.	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.00 to \$38.00
1/5 to std. pkg.	13.60 to 19.00
Standard package, 2200	List per 1000, \$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80 to \$20.54
1/5 to std. pkg.	14.80 to 19.24
Standard package, 2200	List per 1000, \$20.

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
5 1/2 N.C.—Solid Nail-it—N.C.			
Less than 1/5 std. pkg.	\$20.00 to \$29.00	\$23.20 to \$30.75	
1/5 to std. pkg.	13.50 to 15.60	18.70 to 24.20	

CHICAGO

	Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
5 1/2 N.C.—Solid Nail-it—N.C.			
Less than 1/5 std. pkg.	\$11.85	\$30.75	
1/5 to std. pkg.	11.10 to 11.40	24.20	

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/2-in. cap key and push sockets	500	\$0.33
1/2-in. cap keyless socket	500	.30
1/2-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:				
30-amp. S. R. S. T.				\$0.80
60-amp. S. P. S. T.				1.20
100-amp. S. P. S. T.				2.25
200-amp. S. P. S. T.				3.48
300-amp. S. P. S. T.				5.34
30-amp. D. P. S. T.				1.20
60-amp. D. P. S. T.				1.78
100-amp. D. P. S. T.				3.38
200-amp. D. P. S. T.				5.20
300-amp. D. P. S. T.				8.00
30-amp. 3 P. S. T.				1.80
60-amp. 3 P. S. T.				2.68
100-amp. 3 P. S. T.				5.08
200-amp. 3 P. S. T.				7.80
300-amp. 3 P. S. T.				12.00

Low Grade:				
30-amp. S. P. S. T.				0.42
60-amp. S. P. S. T.				0.74
100-amp. S. P. S. T.				1.50
200-amp. S. P. S. T.				2.70
30-amp. D. P. S. T.				0.68
60-amp. D. P. S. T.				1.22
100-amp. D. P. S. T.				2.50
200-amp. D. P. S. T.				4.50
30-amp. 3 P. S. T.				1.02
60-amp. 3 P. S. T.				1.84
100-amp. 3 P. S. T.				3.76
200-amp. 3 P. S. T.				6.76

DISCOUNT—NEW YORK

	High Grade
Less than \$10 list.	List net to + 5%
\$10 to \$25 list	Net to 11%
\$25 to \$50 list.	14% to 15%

	Low Grade
Less than \$10 list.	5% to 10%
\$10 to \$25 list.	10% to 16%
\$25 to \$50 list.	14% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than \$10 list	+5%
\$10 to \$25 list	11%
\$25 to \$50 list	14%

	Low Grade
Less than \$10 list.	5%
\$10 to \$25 list.	16%
\$25 to \$50 list.	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.64
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to net
1/5 to std. pkg.	Net to 15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

	Union and Similar—	List, Each
No. 155		\$0.34
No. 160		.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list	List Net	List Net to + 10%
\$2.00 to \$10.00	10% to 20%	5% to 10%
\$10.00 to \$50.00	20% to 30%	15% to 20%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list	25% to 50%	20% to 40%
\$2.00 to \$10.00	25% to 50%	20% to 40%
\$10.00 to \$50.00	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	\$5.00 to \$7.50
Discount	25% to 30%

CHICAGO

List price	\$5.00 to \$6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

No. 18, less than full spools.	\$0.44 1/4 to \$0.65
No. 18, full spools.	0.43 1/4 to 0.55

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	\$0.57 1/2 to \$0.65
No. 18, full spools.	0.50 1/2 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net					
No.	Less than 500 Ft.		500 to 1000 Ft.		1000 to 5000 Ft.	
11.	\$15.00	\$18.00	\$13.00	\$14.00	\$11.25	\$12.00
12.	23.25	27.09	21.30	23.22	19.35	20.85
10.	32.40	37.80	29.70	32.40	27.00	29.25
8.	45.70	53.34	41.90	45.73	38.00	41.38
6.	72.40	84.42	66.35	72.40	60.30	65.50

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14 ...	\$18.00	\$13.50	\$12.00
12 ...	25.21-27.37	21.30-27.37	17.40-23.46
10 ...	35.29-38.25	29.82-32.72	24.35-30.60
8 ...	49.91-54.27	42.18-46.43	34.45-43.42
6 ...	78.95-92.61	60.85-79.23	45.76-74.04

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$35.25 to \$40.00
25 to 50 lb.	35.25 to 39.00
50 to 100 lb.	34.25 to 38.00

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	\$40.00 to \$40.50
25 to 50 lb.	39.00 to 39.50
50 to 100 lb.	38.00 to 38.50

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Colored Lamp Shade

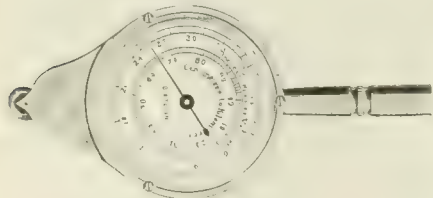
The Pittsburgh (Pa.) Lamp, Brass & Glass Company is manufacturing a red, white and blue lamp shade for use with the usual types of electric light fixtures. The shade is 5 in. (12.7 cm.) high and measures 4 in. (10 cm.) in diameter at the base. In addition to private residence trade, this shade is useful for banks, Red Cross booths, enlistment offices and military outfitting departments of stores.

Firebrick from Coal Ashes

Brick made from coal ashes, suitable to substitute for fireclay brick, building brick, etc., is possible, so it is claimed, by a new process which has recently been developed by the Wagner Fire Brick Company, Scranton, Pa. This company points out that tests have shown that these bricks placed in service and subjected to 3000 deg. Fahr. (1650 deg. C.) gave three times the service that the common firebrick gave. The fusion point is from 2600 deg. to 3250 deg. Fahr. (1427 deg. to 1788 deg. C.), depending on character of binder used; crushing strength, 130 lb. and over to the square inch (9.1 kg. per sq. cm.), with a 22.5 per cent porosity.

Measuring Device for Estimating

The rotary measuring instrument or "map measure" which is illustrated herewith is valuable in rapidly scaling blueprints for estimating purposes. It makes possible a direct reading in inches of the distance between lighting outlets and distribution centers in any desired course. This instrument, which is durably made and well finished, is manufactured by the Eugene Deitzgen Company of Chicago. The use of the instrument is simple. The tracer wheel is placed at one end of the line



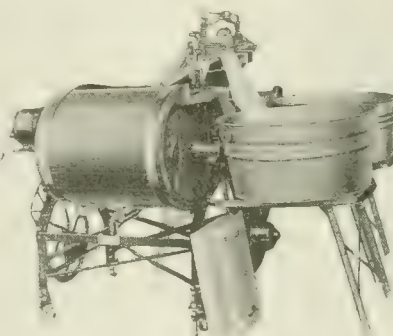
DEVICE THAT SCALES BLUEPRINTS RAPIDLY

to be measured and is then rolled to the other end of the course. The reading on the dial represents distance in inches between the two points. The actual length can be readily obtained from the scale of the drawing. An inner scale is provided on the instrument,

graduated in centimeters, thus enabling inches to be quickly converted into centimeters and vice versa.

Washing Machine

The Buckeye Churn Company of Sidney, Ohio, is manufacturing a washing machine which it claims to be the first ever constructed to wash clothes by employing the principle of surface tension. The tub contains no corrugations or rubbing devices and is entirely smooth inside. The machine depends for its cleaning qualities upon the hammer stroke of the elliptical tub, which breaks up the soapy water and drives it through the fabric of the clothes. One type which the company makes has a capacity of ten sheets or their equivalent and operates at a speed of from forty-eight to fifty-five strokes per minute. The tub is made of fir staves held together by tank lugs which are adjustable. The metal lid



FEATURE IS THE HAMMER STROKE OF THE ELLIPTICAL TUB

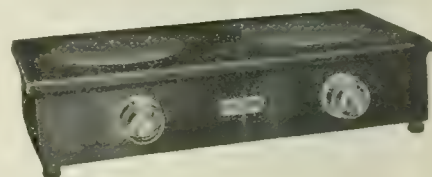
is steam-tight. The frame is made of cast iron and is mounted on casters which may be lifted from the floor by adjustable screws that permit leveling on an uneven surface. All gears are inclosed and run in oil. The wringer is of the swinging reversible transmission type. The machine is driven by a 1/6-hp. Invincible washing-machine motor. The Sidney Electric Company, Sidney, Ohio, is the distributor.

Regulating Socket

A socket carrying an Edison base and having sufficient capacity to regulate small-size 110-volt motors is now being manufactured by the Wirt Company, Germantown, Philadelphia. Four steps are provided, ranging from 0.3 amp. to 0.6 amp. Either gunmetal or nickel finish may be furnished. A milled fiber ring mounted on the socket provides an easy control of the resistance.

Double-Disk Stove

Stoves that are very durable for lunch rooms, schools, hospital diet kitchens and many other places where quick work is desired have been brought out by the Simplex Electric Heating Company of Cambridge, Mass. These stoves contain the company's new type of inclosed-coil heating units which



WILL STAND CONTINUOUS USE ON HIGH HEAT

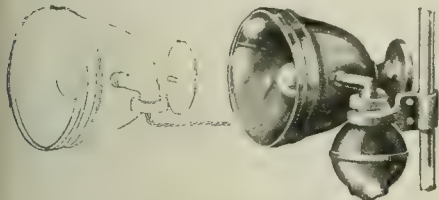
have enabled the makers to produce many types of heating and cooking appliances that will stand very severe usage, it is claimed. The tops of these stoves may become red hot when used continuously on high heat and the elements will not burn out when used this way continually. Each stove is 8 in. (20.3 cm.) in diameter and has three heats, with a maximum wattage of 1200.

Rotary Automatic Starters for Motors

Rotary starters for the automatic acceleration of single-phase polyphase and direct-current motors are made by the Machine Products Company of St. Louis, Mo. This type of starter is inclosed in a substantial housing screwed to the ends of the motor and carrying a set of brushes. It consists of a plate mounted upon the motor shaft and rotating within the housing. Upon this plate are carried a set of slip rings, a set of laminated contacts, a centrifugally operated mechanism and a ventilated type of resistance. The resistance element is always in series with the motor circuit, the current being carried to the starters through the medium of the brushes and slip rings. Upon closing the motor switch the plate revolves with the armature and the weights are gradually thrown outward by centrifugal force and in direct proportion to the increasing speed of the motor. These weights actuate the contact arm, and the resistance is cut out of the motor circuit as the armature attains full speed. A device is provided which prevents the return of the contact arm should the motor speed decrease owing to load or decreased voltage, but which allows its return when the motor has come to a standstill.

Electric Spotlights for Motor Cars

The latest development in the line of automobile electric spotlights manufactured by the Anderson Electric Specialty Company, 562 West Van Buren Street, Chicago, is a lamp the frame of which is designed to clamp to the windshield of the motor car. An automatic



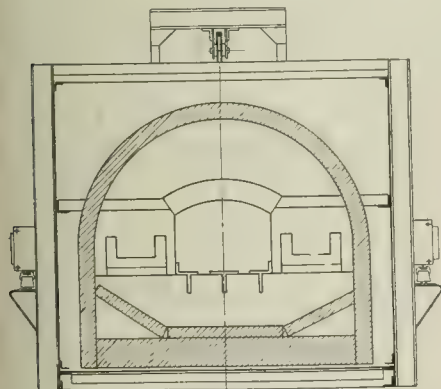
DESIGNED TO CLAMP ON WINDSHIELD

cord reel carrying 12 ft. (3.7 m.) of extension cord is used. By loosening a knurled nut the lamp can be removed for inspection of the motor car, thus converting it into a portable light. When in place the lamp acts as a dirigible searchlight within easy reach of the driver's hand.

Electric Furnaces

Electric furnaces of the resistor type which differ from the arc-type melting furnaces for melting steel in the same general way that the incandescent lamp differs from the arc lamp are made by the Electric Furnace Company of America, Alliance, Ohio. In general detail the furnaces are inclosed in a steel shell having an inner chamber wall of firebrick, the space between this brick wall and the steel chamber being filled with heat-insulating material.

Inside the furnace chamber formed by the firebrick walls are placed two troughs, one on each side of the furnace. These troughs are composed of highly refractory carbide. At the ends of this trough are carbon or graphite electrodes extending from the end of the trough inside the furnace through the wall of the furnace to the outside,



SECTIONAL VIEW OF RESISTOR TYPE OF FURNACE

where each is connected to its electric cable and to the electric service lines through the special transformer always supplied with the furnace.

The trough just referred to is filled with broken carbon or graphite from electrode to electrode, and when the

current is on electricity flows from electrode to electrode through this broken carbon bed, which becomes incandescent through its entire length in the same manner as an incandescent lamp filament or wire. The heat from this huge filament is radiated to the roof of the furnace, and then back onto the hearth of the furnace itself and to the material to be heated. This type of furnace is known as the Baily furnace.

Eight-Paneled Globe for Ornamental Units

Specially designed for residential and park lighting service, an ornamental Novalux fixture has been announced by the General Electric Company of Schenectady, N. Y., having an eight-paneled globe of stippled glass and equipped with a new refractor and reflector. The lamp interior has two important improvements. The bell-



EQUIPPED WITH REFRACTOR AND REFLECTOR

shaped Holophane refractor collects all the upward light and redirects it at the most efficient angle, it is said. A cone-shaped reflector saves the downward rays, otherwise lost, and transmits them to the street.

The eight sections of the globe are all of stippled glass designed to diffuse the light over the greatest possible efficient area and to give the lamp a luminous glow which makes it especially ornamental even in the daytime.

Quick-Break Safety Switch

In the inclosed switch known as type "DF" now being manufactured by the V. V. Fittings Company, Philadelphia, both "quick-made" and "quick-break" features are incorporated. The fuse compartment cannot be opened while the switch is in, and an interlocking device prevents closing the switch while the fuse chamber is open. Heavy sheet steel is used in the box construction. Side openings are provided to allow room for wiring. The switch is made in sizes for 250, 500 and 600 volts and from 30 amp. to 1000 amp.

Waterproof Telephone

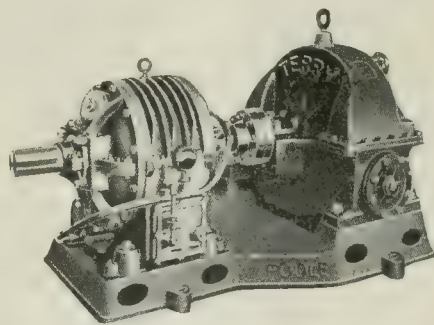
The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., has developed an ironclad and waterproof telephone for service in mines or in other places where the working parts of a telephone instrument must be protected against unusual operating conditions. All parts of this instrument are inclosed within a cast-iron box. This box is provided with double doors which give either partial or complete access to the interior apparatus as desired. One of the features of this instrument pointed out is the spring lock on the outer door, which is arranged so that it can be opened with the use of but one hand by means of a push-button latch.

Semi-Indirect Lighting Fixtures

There is an indirect lighting bowl now being placed on the market by the Superior Brass & Fixture Company, 316 Jackson Boulevard, Chicago, Ill., which is provided with a removable ventilator so that the interior of the bowl may be cleaned in place. Specially designed cleaning brushes are supplied with each outfit. The ventilator, it is pointed out, prevents lamp breakage by keeping the source of light cool in a circulation of air. Specially treated snow-white opalescent glass is used in all of the sunny indirect bowls which are designed for use in connection with nitrogen-filled lamps.

Turbine Speed Reducing Gear

In the accompanying illustration is shown a 100-hp. turbo-gear directly connected to a Terry turbine, reducing the turbine speed from 3600 to 440 r.p.m., which is the speed of the driven unit, in this case a blower. Two of the most noticeable features pointed out in connection with this outfit are its compact and symmetrical appearance and the absence of offset shafts, the driving and driven shafts of the turbo-



ABSENCE OF OFFSET SHAFTS IS FEATURE OF GEAR

gear being in the same straight line. These features result in a considerable saving of floor space as well as permitting a better grouping of the machines. The turbo-gear is manufactured by the Poole Engineering & Machine Company of Baltimore, Md.

Trade Notes

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., will build a new one-story and basement brick substation. The structure will be about 48 ft. by 100 ft. Plans have been prepared.

THE YOUNGSTOWN (OHIO) SHEET & TUBE COMPANY has opened a branch office in the Munsey Building, Washington, D. C. W. B. Blowers will be in charge as district sales agent, assisted by H. E. Richardson, who has been transferred from the Philadelphia office.

THE ELECTRIC FURNACE CONSTRUCTION COMPANY, Philadelphia, announces that Frank Wharton Brooke, formerly metallurgist of Crowleys, Detroit, Mich., and at the Ludham Steel Works, and G. W. Ketter, who has been directing and superintending electric furnaces for years, have joined its staff.

THE PENNSYLVANIA RAILROAD COMPANY, in "Loss and Damage, Bulletin No. 7," calls for co-operation from shippers to save waste. The company estimates that more than \$2,000,000 worth of freight every year is destroyed, and the purpose of the bulletin is to urge shippers to pack their goods properly and to use containers that are strong enough to stand transportation.

R. P. PAYNE and F. N. Wilson began on Nov. 1 to cover for the Northwestern Electric Equipment Company, St. Paul, the territory in Minnesota formerly looked after by A. M. Baldwin, Jr. On that date Mr. Baldwin became business district manager of the company's new branch warehouse and sales office at Duluth, as mentioned in the ELECTRICAL WORLD of Oct. 27. In Montana and North Dakota, with some few exceptions, the trade will be divided between W. G. Hosking and J. S. Eaton. The exceptions will be cared for by special representatives from the main office.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., has of late added considerably to its manufacturing facilities. President E. M. Herr recently made an announcement concerning the company's growth from which the following is taken: "In the village of Turtle Creek and near our East Pittsburgh works a thoroughly equipped and highly efficient copper-refining and copper-manufacturing plant has been installed, enabling the company to make a large part of the switchboard, commutator and other manufactured copper formerly purchased. Adjacent to this copper mill a complete metal-reclamation plant has been built in which all the more expensive metal scrap from our various factories is worked over and reclaimed. The growth in the use of mica products has necessitated a rapid expansion in the manufacturing facilities for this product, cared for by additions to the shop where this material is fabricated at our East Pittsburgh works. The rapid increase in transformer business has made necessary the erection of a building for the manufacture of tanks for large transformers and built-up cases for all kinds and sizes of transformers. This shop is located at Trafford immediately adjacent to the foundry of the Westinghouse Machine Company—6 miles from East Pittsburgh and connected with it by the Westinghouse Interworks Railway. In order to provide for the rapid increase in business of fractional horsepower motors, an additional story has been added to the building at East Pittsburgh in which these motors are manufactured, which, together with machinery added in other parts of this building, has increased its capacity from 5000 to 10,000 motors per month. In order to do the necessary research development work required by the many activities of the company, a new research building, with complete modern equipment, was erected and is in full operation, almost a mile from the East Pittsburgh works, at a point where cleanliness and freedom from vibration are completely secured. The most important recent addition to our manufacturing facilities has been the plant now building at Essington, Pa. Contracts have been let and construction is rapidly progressing on two large machine shops, an adjoining erecting shop, power house, forge shop, foundry, pattern shop and pattern storage building. This entire plant will be finished and fully equipped with machinery before the end of the year and will add 820,000 sq. ft. to our manufacturing floor space. This plant, it will be seen, will be a new center of growth for our manufacturing activities. In the immediate future, owing to the needs of our government for engines and engine-room equipment for its large shipbuilding

program, both this new plant at Essington and a portion of the machine works at East Pittsburgh will be devoted to the manufacture of steam turbines, condensers and Westinghouse high power transmission gearing. Ultimately, however, the steam-turbine manufacture will all be carried on at Essington, the machine works at East Pittsburgh being then occupied by the necessary expansion of our electrical business."

Trade Publications

STORAGE BATTERIES.—The General Storage Battery Company of St. Louis has prepared a booklet descriptive of its storage batteries.

A. S. M. E. PUBLICATIONS.—The American Society of Mechanical Engineers has prepared a leaflet descriptive of important publications it has recently issued.

PORTABLE ELEVATOR.—Bulletin 42, descriptive of how to use the revolvator for piling work, has been prepared by the New York Revolving Portable Elevator Company of Jersey City, N. Y.

FANS.—H. Boker & Company, Inc., of New York City, have prepared a booklet in which is given a table showing the cost per hour of energy consumed at rates from 1 cent to 10 cents per kilowatt-hour.

ELECTRICAL SPECIALTIES.—The Chelton Electric Company of Philadelphia has prepared its 1918 catalog descriptive of its wiring devices. This catalog has been prepared with the intention of answering any questions the prospective purchaser may ask.

ELECTRICAL MACHINERY.—The Department of Commerce has ready for distribution its booklet on "Electrical Machinery, Apparatus and Supplies." The material has been prepared under the supervision of M. W. Steuart, chief statistician for manufacturers.

CONDUIT FITTINGS.—The Killark Electric Manufacturing Company of St. Louis has prepared three sheets for its general catalog descriptive of its electrolet conduit fittings. This company has also prepared a sheet descriptive of its Killark bell-ringing transformer.

STOKERS.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has prepared leaflet No. 3987, descriptive of its underfeed stoker. This company has also prepared leaflet No. 1700, superseding leaflet No. 3790, descriptive of its full magnetic elevator control, type C.

NEW WAR LAWS.—The war tax law and the "trading with the enemy" act, passed at the recent session of Congress, have been carefully annotated, epitomized and indexed, and the unabridged text of each statute is published in book form by the Guaranty Trust Company, 140 Broadway, New York. Copies of these valuable compendiums may be had on application.

EXPORT TRADE.—"Utility Letters of Credit in the Export Trade—A Plea for Standard Forms" is the title of a new pamphlet issued by the American Steel Export Company of New York. In this article the author, J. P. Beal, who is secretary and assistant treasurer of this company, makes recommendations that should be heeded by the American banker and exporter. He has indicated a point of weakness which to him seems worthy of immediate attention, to the betterment of our entire overseas financial facilities.

MANAGEMENT.—An eighty-page book explaining the successful methods which John F. Sherman employs in eliminating discord and promoting harmony between employer and employee has been prepared. It contains many features valuable to executives at this time. The main offices of the "Sherman Service" at 20 Broad Street, New York City; 208 South La Salle Street, Chicago; 10 State Street, Boston, and 42 Church Street, New Haven, Conn., are sending out this book to executives only who request it on their corporation's letterhead.

FOREIGN TRADE OPPORTUNITIES.—In the "Commerce Reports" of Oct. 22, published by the Bureau of Foreign and Domestic Commerce, several inquiries from European buyers appear for electric toys, appliances, machinery and supplies, pumps and motors. The bulletin also has a complete conservation list and one of articles requiring export license. A subsequent number furnishes "don'ts" to be carefully noted in connection with "introductory methods" followed in the Chinese trade, where the demand is growing rapidly for electric goods of various kinds.

New Incorporations

THE ELECTRIC SUPPLY COMPANY of Clearfield, Pa., has been incorporated with a capital stock of \$5,000 by W. W. Wrigley and others.

THE ELECTRIC UTILITIES COMPANY of Detroit, Mich., has been incorporated with a capital stock of \$20,000 by D. C. Seymour, L. R. Wilbur and F. A. Tilton.

THE ELECTRICAL CONSTRUCTION COMPANY of Racine, Wis., has been incorporated with a capital stock of \$18,000 by Charles F. Breitzke and William B. Pierce.

THE AUTOMATIC ELECTRIC DEVICES COMPANY of Cincinnati, Ohio, has been incorporated by Clarence E. Ogden, W. N. Simlick and others. The company is capitalized at \$10,000.

THE NATIONAL ARMATURE & ELECTRIC WORKS of Bluefield, W. Va., has been incorporated with a capital stock of \$25,000 to carry on a general electrical repair business in Bluefield.

THE NEW JERSEY GAS & ELECTRIC COMPANY of Morristown, N. J., has been incorporated to construct and operate an electric and gas plant. Edwin Hawley. Van Wyck, is interested in the company.

THE NORTHWESTERN LIGHT & POWER COMPANY of Mount Prospect, Ill., has been incorporated by William Busse. Edward Busse, Henry J. Ehard, Ralph L. Peck and Henry Beigel. The company is capitalized at \$5,000.

THE PUBLIC SERVICE POWER COMPANY of New York, N. Y., has been chartered with a capital stock of \$250,000 to develop hydroelectric projects. The incorporators are: Charles H. Stanton, J. F. Hory and William M. Card.

THE NEWARK MACHINE & ENGINEERING COMPANY of Newark, N. J., has been incorporated by Emanuel P. Scheck, Lewis Fisher and E. I. Quinn. The company is capitalized at \$100,000 and proposes to deal in machinery.

THE EMPIRE ELECTRIC STEEL CORPORATION of New York, N. Y., has been incorporated with a capital stock of \$500,000 to do a general contracting business. The incorporators are: George R. Hamilton, Eric Pusinell and E. H. Rapp.

THE CUMBERLAND POWER COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$100,000. The incorporators are: F. D. Buck, K. E. Longfield and M. L. Harty of Wilmington, Del.

THE DEAN & STEWART ELECTRICAL COMPANY of Dunkirk, N. Y., has been chartered with a capital stock of \$2,500 to manufacture lamps and electrical fixtures. The directors are: John Dean, Edward G. Dean and Ernest H. Stewart all of Dunkirk.

THE HOOSIER GAS & POWER COMPANY of Indianapolis, Ind., has been chartered with a capital stock of \$100,000 to operate an electric generating plant. The incorporators are: Francis J. Catternin, Wilkins W. Wiswell and Justice D. Detwiler.

THE H. B. SHONTS COMPANY of New York, N. Y., has been incorporated by J. A. Smith, H. B. Shonts and P. J. Durham. 244 West Forty-ninth Street. The company is capitalized at \$50,000 and proposes to manufacture motors, engines and electric batteries.

THE CRANK SHAFT COMPANY of Wilmington, Del., has been incorporated by C. L. Rimplinger, M. M. Clancy and Clement M. Egner. The company is capitalized at \$60,000 and proposes to do a general electrical and mechanical engineering business.

THE MARTIN-McHOLLAN COMPANY of New York, N. Y., has been incorporated by G. W. Martin of Ridgewood, N. J.; J. Q. McHolland of Sparkill, and F. E. Anderson. 9 West Ninety-first Street, New York, N. Y. The company is capitalized at \$50,000 and proposes to do a general electrical, mechanical, civil, water supply and mining engineering business.

THE SMYRNA MILLS ELECTRIC LIGHT & POWER COMPANY of Houlton, Me., has been chartered with a capital stock of \$10,000 to generate and distribute electricity in the towns of Smyrna, Oakfield, Merrill and Dyer Brook. The officers are: Peter J. Garcelon of Houlton, president; Arthur A. Garcelon of Merrill, treasurer; and Walter E. Matthews of Oakfield, clerk.

New England States

BOSTON, MASS.—Work has begun on the construction of an electric street car line to the new South Boston Fish Pier. The line will connect with the Boston Elevated Railway at the junction of Summer Street extension. The cost of the road is estimated at \$30,000.

BOSTON, MASS.—Bids will be received by the purchasing committee of the Commonwealth of Massachusetts, Room 38, State House, Boston, until Nov. 27, for furnishing approximately 50,000 incandescent lamps for certain institutions, boards and commissions of the Commonwealth of Massachusetts. For details see Searchlight Section.

BOSTON, MASS.—The Aberthaw Construction Company of Boston, Mass., has awarded a contract to the Baldwin-Stewart Electrical Company, 214 Pearl Street, Hartford, Conn., to wire and install all electrical apparatus in the United States government factory which is being erected by the former in Squantum, a suburb of Boston.

FALL RIVER, MASS.—The Fall River Electric Light Company has been granted a permit for the erection of a one-story substation on Hathaway Street, to cost about \$19,000. Beattie & Cornell are contractors.

SPRINGFIELD, MASS.—Work has begun on the erection of a three-story addition to the plant of the Standard Electric Time Company, Logan Street, to cost about \$25,000.

PROVIDENCE, R. I.—Work has begun by the Bethlehem Shipbuilding Corporation, Fore River Works, for the erection of a one-story boiler plant, 140 ft. by 550 ft., with two ells, at Fields Point, Providence.

EAST HAMPTON, CONN.—The Public Utilities Commission has approved the petitions of the Central Connecticut Power & Light Company of East Hampton for the erection of an electric transmission line in the town of Lyme between the Hadlyme post office and the Hadlyme dock; also for the proposed extension of a 2200-volt lighting circuit upon an existing line of poles in South Glastonbury.

GROTON, CONN.—The question of enlarging the municipal electric-light plant is under consideration by the Borough Council.

NEW HAVEN, CONN.—The Public Utilities Commission has given its approval of the erection of an electric transmission line from Station A of the Connecticut Company in New Haven to Middletown Avenue along the private right-of-way and across highways in the town of North Haven.

STAMFORD, CONN.—The plant of the John Davenport Company has been taken over by Morris C. Rosenbaum and others. The Bridgeport and Newark companies will be consolidated with the new organization in the manufacture of gasoline engine and electric truck equipment. Several additions, it is understood, are contemplated.

Middle Atlantic States

ROCHESTER, N. Y.—Plans have been filed by the Bridgeford Machine & Tool Corporation for the construction of a new power house on North Third Street, Rochester. Contract has been awarded to Fred Belt, 42 Copeland Street, Rochester.

BRONXVILLE, N. Y.—The Public Service Commission has refused to grant the petition of the Lawrence Park Heat, Light & Power Company of Bronxville to supply electricity in the business section to compete with the Westchester Light & Power Company. Originally the Lawrence Park company was intended only to light buildings owned by the members of a family that owned the company.

BROOKLYN, N. Y.—The National Aniline & Chemical Company is planning to build an extension to power house, 36 ft. by 87 ft., to cost about \$30,000, at the corner of Ditmas Avenue and Eighty-third Street.

BROOKLYN, N. Y.—Plans are being prepared for the erection of a new one- and two-story, 100-ft. by 200-ft. ice-manufacturing plant for Rubel Brothers, Inc., Glenmore Avenue, Brooklyn. The proposed plant will be erected at Blake Avenue, and will cost about \$75,000.

BUFFALO, N. Y.—Plans have been filed by the New York Central Railroad Company for the construction of a new signal tower, two stories, 20 ft. by 55 ft., at its local works, on Curtis Street, to cost about \$5,000. Contract has been awarded to the Eastern Concrete Steel Company, Morgan Building, Buffalo.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

BUFFALO, N. Y.—Extensive additions are being made to the generating equipment in the power plant of the International Railway Company. Substations are being erected at North Division and Oak Streets and in Military Road near the Hertel Avenue carhouse. The new 10,000-kw. generating unit at the old Niagara Street power house will soon be ready to put in operation.

BUFFALO, N. Y.—The Buffalo, Rochester & Pittsburgh Railway Company is making improvements to its shops and yards at East Salamanca, N. Y., including the construction of a new machine shop and plant to be used for heavy locomotive repair work. The capacity of the roundhouse will be increased and the power house remodeled and enlarged. The company is also making extensions at Punxsutawney, Pa., including the erection of a new engine terminal, 16-stall roundhouse and other buildings.

CENTRAL ISLIP, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Nov. 14, for power house for heating and lighting plant, construction, heating and sanitary work at the Central Islip (N. Y.) State Hospital. Drawings and specifications may be consulted at the Central Islip State Hospital and at the New York office of the Department of Architecture, 1224 Woolworth Building, New York City. Drawings and specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher, Capitol, Albany, is state architect.

FLUSHING, N. Y.—Work has begun on the construction of the new substation for the New York & Queens Electric Light & Power Company on Lawrence Street, north of Broadway. The station will provide electricity for the residents and factories of the Third Ward in Queens Borough.

NEW YORK, N. Y.—The American Ice Company has decided to purchase energy from the New York Edison Company owing to the shortage and uncertainties of the fuel supplies. The ice company has 15 ice plants in the Metropolitan district.

NEW YORK, N. Y.—A new fire alarm system is being installed, which, when completed, will give the borough of Manhattan 1651 fire alarm boxes where there are but 861 at present. The new fire alarm headquarters on the Seventy-ninth Street Transverse Road in Central Park will be opened as soon as the installation of the boxes is completed.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 19 for provision and installation of an extension to and the rearrangement of the pneumatic-tube transmission system in the navy yard, New York. Drawings and specifications (No. 2658) may be obtained at the above bureau or at the navy yard named.

SCHUYLERVILLE, N. Y.—Work has begun on the construction of a new power plant for Saratoga Victory Manufacturing Company at Schuylerville. The Kingsbury Construction Company has the contract.

DOVER, N. J.—Plans are being prepared for the construction of a new assembling plant and igniter building at the Picatinny Arsenal of the United States government, for which \$40,000 has been appropriated.

NEWARK, N. J.—Plans have been filed by the Miner Edgar Company for the erection of a new four-story addition 70 ft. by 165 ft. to its power plant on Blanchard Street. Contract has been awarded to Frederick Ilgus, Inc., 13 South Sixth Street, Newark.

NEWARK, N. J.—Plans have been prepared for the installation of a large condenser at the Essex power station of the Public Service Electric Company. The condenser will have a condensing capacity of 420,000 pounds of steam per hour, and will be equipped with two auxiliaries for the circulation of the water.

NEWTON, N. J.—Preparations are being made by the Newton Electric & Gas Company for the installation of new lamps in the Stewart Street section, work on which has already begun. The company is also making extensive improvements in its system.

NEW BRUNSWICK, N. J.—Bids will be

received by the Board of Chosen Freeholders of the county of Middlesex, County Building, New Brunswick, until Nov. 12, for furnishing 20 or more 40-cp. incandescent electric lamps or two or more 80-cp. incandescent electric lamps, and also three single-mantle Welsbach incandescent lamps for a period of three years.

WRIGHTSTOWN, N. J.—Contract has been awarded by Mastbaum Brothers & Fleicher, 1424 South Penn Square, Philadelphia, Pa., for a new electric lighting and heating plant at its local works.

ASHLEY, PA.—Plans have been filed by the Central Railroad of New Jersey, 143 Liberty Street, New York City, for the erection of an addition to power house, 40 ft. by 70 ft., at its local works, to cost about \$10,000. Contract has been awarded to John W. Ferguson of Paterson, N. J.

BOYERTOWN, PA.—The Boyertown & Pottstown Railway Company has submitted a proposal to the Town Council to connect its system with the Oley Valley Electric Railway to Reading. It is proposed to do this by means of a loop on several streets, and thus complete the last electric railway link between Reading and Philadelphia.

DOVER, PA.—The Dover-Rossville Transit Company, which proposes to operate a trackless trolley railway between Dover and Rossville, has applied for a franchise to erect poles and power lines on the State highways in York County.

PHILADELPHIA, PA.—Plans have been prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the installation of new mechanical equipment at the government marine works, Philadelphia, to cost about \$99,000.

PITTSBURGH, PA.—Plans are being prepared by Ballinger & Perrot of Philadelphia for heating, electrical and elevator equipment for the seven-story addition to the factory of the Pennsylvania Chocolate Company to be erected at Pittsburgh.

ROSEDALE, PA.—The board of school directors has authorized the installation of electric lamps in the Rosedale school house.

WILLIAMSPORT, PA.—Preparations are being made by the United States Rubber Company of Williamsport for the erection of a five-story addition to its plant. The construction of a new power plant is included in the plans.

WILMINGTON, DEL.—The Illinois Leather Company, South Market, Wilmington, is building power plant addition, 19 ft. by 40 ft., at its works.

BALTIMORE, MD.—Plans are being prepared for a new electric distributing station for the Consolidated Gas, Electric Light & Power Company to be erected on Custom House Avenue. Contract, it is understood, will be awarded in the spring.

CHARLESTON, W. VA.—The power plant of the West Virginia Water & Electric Company was badly damaged by fire recently.

GLENVILLE, W. VA.—Bids will be received by the County Court of Gilmer County, Glenville, until Dec. 1, for the construction of a court house, jail and jailer's residence, including electric and gas lighting, steam heating, etc. The cost is estimated at about \$55,000. Plans and specifications may be obtained at the office of A. F. Wysong, architect, Princeton, W. Va.

RICHMOND, VA.—The contractors have been directed by the Administrative Board to proceed with the completion of the annex to the municipal electric-light plant. A concrete base is to be installed for the new turbo-generator. The generator ordered having been seized by the United States government, the city will have to wait until the General Electric Company can build another and ship it to Richmond.

WASHINGTON, D. C.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 19 for fitting out cranes and other work at the Brooklyn Navy Yard, to cost about \$850,000. Plans are also under way for the construction of a new 50-ton crane, to cost about \$150,000.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 3 for supplying to various public buildings under the control of the Treasury Department hand, electric, portable vacuum cleaners during the fiscal year ending June 30, 1918. For details see Searchlight Section.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 26 for the construction of two 200-ft. steel towers at the naval radio station at St. Thomas, Virgin Isles, West Indies. Drawings and specifications (No. 2568) may be obtained upon application to the above bureau.

North Central States

ALMA, MICH.—The new power plant of the Central Michigan Light & Power Company in Alma, it is expected, will be completed about the middle of November. Arrangements will then be made by the company to furnish heat to the Republic Truck plant when it is completed.

DETROIT, MICH.—Plans prepared by Malcolmson & Hugginbotham for the erection of a new annex to the Cass Technical School have been approved by the Board of Education. The first unit of the building will be a two-story structure of reinforced concrete, 193 ft. on Second Avenue, 60 ft. on High Street and it will be 166 ft. deep. The cost is estimated at \$250,000. The plans provide for enlarging the building to seven stories and connecting it with the present Cass Technical School by tunnel and viaduct.

GRAND RAPIDS, MICH.—Plans have been prepared by John C. Parker, head of the Department of Electrical Engineering at the University of Michigan, for improvements to municipal electric lighting system, which if adopted will save the city many thousands of dollars in upkeep and fuel bills and greatly improve the street-lighting system. The City Commission recently included \$30,000 in the budget for a new turbo-generator. This will not be necessary under the plans recommended by Mr. Parker, which include the use of the nitrogen-filled incandescent lamp, using 600, 400-cp. and 250-cp. units. The cost of these changes is estimated at \$35,000. The installation of a new turbo-generator would take 18 months. The new system proposed by Mr. Parker can be put in operation in about eight months. Suggested refinements in the power plant should save at least \$18,000 in coal.

KALAMAZOO, MICH.—The Michigan State Telephone Company is contemplating the erection of two additional copper wire circuits between Kalamazoo and Grand Rapids. A. W. Robb, 318 South Burdick Street, is manager.

TRAVERSE CITY, MICH.—The power plant of the Boardman River Electric Light & Power Company, recently destroyed by fire, causing a loss of about \$50,000, will be rebuilt at once.

CANTON, OHIO.—Plans have been completed by the Canton & Ohio River Railways Company for the construction of its proposed electric railway, which will extend from Canton, Ohio, to Kingwood, W. Va., a distance of about 180 miles. The proposed road will cover a trackage of about 400 miles. Power plants for the Kingwood division will probably be located at Cameron and Morgantown, although definite plans have not yet been made. On the Ohio side the substations will probably be located at Minerva, Carrollton, Toronto and Martins Ferry. The cost of the road complete is estimated at \$6,000,000. James D. White of Pittsburgh, Pa., is secretary and treasurer.

CHILLICOTHE, OHIO.—The United States government, it is reported, will build a double-track extension of the Chillicothe Electric Railroad. Light & Power Company to Camp Sherman.

CINCINNATI, OHIO.—Steps have been taken to secure the consent of the property owners on Elberon Avenue between Eighth and Warsaw Streets for the extension of the car tracks to establish the Warsaw-Elberon line.

COLUMBUS, OHIO.—Bids will be opened on Dec. 3 by the Ohio State University, Columbus, for power plant equipment, including stoker for a 600-hp. boiler. Specifications may be obtained from Carl E. Steeb, secretary.

COLUMBUS, OHIO.—The plant formerly operated by J. B. Hoover at 619 North Fourth Street has been taken over by the Capital Die, Tool & Machine Company of Columbus, recently incorporated, which will continue to manufacture dies, jigs and other small tools. The company also manufactures metal heat-treating furnaces.

TOLEDO, OHIO.—The Lewis Electric Welding & Manufacturing Company of Toledo, recently incorporated with a capital stock of \$100,000, has taken over the business of the Lewis Foundry Company. Some extensions, it is understood, will be made to the plant. The company will specialize on semi-cast head valves for gas, gasoline and oil engines.

COVINGTON, KY.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 4 for remodeling an electric passenger elevator in the United States court house and post office at Covington. For details see Searchlight Section.

LOUISVILLE, KY.—The Roy C. Whayne Supply Company of Louisville contemplates the purchase of a 7½-hp. or 10-hp., 25-cycle,

direct-current motor, 220 or 440 volts; also a 4-ton electric locomotive, 250 volts, direct-current, 40-in. gage.

LOUISVILLE, KY.—The Louisville Gas & Electric Company is planning to install new generating machinery and auxiliary equipment at its electric power plant. H. M. Bylesby & Company, 208 South La Salle Street, Chicago, Ill., are engineers.

ELWOOD, IND.—The Indiana General Service Company of Elwood has petitioned the Public Service Commission for permission to purchase and absorb the Marion (Ind.) Light & Heat Company and the Muncie (Ind.) Electric Light Company.

BYRON, ILL.—The plant and holdings of the Byron Electric Light & Power Company have been purchased by the Illinois Northern Utilities Company of Dixon.

PEKIN, ILL.—The City Commissioners are considering a proposal submitted by the Central Illinois Light Company for the installation of an ornamental lighting system in Pekin.

MILWAUKEE, WIS.—Van Ryn & DeGelleke, architects, Caswell Block, Milwaukee, have been engaged by the board of school directors of Milwaukee to prepare plans for a new high school, with manual training department, to be erected at Lenox and Montana Streets, Bay View, to cost about \$600,000. Bids, it is understood, will be asked for early in December. Frank M. Harbach is secretary and business manager.

MILWAUKEE, WIS.—Work has started on the installation of three units of the new lighting system. The first unit takes in the Auditorium district, extending from the Auditorium proper and Fifth Street, from Auditorium to Grand Avenue; the second is on Grand Avenue from the bridge to Seventh Street, and the third on Wisconsin Street, from the bridge to the lake. The management of the Auditorium Building will erect four double-bracket posts on Cedar Street, four on Fifth Street, four on Sixth Street and three on State Street. Each post will be mounted with two lamps of 1000 cp. each. The Illumination Bureau has completed the installation of concrete posts on Grand Avenue from Sixteenth Street to the western limits. Each post will carry an individual harp-style lamp. It is expected to have the new lamps ready to put in operation before Christmas.

ST. PAUL, MINN.—The St. Paul Real Estate Board has indorsed the campaign to establish a municipal electric-light and power plant. A committee will be appointed to co-operate with the city officials in their efforts to promote the project.

CEDAR RAPIDS, IOWA.—The contract for electrical work on the new Young Men's Christian Association Building has been awarded to the W. L. Fowler Electric Company of Cedar Rapids. The cost of the building is estimated at \$160,000.

CLINTON, IOWA.—The contract for the erection of an electric transmission line from Charlotte to the County Poor Farm has been awarded to J. J. Maher.

COUNCIL BLUFFS, IOWA.—Extensive improvements are contemplated by the Union Pacific Company to its local works involving an expenditure of about \$2,000,000, and will include a new 40-stall round-house, machine shops, power plant and cooling station, freight trackage, etc.

SPIRIT LAKE, IOWA.—Contract has been awarded by the Knights Templar of Iowa for the construction of a hotel and administration building, including electric wiring and plumbing, to the Guarantee Construction Company of Cedar Rapids, at \$93,960.

VAIL, IOWA.—A petition is being circulated asking that an election be held to vote on the proposal to issue bonds for the erection of an electric transmission line from Bennison to Vail.

JOPLIN, MO.—The Empire Electric Supply Company has petitioned the Public Service Commission for authority to sell all its holdings to the Empire District Electric Company of Joplin.

ST. JOSEPH, MO.—Extensive improvements are contemplated by the Western Union Telegraph Company to its local system, including the installation of underground conduits, cables and new apparatus at its office, to cost about \$100,000.

SPRINGFIELD, MO.—Negotiations have been closed between the Springfield Gas & Electric Company and the management of the Frisco Lines, whereby the power plant of the latter, located just west of the Frisco general office building, will be taken over by the Springfield company. The plant will be used as an auxiliary and will furnish heat to downtown business buildings.

CLAY CENTER, NEB.—The contract for electric wiring in the new court house at Clay Center has been awarded to the Standard Electric Company of St. Joseph,

Mo., at \$1,390. W. F. Gernandt, Keeline Building, Omaha, is architect.

JOHNSTOWN, NEB.—Preparations are being made for the installation of a municipal electric-lighting plant in Johnstown, for which bids have been received. The cost is estimated at \$4,700. Bruce & Standevan, Bee Building, Omaha, are engineers.

OMAHA, NEB.—Plans are being prepared by James T. Allen, architect, Brandeis Theater Building, Omaha, for the erection of a garage at Eighteenth and Davenport Streets, at a cost of \$20,000. Bids are being asked by the architect on electric wiring, heating and plumbing for the building.

ORD, NEB.—At an election held recently the proposal to issue \$30,000 in bonds for the installation of an electric-lighting system was carried.

PENDER, NEB.—All bids submitted for improvements to the municipal electric-lighting system were rejected. Bonds to the amount of \$16,000 were recently voted for the work. The Henningson Engineering Company of Omaha has charge of the engineering work.

SALINA, KAN.—Alterations are being made in the boiler room of the Salina Light, Power & Gas Company, which will provide for the burning of coal under the boilers. In the past oil burners have been used exclusively. The change is being made to meet the possible shortage of oil.

SMITH CENTER, KAN.—The contract for electric wiring for the new court house at Smith Center has been awarded to the Hubbard Electric Company of Beloit, at \$1,273.

WINFIELD, KAN.—Contracts have been awarded by the city of Winfield for equipment for water-works system as follows: To the American Cast Iron Pipe Company for cast-iron pipe, at \$59,856; American Well Works Company for eight pumps, \$5,850; Charles A. Millbank Company of Kansas City, Mo., for eight motors, \$3,526, and 15 transformers, \$3,365; the B-R Electric Company of Kansas City, Mo., for telephones and switchboard equipment.

Southern States

BADIN, N. C.—All contracts for the construction and equipping the second Yadkin River dam at Yadkin Falls site 2 miles below the Narrows dam have been awarded by the Tallassee Power Company, a subsidiary of the Aluminum Company of America of Pittsburgh, Pa., as follows: For construction of dam and power house at dam site near Badin to the Hardaway Contracting Company of Columbus, Ga.; three vertical turbines, capable of developing 10,000 hp. each under a 50-ft. head, to the S. Morgan Smith Company of York, Pa.; generators to the Central Electric Company of Schenectady, N. Y.; governors to the Allis-Chalmers Company of Milwaukee, Wis., structural steel in floodgate and power house to the McClintie Marshall Construction Company of Pittsburgh, Pa. Other contracts covering miscellaneous equipment have been let. James W. Rickey is chief hydraulic engineer of the Aluminum Company of America.

FREMONT, N. C.—The Town Commissioners are considering issuing \$20,000 in bonds, the proceeds to be used for improvements to the municipal electric-light plant, streets and sidewalks.

PIKESVILLE, N. C.—The proposal to issue bonds for the installation of a municipal electric-light plant is under consideration by the Town Commissioners.

REIDSVILLE, N. C.—At an election held recently the voters ratified the sale of the municipal electric-light plant to the Southern Public Utilities Company of Charlotte. The company was also granted a 30-year franchise.

ATLANTA, GA.—The American Machine & Manufacturing Company is adding an ammunition department to its present plant and has made arrangements with the Georgia Railway & Power Company for energy calling for approximately 500 hp. additional service, 220 volts, three-phase, 60 cycles.

ATLANTA, GA.—The Armour Fertilizer Works have closed a contract with the Georgia Railway & Power Company for approximately 800 hp. This service will displace the present 220-volt direct-current isolated plant. The new equipment will operate at 550 volts, three-phase, 60 cycles, and will include fire and service pumps and air compressors.

DECATUR, GA.—The City Council is considering entering into a contract with the Georgia Railway & Power Company of Atlanta for the construction of an electrically operated pumping station for water-works system.

SOPERTON, GA.—At an election held recently the proposal to issue \$10,000 in bonds to establish a municipal electric-light plant was defeated.

JACKSONVILLE, FLA.—The Jacksonville, Miami & Tampa Interurban Railway Company is contemplating the construction of an electric railway from Jacksonville to Miami, with a cross line from Melbourne to Haines City, and thence to Tampa, Fla., a total distance of about 500 miles. Surveys will soon be made and work, it is understood, will begin this winter. True Davis of St. Joseph, Mo., is president.

CHARLESTON, MISS.—Bids will be received by the Mayor and Board of Commissioners of Charleston, Miss., until Nov. 20 for improvements to the municipal electric-light plant and water-works system, including alternators and miscellaneous for the electric plant, and oil engines, pumps, deep well, reservoir, elevated tank and oil-storage facilities for water-works system. Plans and specifications may be obtained on application to Xavier A. Kramer, consulting engineer, Magnolia, Miss.

EARLE, ARK.—The capital stock of the Earle Light, Water & Ice Company has been increased from \$15,000 to \$60,000.

FORDYCE, ARK.—The Ashcroft-Hampton Manufacturing Company, recently incorporated with a capital stock of \$40,000, is planning to install an ice manufacturing and cold storage plant. Joseph Ashcroft, G. M. Hampton and others are interested in the project.

NEW ORLEANS, LA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 26 for the construction of radio buildings, including a one-story wood-frame dormitory, an outhouse and a brick receiving building, including electrical work, plumbing, etc., at the naval station at New Orleans. Drawings and specifications (No. 2649) may be obtained on application to the above bureau or the commandant of the naval station named.

FORT TOWSON, OKLA.—The installation of an electric-light plant is under consideration. W. S. McKinney is reported interested in the project.

BREMOND, TEX.—The electric plant of the Bremond Electric Light Company was recently destroyed by fire.

DECATUR, TEX.—Improvements are contemplated at the municipal electric-light plant, including the installation of a new engine and other machinery.

DILLEY, TEX.—J. D. Seamonds of Dilley is contemplating the installation of an irrigation pumping station on the Leona River near Dilley.

NAVASOTA, TEX.—The Intermountain Light & Power Company, it is reported, will rebuild its local distributing system.

QUANNAH, TEX.—Plans are being considered by Charles Sumner and associates for the construction of a water-works system, including a pumping station, to cost about \$150,000.

STAMFORD, TEX.—The Stamford Gas & Electric Company, which recently completed the erection of an electric transmission line to Hamlin, is planning to extend the line to Anson. Three new substations will be built.

WOLFE CITY, TEX.—The City Council is considering increasing the municipal water supply and may install a new pumping plant.

Pacific and Mountain States

EVERETT, WASH.—The City Council has engaged Burns & McDonnell, consulting engineers, Interstate Building, Kansas City, Mo., to complete preparations of plans in connection with the proposed site on the Sultan River for a municipal electric-light plant. The Commissioners are contemplating calling a special election to submit the question of issuing bonds for the project to the voters.

LA CONNER, WASH.—The sum of \$21,000 has been raised by the residents of La Conner for the erection of an electric transmission line from Mount Vernon to La Conner. The line will be built by the Puget Sound Traction, Light & Power Company under an agreement made between the company and the citizens of La Conner. The proposed line will be 21 miles long and will transmit 6600 volts, furnishing a 24-hour service. Owing to financial difficulties the local plant has closed down.

OLYMPIA, WASH.—The transmission lines of the Stone & Webster Corporation, which will transmit energy from the Fernhill power plant to Olympia, will soon be completed. The Fernhill station is located about 40 miles from Olympia. A pole transmission line has been built from Fernhill to Tumwater, where a transformer station

has been erected to receive the power. The station is equipped with three 500-kva. transformers. The cost of the entire work is estimated at about \$75,000.

PORT ANGELES, WASH.—The municipal electric-lighting system was badly damaged recently. The large transformer was put out of commission and the switchboard and its instruments badly damaged. The system has been temporarily repaired, but is in a precarious condition.

PORT WASHINGTON, WASH.—Extensive improvements are needed at the municipal electric-light plant to enable it to meet the demands for electrical service.

COQUILLE, ORE.—The Sitka Spruce Company of Coquille has secured an additional water power and will install electric generating machinery and electric-lighting equipment, preparatory to doubling the output of its plant.

DALLAS, ORE.—Extensive improvements are being made to the local power plant of the Oregon Power Company, including the installation of a 750-hp. tandem compound engine, to replace a 150-hp. engine. A 450-kw. generator is also being installed. The output of the plant will be increased from 770 hp. to 1700 hp.

ECHO, ORE.—The Council and Echo Commercial Club are considering the installation of cluster lamps on the streets this winter.

MEDFORD, ORE.—The Copco (Cal.) plant of the California-Oregon Power Company will be put in operation about Dec. 1. The plant represents an expenditure of about \$2,000,000, and will have a generating capacity of 25,000 hp., which will be increased to 50,000 hp. by a subsidiary station a quarter of a mile down the river.

PORTLAND, ORE.—The Pacific Power & Light Company, operating in Oregon and Washington, has recently sold an issue of \$750,000 in bonds, the proceeds to be used to pay for extensions and improvements made this season and others under consideration to provide for the increasing demand for electrical service in the Columbia River basin towns.

AUBURN, CAL.—Arrangements, it is reported, are being made by the Pacific Gas & Electric Company to discontinue the use of the old Newcastle electric power plant. Transformers are being installed at the Wise power plant in Auburn ravine below Auburn to take on the Auburn-Newcastle load.

CALEXICO, CAL.—The State Railroad Commission has authorized the Southern Sierras Power Company to install a new electric auxiliary plant at Calexico. The Holton Light & Power Company must co-operate with the Sierras company in this undertaking.

FRESNO, CAL.—The Pacific Gas & Electric Company of San Francisco is erecting a machine shop in connection with its new generating plant near the West Side Branch of the Southern Pacific Railroad, near Fresno.

FRESNO, CAL.—The San Joaquin Light & Power Company of Fresno has purchased the plant and power lines of the Merced Stone Company at Kittridge, Mariposa County, and will extend the transmission lines to several mining claims as well as Coulterville.

FRESNO, CAL.—The State Railroad Commission has authorized the San Joaquin Light & Power Corporation to operate under a franchise granted the company by Mariposa County in July in that portion of the county not now served by any other utility company.

HOLTVILLE, CAL.—Preparations are being made to put the local plant of the Holton Power Company in operation to be used as an auxiliary for the power service furnished by the Southern Sierras Company of Riverside. W. H. Brown of El Centro is superintendent of the electrical department.

LOS ANGELES, CAL.—The Southern California Edison Company of Los Angeles has filed an application with the United States district engineer for permission to erect a high-tension transmission line across Newport Bay.

LOS ANGELES, CAL.—Application has been made to the State Water Commission by the United Light & Power Company, represented by F. C. Riley and G. W. Gilbreth of Los Angeles, for permission to appropriate 15 cu. ft. per second of water from the San Gabriel River in Los Angeles County to be used for generating electricity for commercial purposes. Impulse wheels directly connected to generators will be used. A total fall of 1280 ft. will be secured and 10,000 hp. will be generated. The proposed work includes the driving of a tunnel and pipe line 2½ miles long and the construction of a dam 200 ft. high and 500 ft. long.

MERCED, CAL.—The installation of a municipal electric-light plant in Merced is under consideration.

NORTH BEND, CAL.—The North Bend Mill & Lumber Company has purchased the property adjoining the North Bend Iron Works and is installing an electrically driven planing mill and lumber finishing plant, 140 ft. by 160 ft., at a cost of \$100,000.

SAN JOSE, CAL.—All distribution and power lines of the San Jose Railroads and the Peninsular Railway Company have been taken over by the Pacific Gas & Electric Company. Up to the present time the railways have furnished electrical service in San Jose and on the outskirts of the city and to residents along the car lines.

SONOMA, CAL.—San Francisco capitalists have purchased the property of the Sonoma Water, Light & Power Company at El Verano, which has been furnishing a large portion of the Sonoma Valley and the town of Sonoma with water. The new owners, it is understood, will acquire further water rights and make additional extensions to the service.

TAHOE CITY, CAL.—Application has been made to the State Water Commission by Lora J. Moore of Tahoe City for a half second-foot of waters of Slim Jim Creek, a tributary of Lake Tahoe, in Placer County, for the purpose of developing electric power. The plans call for the construction of a rubble dam 12½ ft. high and 200 ft. long, and a fall of 369 ft. It is proposed to develop 17½ hp. at a cost of about \$10,000.

WILLOWS, CAL.—Application has been made to the State Water Commission by W. F. Fowler of Willows for 250 cu. ft. per second of water of the Sacramento River for rice culture on 14,000 acres. The water will be raised by electrically driven pumps to the main canal which is given as 10 miles in length. The cost of the proposed project is estimated at \$180,000.

GRANGEVILLE, IDAHO.—The Grangeville Light & Power Company is building a dam across the South Fork of the Clearwater River, at a point between the present power house and the present dam. It is expected to have the concrete dam completed within six months.

BUTTE, MONT.—Preliminary work has been completed, including surveys, and plans prepared by the Montana Power Company for a large hydroelectric development at Kootenai Falls, at a cost of about \$6,000,000. The proposed plant will have a head of 110 ft. and develop 68,000 hp.

GREAT FALLS, MONT.—The construction of a substation in the downtown section, to cost from \$150,000 to \$175,000, is under consideration by the Montana Power Company.

MOORE, MONT.—Preparations are being made by the Montana Power Company of Butte for a large hydroelectric power development at the foot of Mystic Falls, in Stillwater County.

PLEVNA, MONT.—The installation of an electric-light and power plant in Plevna is under consideration. Stater Brothers of Baker are interested in the project.

Canada

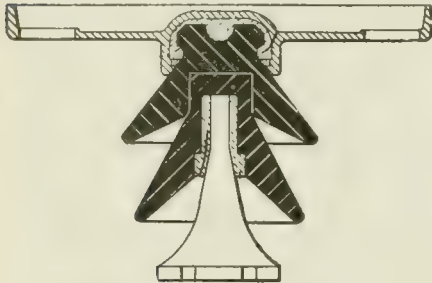
PENTICTON, B. C.—The Kettle Valley Railway Company, which owns and operates the section of the Coast-Kootenay railway between Midway and Hope, is planning to build a branch from Penticton to Copper Mountain, a distance of 14 miles, at a cost of about \$1,000,000.

TORONTO, ONT.—The Dominion Board of Railway Commissioners has authorized the Hydro-Electric Power Commission of Ontario to proceed with its agreements with the Niagara, St. Catharines & Toronto Railway, the Grand Trunk Railway and the Michigan Central Railway Companies for the construction of a power development canal and construction railway and for a temporary division of the tracks of the companies mentioned at Stamford Township, Ont.

Miscellaneous

GUANTANAMO, CUBA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 10 for fuel-oil fire protection, including the installation of pumps, motors, piping, distributing connections, etc., for a foam fire protection system for fuel-oil and gasoline tanks and reservoirs at the naval station, Guantanamo, Cuba. Drawings and specifications (No. 2636) may be obtained at the above bureau or from the commandant of the naval station named.

1,244,454. FAN-HANGER OUTLET; Frederick B. Adam, St. Louis, Mo. App. filed April 27, 1916. Provides a combined receptacle carrier and fan hanger that presents a neat and ornamental appearance at all times, thus overcoming the necessity of mounting a bracket, shelf, plate or other device on a wall, in addition to the receptacle carrier, for supporting a fan that is in use.



1,244,473—Insulating Support

1,244,473. INSULATING SUPPORT; Charles W. Covell, Wilkinsburg, Pa. App. filed Sept. 25, 1914. Has special reference to supports which may be utilized upon current-limiting reactance coils of various diameters.

1,244,476. CURRENT-COLLECTING DEVICE; John S. Dean, Wilkinsburg, Pa. App. filed July 3, 1914. Provides a relatively short and advantageously located conducting member or shunt for conducting current around the spiral spring which is customarily provided in many types of current-collecting devices.

1,244,478. CONTROLLER; Isidor Deutsch, Avalon, Pa. App. filed March 7, 1913 Drum type.

1,244,483. VAPOR RECTIFIER; Sidney W. Farnsworth, Pittsburgh, Pa. App. filed April 6, 1914. Applies more particularly to liquid electrodes therefor.

1,244,486. VACUUM-TYPE CONVERTER SYSTEM; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed Nov. 3, 1916. Improvement.

1,244,492. CONTROL SYSTEM; Arthur J. Hall, Wilkinsburg, Pa. App. filed Oct. 9, 1914. Means for preventing the making or breaking of control circuits having the full supply-circuit voltage impressed thereon, at more than one point in the system, throughout the operation thereof, thereby obtaining the well-known advantages of relatively low-voltage operation.

1,244,509. DYNAMO-ELECTRIC MACHINE; Benjamin G. Lamme, Pittsburgh, Pa. App. filed Aug. 22, 1913. Means for reducing the circulation of eddy currents in the laminations caused by fringing of the magnetic flux in the annular ventilating spaces.

1,244,511. UNIVERSAL MOTOR; Benjamin G. Lamme, Pittsburgh, Pa. App. filed Aug. 7, 1914. Provides simple and effective means for automatically adjusting the field strength of the motor in accordance with the character of the current supplied thereto.

1,244,518. METHOD OF AND APPARATUS FOR PRODUCING SPARKLESS COMMUTATION; John C. Lincoln, Cleveland, Ohio. App. filed May 5, 1913. Improvement.

1,244,528. VACUUM LIGHTNING ARRESTER; David T. May, New York, N. Y. App. filed Nov. 9, 1916. The present invention is characterized by the employment of deliquescent material which normally separates short-circuiting contact members that tend to engage one another. When the deliquescent material is softened by absorption of moisture carried into the evacuated container by the air when the vacuum fails, it permits the short-circuiting contact members to engage one another.

1,244,544. SELECTOR; Charles S. Rhoads, Jr., West Lafayette, Ind. App. filed Feb. 18, 1916. Is concerned more particularly with the production of a selecting device of use in systems of this or similar character.

1,244,545. SWITCHING DEVICE; Lynn G. Riley, Wilkinsburg, Pa. App. filed April 3, 1914. Particular reference to safety interlocking means that are adapted for use in controllers for automobiles and other vehicles of a similar nature.

1,244,555. SHIELDING SYSTEM FOR VAPOR CONVERTERS; Edmund F. Sipher, Wilkinsburg, Pa. App. filed Dec. 29, 1915. Improvement.

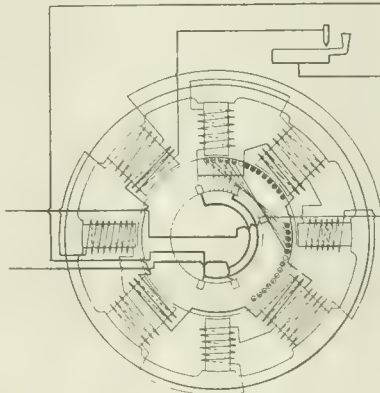
Record of Electrical Patents

Notes on United States Patents issued on October 30, 1917

1,244,569. MEANS FOR INTERCONVERTING ALTERNATING AND DIRECT CURRENTS; Joseph L. Woodbridge, Philadelphia, Pa. App. filed July 16, 1915. Applies especially to converting apparatus in which there is a magnetic structure, all parts of which are relatively fixed, upon which are wound suitable coils or windings connected to the alternating-current and direct-current circuits.

1,244,589. INCLOSED ELECTRIC FUSE; Robert C. Cole, Hartford, Conn. App. filed April 3, 1917. Renewable.

1,244,614. PROCESS OF AND APPARATUS FOR INTERCONVERTING AND ADJUSTING THE RELATIVE VOLTAGE OF HIGH-POTENTIAL ALTERNATING AND DIRECT ELECTRIC CURRENTS; Carl G. Koppitz, Youngstown, Ohio. App. filed Jan. 21, 1913. The present invention utilizes the broad principles set forth in said prior applications, but involves the provision of two pairs of brushes of opposite polarity which are



1,244,518—Method of and Apparatus for Producing Sparkless Commutation

rotated in unison but are relatively adjustable to vary the angular distance between the brushes of like polarity.

1,244,634. ELECTRICAL ATTACHMENT FOR READING METERS; Albert C. Neff, Urbana, Ohio, and Edwin H. Ford, Wabash, Ind. App. filed April 16, 1915. Particularly for those meters which are located at inconvenient points in residences or other buildings for registering gas, water and the like.

1,244,671. LOCK; Peder L. Wikheim, Everett, Wash. App. filed Sept. 11, 1916. Locks for ignition circuits and the like on automobiles.

1,244,705. METHOD OF ELECTRIC-ARC WELDING, HEATING AND METAL WORKING, AND APPARATUS THEREFOR; Charles L. Coffin, Parks, Ga. App. filed Feb. 7, 1917. Improvements.

1,244,709. WINDING FOR DYNAMO-ELECTRIC MACHINES; John C. Davenport, Norwood, Ohio. App. filed April 22, 1914. Improvement.

1,244,817. ELECTRIC HEATER FOR HOT-WATER TANKS; Russell A. Willson, Spokane, Wash. App. filed Feb. 15, 1917. Adapted for local application to a hot-water tank.

1,244,868. DYNAMO-ELECTRIC MACHINE; Gustaf M. Larsson, Newark, N. J. App. filed Dec. 12, 1913. Used for electric self-starters in automobiles.

1,244,873. SIGNALING APPARATUS; Fred W. Lohr, New York, N. Y. App. filed Jan. 11, 1915. For use on motor cars.

1,244,909. FILLING DEVICE FOR BATTERY CELLS; James M. Skinner, Philadelphia, Pa. App. filed Oct. 10, 1916. For use in supplying water or electrolyte to storage-battery cells.

1,244,926. ELECTRICAL DISTRIBUTOR; Carl J. Wallace, Springfield, Ohio. App. filed July 31, 1915. Improvements.

1,244,927. DISTRIBUTOR FOR AUTOMOBILE CIRCUITS; Carl J. Wallace, Springfield, Ohio. App. filed July 31, 1915. Improvements.

1,244,929. RHEOSTAT; Harry W. Ward, Detroit, Mich. App. filed March 6, 1917. Resistance to the current to be tested may be varied easily and with exact knowledge on the part of the operator as to the degree of change which his various adjustments of the parts is effecting.

1,244,945. STOKER-DRIVING ARM; John W. Bell, Covington, Ky. App. filed July 9, 1914. Improvements.

1,244,952. METHOD OF SEPARATING AND RECOVERING DOMESTIC REFUSE; Joseph W. Bryan, New York, N. Y. App. filed March 21, 1916. Improvements.

1,244,960. ELECTRIC DISTRIBUTION; John L. Creveling, New York, N. Y. App. filed Jan. 15, 1912. For cases where it is desired that a generator be automatically governed.

1,244,962. TELLTALE; John H. Derby, New York, N. Y. App. filed Dec. 7, 1915. Relates particularly to devices for indicating or controlling the height of a liquid in a reservoir, tank or other receptacle or storage means.

1,244,983. ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINE; Louis J. Hunt, Sandycroft, Wales. App. filed Dec. 10, 1915. Improvements.

1,244,997. APPARATUS FOR SETTING BUNG BUSHINGS; Albert C. Ludlum, New York, N. Y., and Arthur Lowy, Newark, N. J. App. filed April 14, 1916. Provides a hand-operated device comprising a novel form of bushing setter with means for holding it in operative relation to the barrel and bushing.

1,245,036. PROTECTIVE CASING FOR ELECTRIC SERVICE CONNECTIONS AND METER DEVICES; Joseph Sachs, Hartford, Conn. App. filed Jan. 21, 1915. Improvements.

1,245,037. MULTIPLE-METER ADAPTER; Joseph Sachs, Hartford, Conn. App. filed July 26, 1916. Improvements.

1,245,038. METER-TESTING APPURTENANCE; Joseph Sachs, Hartford, Conn. App. filed Nov. 17, 1916. Improvements.

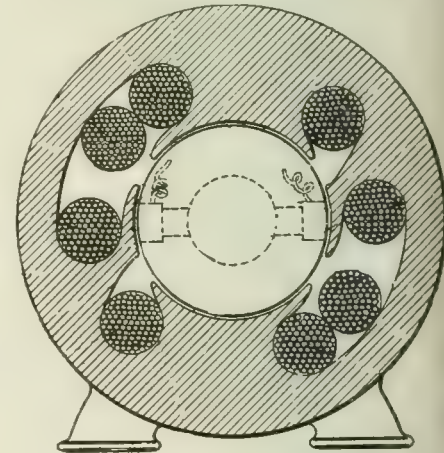
1,245,068. ATTACHMENT-PLUG FITTING; George B. Thomas, Bridgeport, Conn. App. filed April 10, 1916. Provides a receptacle with a signal device operated by the insertion of the plug.

1,245,077. JUNCTION-BOX COUPLING FOR ELECTRIC-WIRE CONDUITS; Lewis E. Webster, Wilkes-Barre, Pa. App. filed Oct. 14, 1915. Improvement.

1,245,080. BATTERY SEPARATOR; Frank E. Whitney, Philadelphia, Pa. App. filed Sept. 20, 1917. Provides a retaining plate which may also serve as a separator.

1,245,084. ELECTRIC HEATER; Edmund N. Brown, San Francisco, Cal. App. filed July 10, 1917. Heat waves are generated by a resistance coil or heating unit and are then reflected from a highly polished surface.

1,245,103. ELECTRIC SWITCH; John S. Hickman, Titusville, Fla. App. filed Dec. 29, 1916. Terminals are completely inclosed in sockets within slidable bars of insulation material.



1,244,868—Dynamo Electric Machine

1,245,105. FLASHER; Fred Hotchner, San Francisco, Cal. App. filed Feb. 23, 1915. For electric signs.

1,245,135. DETECTOR; Jim Thompson and Roy J. Thompson, Elk Grove, Cal. App. filed Oct. 18, 1916. Particularly adapted for use with electric generators.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN
Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, NOVEMBER 17, 1917

No. 20

Effective Distribution of Factory Power

NOTWITHSTANDING the efforts made to direct careful attention to the problem of motor application in factory work, there is every likelihood that distribution circuits for supplying the motor and lighting equipment in many factories will not receive the necessary consideration unless special thought is given to them by the management. It is reasonable to expect that in a new plant the distribution circuits will usually be planned with due care to meet the initial needs. The typical factory, however, and more particularly the machine shop, requires continual rearrangement of machinery, and the tendency of the electrical department, in meeting calls for hurried changes in positions of motors, is to utilize as far as possible the existing wires in the various sections of the plant. One natural result is confusion in the circuits, with unbalanced load conditions, excessive power losses and an undue voltage drop in the overloaded circuits and accompanying reduction in production of the machine tools or other machinery supplied.

In his article in this issue on the distribution of electric power in factories Professor Clewell touches upon a timely and important part of the motor application problem, one which has a particular relation to efficiency of production. Sometimes, as the article points out, there is a tendency to forget that the electric circuit is the vital connecting link between generating machinery and motors or lamps. It thus takes the place of line shafting and belting with their high mechanical losses, and introduces more effective means for power supply and at the same time makes longer extensions possible than could be realized with the older mechanical methods of distribution.

Their very flexibility is one reason why circuits are overlooked so easily and are allowed to become inferior to the well-balanced status which may have existed when the plant was constructed. Professor Clewell emphasizes in a practical manner methods whereby one of the larger manufacturing establishments reduced circuits to diagrams or "wiring maps" which form part of the records of the electrical division. Several methods of preparing such charts are outlined, together with ways of keeping them up to date and promoting their regular use in wiring work.

The value of suitable standardization for the factory distribution system should not be overlooked, since the addition of equipment must be governed, in part at least, by the adaptability of apparatus on the market to the classes of circuits available in the plant. As the article indicates, a leading consideration in the lighting equipment, although it may be relatively unimportant in

the motor problem, is that of maintaining rigid separation of power and lighting circuits so that the latter may be protected against voltage variations probable as a result of changing load conditions imposed on the motors.

When advocates of scientific management look upon a 1½ per cent improvement in production efficiency as sufficient to warrant extended efforts to better the manufacturing methods, any part of an electrical system like the supply circuits demands sufficient attention to insure the maintenance of highly effective operating conditions.

International Standardization

THE proceedings of the International Electrotechnical Commission have been temporarily arrested by the war, but the standardization work goes on in individual countries in directions mapped out by the previous work of the I. E. C. The standardization rules of the American Institute of Electrical Engineers relating to the performance of dynamo-electric machinery have been developed steadily during the last five years, and also the corresponding rules of the British Engineering Standards Committee. The twelfth report of the latter body has been published recently. It states and epitomizes the eighty or more individual published reports of the various sub-committees. During the last three years three conferences have been held between the American and British electrical standards committees for the unification of their respective rules. Quite recently, as was stated in last week's issue, H. M. Hobart, representing the A. I. E. E. standards committee, has been attending the rating conference of the British committee.

As a result of these conferences the electrical standardization rules in England and in America are substantially alike on all essential points and are also in conformity with the rulings of the I. E. C. so far as that body has yet been able to act internationally. This degree of uniformity is not only a matter for congratulation to both of the national committees involved, but it is also an international asset of great scientific, technical and general commercial value. So far as it is of commercial benefit to each of the two countries to formulate similar rules for the standardization of machine performance, it is also of like commercial benefit to other countries, which similarly gain in understanding clearly the nature and characteristics of machinery standardized either in Great Britain or in America.

Sooner or later we may hope to secure an international set of rules for the standardization of electric machinery whereby a machine correctly rated in any part of the civilized world will have definite and defi-

nately understood performance characteristics. There is no good reason why such characteristics should be dependent upon geographical co-ordinates of latitude and longitude.

Problems Relating to Magnitude

THE very interesting paper by A. O. Austin published in our last week's issue suggests some reflections which extend far beyond the reliability of insulators and related problems. The improvements of the last few years have gone far to lessen the difficulties of insulation as such. The chief trouble with insulation in the past has been an altogether inadequate factor of safety. As Mr. Austin very properly notes, the insulation must be reckoned with reference not to the nominal voltage of the line but the greatest voltage to which it may be subjected. In its broadest aspect this includes not only surge voltages, themselves highly formidable, but those due to the interference of lightning. It is a well-known fact that high-tension lines are not the chief seat of damage from lightning. If a system working at from 50,000 volts to 100,000 volts has insulation which will stand at a pinch 250,000 or 300,000 without flashing over, it is relatively immune to the ordinary strains of lightning discharges. A direct stroke may be of a magnitude which no practicable insulation can withstand, but the larger part of troubles from lightning are of limited voltage, high indeed, but not beyond control. Thus a line which has the insulation strength just referred to could stand an additional pressure of 100,000 volts to 150,000 volts and probably discharge it harmlessly through the arresters without breaking down the line insulation. On the other hand, a much less severe stroke would cripple secondary lines.

In other words, one may regard the majority of disturbances due to lightning as producing an increment of pressure on the line which may be dangerously large on a secondary system and not at all serious on the primary. This is merely a question of the absolute, and not the relative, factor of safety; hence many of our big high-tension distribution systems have come through excellently well on the primary side in spite of suffering in the secondary lines from local thunderstorms. In this way the magnitude of the transmission voltage for which the insulation is designed for some reasonable factor of safety may actually increase the reliability of the system as a whole. In the same way surging is profoundly dependent upon the magnitude of the currents involved, so that a secondary system carrying great amounts of energy may put up terrific surge voltages compared with anything contemplated in the normal insulation of the lines. Broadly, of course, Mr. Austin was quite correct in reckoning on a great increase in liability to trouble with increase of extent of lines, owing to the fact that every part of the system may react on every other part and that additional lines mean not only additional length but additional consumers and complexity of service. It would perhaps be unsafe to attach too much importance to any numerical reckoning of these added risks.

There are several human factors, too, which enter this situation and which cannot be even approximately evaluated. A very large and lightly loaded system seldom gets the careful inspection of a more restricted and heavily loaded system, so that the possible risks per mile of line are quite certain to increase from this cause irrespective of all others. There is, however, a contrary factor which has made itself felt most beneficially in many of the great distributing networks. This is the cushioning effect of very long lines on local disturbances. The mere resistance of the circuits is an important factor in the fading out of surges which in a short line of low resistance might reach a point where great damage would result. It therefore happens that many widely extending systems with numerous stations feeding into them have exceedingly little trouble due to the mutual effects of their several parts, while they would be very likely to experience relatively more were they of greater output for the same extent of lines. Reliability is not merely a question of extent but of many other factors, including the nature of the service and the distribution of the load. One suggestion of Mr. Austin's with respect to the difficulties of increased line mileage, and particularly of additional circuits, must be taken very seriously in this connection. This is the desirability of segregating load, at least certain kinds of load, at certain times so as to lessen the risks which may spread from one part of the system to another.

The operation of every line from a common set of busbars linked to a common set of generators operating in parallel is a very attractive and symmetrical sort of idea. It means, however, a possibility of surges and short circuits on an enormous scale, and it also means extraordinary increase in the station switching facilities. In principle, if one has ten generators in parallel each must be equipped with switching apparatus to control the current of the whole ten, and the actual result of this requirement has been a relatively very large increase in the cost of switchboard equipment. Sectionalizing the plant, in its normal operation at the least, is therefore a somewhat useful resort, and in many instances it may be found desirable, on account of the particular nature of some one load which has to be carried, to operate this load for the most part independently of the rest. The penalty may, of course, be slightly lessened generator efficiency, but on the other hand, if the load distribution is skilfully done this penalty may not be in practice exacted. Another practice carried sometimes to excess is the habit of running everything in parallel on the low-tension side, when it is really sometimes more desirable to parallelize through the transformers at the end of long lines. It is not really necessary that any feeder, A to Z inclusive, should be able to be fed at will from any generator, A to Z inclusive. The real necessity is that some generator should be ready to take up the burden of any specified feeder. The bigger the plant operated fully in parallel the more terrific the shock of a short circuit, and while "shorts" are always "undesirable citizens" the bigger they are the worse for the system.

Harmonics in Transformer Exciting Currents

THE method generally adopted in determining the harmonics in the alternating current supplied to a transformer is to take an oscillogram of this current, find the wave form, and analyze it, by any of the regular methods, into Fourier components. It is well known that if a lighting transformer, with its secondary circuit open, is connected to primary alternating-current mains maintaining a simple sinusoidal emf., the voltage induced in the secondary winding will be very nearly sinusoidal; but the current taken by the primary winding from the mains will be non-sinusoidal. This primary current will contain, ordinarily, a marked peak and a correspondingly marked triple harmonic component. There will also be other and higher harmonic components. The magnitudes and phases of these harmonics in the primary current of the transformer will depend upon the quality and dimensions of the steel core, as well as the degree of magnetic saturation reached in the cycle of magnetization.

The article by Prof. Waldo V. Lyon in this issue points out a relation that is not generally known for finding the harmonic components in a transformer primary current when the cyclic hysteresis loop of the steel core is given instead of an oscillogram. The problem is capable of being solved even when the impressed primary emf. is non-sinusoidal but has a definitely known wave form. The solution of the problem is, however, rendered much easier if the primary impressed emf. may safely be regarded as sinusoidal. Then, because a sinusoidal emf. can only be generated by a sinusoidal inducing magnetic flux, the phase of the excitation at each and every point of a properly drawn hysteresis loop becomes determined. The article shows that, after selecting eight suitable points on the curve, it becomes readily possible to compute the magnetizing forces in a Fourier series up to and including the seventh harmonic. It is interesting to notice the remark that the components in phase with the magnetization depend only on the co-ordinates of the mean magnetization curve, whereas the quadrature components depend only on the breadth of the hysteresis loop. Consequently, an indefinitely thin hysteresis loop betokens only inphase magnetizing components, whereas a wide and adipose loop rejoices in the possession of quadrature components. In all cases, as soon as the Fourier magnetizing components are known the corresponding exciting-current components, being severally proportional thereto, are readily deduced.

The disclosures in the article lead to the inference that valuable magnetic data might be obtained by meas-

uring the hysteretic properties of a given transformer core, and also by securing oscillograms of the excitation current obtained from impressed sinusoidal emfs. of observed frequency and magnitude. A comparison between the Fourier series obtained by these two series of observations might evolve some interesting results. The method presented deserves careful study.

Standardizing Outdoor Substations

IN THESE days when the costs of labor and material are running to formidable figures the outdoor substation is coming into its own. We have over and over again commented on the change of practice in this respect, and we wish now once more to emphasize the importance of the matter from the purely practical standpoint of economics. The work of the Southern Illinois Light & Power Company along this line is especially important because it has reduced the designs to unusual simplicity of construction and to standard forms which promise well in the regular hard service of a distribution system. The two designs shown in the article on another page are for an ordinary two-pole station for a capacity of 150 kw. and below and for a four-pole type for heavier work. The practical point of the matter is that a two-pole station can be built without the transformers for less than \$800, and a four-pole station for less than \$1,800. The high-tension switching structure installed in connection with each cost less than \$400. The meaning of this is that a substantial and permanent switching station and substation can be put up at a cost very moderate compared with that of the ordinary well-housed plant still widely used; that it will give equally good service, and that because of its low cost it will enable customers to be taken on in places where the cost of a building might prove, if not prohibitive, at least a serious matter in figuring the expense.

By thus standardizing the structure the labor of erection as well as the cost is in a very great degree economized. The figures are high compared with what would have been possible three or four years ago, but with the present costs of material and labor in building operations the estimates speak for themselves as to the desirability of carrying out work in this simple way. Time was when outdoor substations were looked at askance and generally considered desirable only for very mild climates. Experience has taught their more general applicability, and the data before us sufficiently emphasize their practical advantages.

AMONG the articles which will be contained in the next issue of the **ELECTRICAL WORLD** will be one on the advantages of electrified rolling mills, which will dwell on the considerations necessary in applying motor drive, comparative costs, and useful information on power costs. The fourth installment of Prof. C. E. Clewell's indus-

The Coming Issues

trial series will discuss the attitude of machine tool builders to motor drive. In addition there will be special articles concerning the commercial side of the industry, besides the regular departments devoted to technical, operating, central station and market news and current happenings.

Distribution of Electric Power in Factories

Discussion of the Usual Practice in Distributing Energy, with a Consideration of the Effects of Changing Locations of Motors and the Value of Wiring Charts

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

SYNOPSIS.—In this article the author points out the fundamental importance of distribution circuits as the link between the power plant and the machines used for manufacture. Methods of preparing and using charts for keeping an accurate and up-to-date record of factory circuits, and of all changes which may be made on the circuits from time to time due to rearrangements in machinery and other causes, are discussed in connection with the advantages of having such wiring diagrams available when plans must be made for the installation of new motor equipment. The importance of circuit standardization to the factory as well as to the motor manufacturer is brought out, and interrelations which may exist between lighting and motor loads on given circuits are cited. Attention is called to the care which must be exercised in a proper division of the total load on the various circuits. The wiring diagrams shown in this article are based on the practice of a large manufacturer and illustrate methods which have proved successful in handling this problem.

A NUMBER of practical problems arise in connection with the distribution circuits in the average factory which have a close relation with the general operating features of the motor equipment. It is the purpose in the following notes to discuss some of these problems, not so much from the viewpoint of the design and installation of the circuits in a new plant as from that of the existing establishment in which changes in the location of machinery are necessary from time to time and also in cases where extensions of the plant are brought about by the large demands of an increased volume of business.

In many older and smaller factories, and also in many cases of large plants which have been in service for a number of years, there will be found a direct-current generating and distribution system which was governed to some extent at least by the class of apparatus, whether lamps or motors or both, which was installed at the time the plant was constructed. It is not uncommon, moreover, to find in the older and larger factories the initial direct-current system operating for the supply of the motors and lamps in certain parts of the factory within a small radius of the power house, with the addition later on of alternating-current distribution as the plant develops and the distances between the power house and more remote buildings become too great for the economical use of a direct-current supply.

Furthermore, as an additional factor, the increasing use of the adjustable-speed direct-current motor has made necessary the use of direct-current supply circuits in many large plants even where the distance of motors away from the power house was or has become too great for the economical use of direct current throughout.

Such a case is illustrated in Fig. 1, the advantages of high-voltage distribution being attained between the power house and rather remote sections of the factory by using alternating-current circuits as the means for transmitting the power from the generating room

to convenient load centers. Motor-generators or synchronous convertors or both are installed at the end of the alternating-current lines and from this point the lower direct-current and alternating-current voltages are distributed up and down the aisles within reasonable distances of these centers.

Even in such cases, however, it has sometimes been found desirable to supply direct-current circuits of, say, 500 volts directly from the power house, and particularly so when such special circuits involve a somewhat small element of the total power required by each section of the factory. Fig. 1, therefore, gives a good general idea of a more or less typical lay-out of circuits where both direct-current and alternating-current transmission have been found to work out successfully for sections somewhat remote from the center of gravity of the plant.

In its broader aspects the electric circuit, as the con-

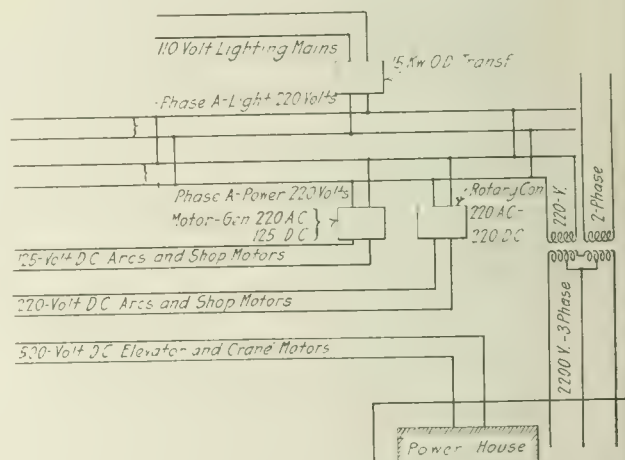


FIG. 1—SKELETON OUTLINE OF THE WIRING AS ARRANGED FOR ONE SECTION OF A GIVEN FACTORY

necting link between the power plant and the motors of a factory, forms a most important part of the complete power problem, since it is largely through efficiency in electric power distribution that the use of the motor has received such widespread acceptance as a substitute for line shafts and belting.

Notwithstanding the greatly superior characteristics of the electric circuit in contrast with mechanical power distribution, there is every reason from an engineering standpoint why the circuits in the average factory should receive the same care and attention in the everyday operation of the plant that is beginning to be recognized as essential for the successful operation of motor and lamp equipment.

Unfortunately, however, it is quite usual to find a marked degree of indifference in manufacturing concerns to the upkeep and general load conditions on the various component circuits which make up the entire distribution system, with the result that voltage and

power losses become excessive. Cases have occurred where some of the circuits in a given section were overtaxed while other circuits in the same section were either used very ineffectively or perhaps not loaded at all, owing to continual changes in motors from one part of the section to another and to the lack of any information concerning the amount of load on each circuit.

In instances of this kind not only do the lamps and

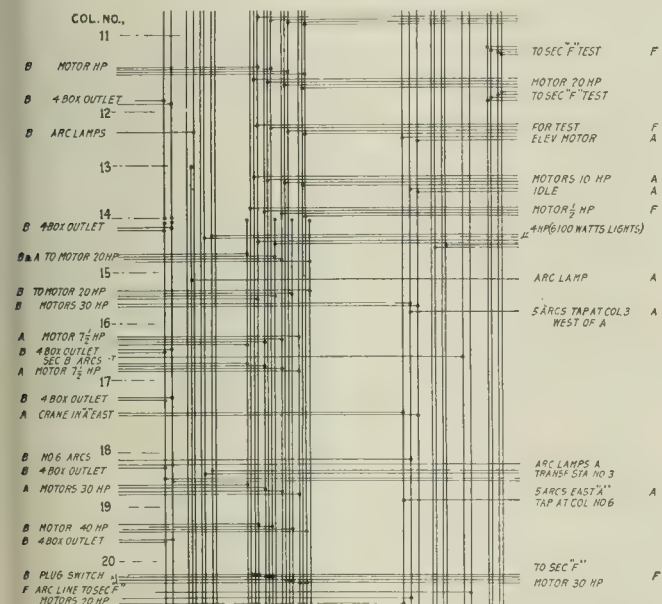


FIG. 2—METHOD OF INDICATING USES OF VARIOUS CIRCUITS

motors supplied by the overloaded circuits suffer by the low voltage due to the excessive voltage losses, but the power losses in the circuits become excessive and there is added the element of tying up the initial investment in long lines of copper which through oversight have become virtually non-producing as a part of the equipment.

Cases of just this kind are on record in practice, and as a remedy for the disadvantages of such a state of

Fortunately, there are some establishments which have realized the need for such accurate information concerning their circuits and which have taken steps to remedy the older haphazard method of making changes in the wiring. This makes it possible in the present article to describe briefly a typical case where the whole wiring situation has been worked out successfully.

An important point to note before describing this case is the fact that some plants, both large and small, have an electrician who has possibly been with the plant from its beginning and who knows or is supposed to know every circuit which has been installed. He may even resent the idea of placing on paper what he considers it his duty to carry in his head. However, the average electrician does not, nor is he able to, remember the changes in circuits which have been made over a period of years. If properly approached, he may be made to see that to reduce the wiring conditions to a definite set of diagrams not only serves to clarify the situation at the time of making changes in the wiring but that he is thereby saved much unnecessary care regarding the details of existing conditions.

It is, of course, a fairly simple and obvious matter to prepare such a map of all circuits in the new factory at the time of its construction, but as this article relates rather to older plants, the method now described will appeal to the latter rather than the former. Two general schemes are possible. One is to trace out and to reduce to a drawing all the circuits in a given section or on a given floor, with proper designations as to where each circuit comes from or where it goes and of all apparatus supplied from each tap. Such a diagram is shown in part in Fig. 2.

It may be stated that in this diagram the number and size of wires in each leg of the various circuits are indicated. Taps from these circuits are shown by lines up or down from the wires which extend along the aisle. Thus the load and its distribution along the circuit may readily be determined from the taps and the

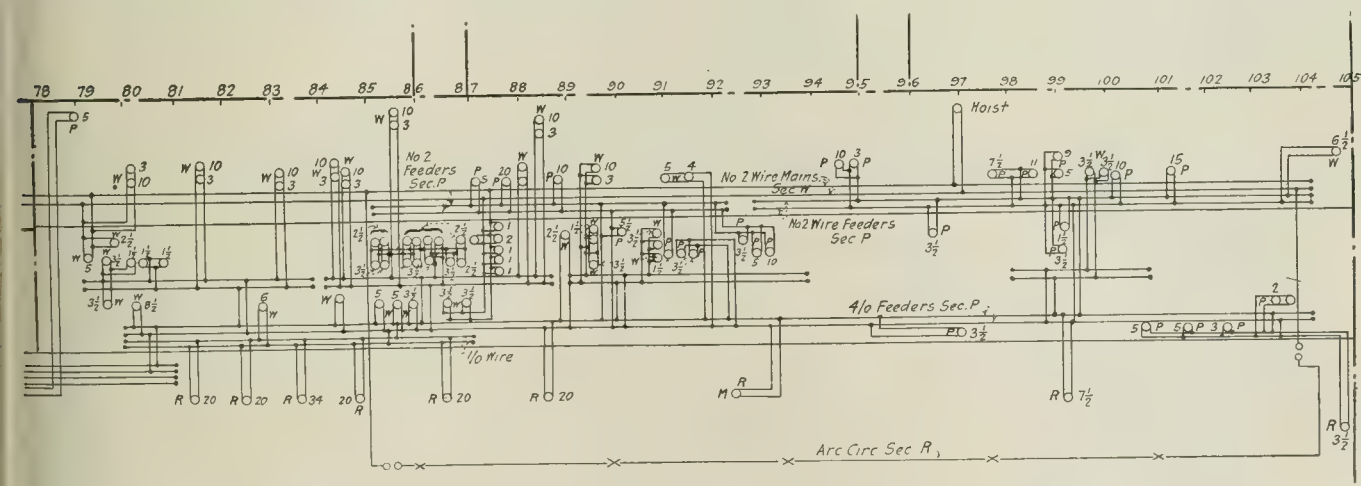


FIG. 3—METHOD OF TRACING RAMIFICATIONS OF 250-VOLT AND 500-VOLT CIRCUIT THROUGH A FACTORY

affairs the suggestion is here made that no factory should fail to provide as a part of its working records carefully prepared wiring diagrams of all existing circuits in such form that they may be available for everyday use in the changes which are sure to occur in practically every factory for both the lighting and power loads in the various sections of the plant.

designations of the character of the load on each of the taps.

Where there are several bays in the same aisle a comprehensive idea of the circuit conditions throughout the entire section can be obtained by placing a number of diagrams like Fig. 2 end to end and studying the complete situation. This scheme is rather awk-

Obtaining Approximate Values of Harmonics

Simple Method Which Is Based Chiefly on Shape of Hysteresis Loop—
Applicable to Sinusoidal or Non-Sinusoidal Impressed Voltages
but Most Accurate for Former

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A KNOWLEDGE of even the approximate magnitudes of the harmonics present in the no-load current of a transformer operating under specific conditions is often desirable. These harmonics are due to the cyclic variation in the permeability of the magnetic circuit. Unfortunately there is no exact method of solving the general case in which the electric "constants" of a circuit are variable. Any harmonic in the voltage can of itself produce no harmonic in the current of a lower frequency. If, however, it acts in conjunction with another harmonic of lower frequency, it will modify the harmonic of this frequency that would otherwise be produced. It is thus impossible to solve for the effects of the separate harmonics as if they acted alone and then to combine the results, as is done when the electric "constants" are not variable.

Apart from the circuit conditions outside the trans-

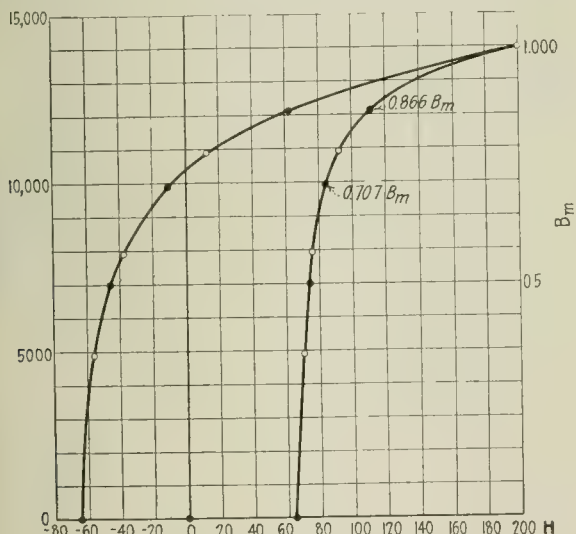


FIG. 1—VALUES ON WHICH CALCULATIONS ARE BASED ARE TAKEN FROM HYSTERESIS LOOP

former, the magnitudes of the harmonics depend almost entirely upon the shape of the hysteresis loop. Ordinarily eddy currents and the resistance of the coils play but a small part in determining them. Both of these effects will be neglected in the following calculation. In the method that is developed here the coefficients of the approximate current curve are chosen so that it intersects the true curve at eight points in each half cycle. The points chosen are when $\omega t = 0, 30 \text{ deg.}, 45 \text{ deg.}, 60 \text{ deg.}, 90 \text{ deg.}, 300 \text{ deg.}, 315 \text{ deg.}$ and 330 deg. It is, of course, not so accurate as a Fourier analysis, which uses a greater number of points than this, but it possesses the advantage of being less laborious.

If the sinusoidal voltage that is impressed on the transformer is

$$e = \sqrt{2}E \sin \omega t, \quad (1)$$

the flux in the core is

$$\varphi = \varphi_m \cos \omega t. \quad (2)$$

The maximum flux density in the core for this case is

$$B_m = \frac{0.225E10^8}{NfA} \quad \text{lines per sq. cm.,} \quad (3)$$

where N , f and A are respectively the number of turns in the coil, the frequency of the applied voltage and the cross-section of the core in square centimeters. The hysteresis loop for this quality of iron, shown in Fig. 1, is drawn for this maximum flux density. A higher density than is used in practice is taken in order to exaggerate the errors of the method.

Assume that the expression for the magnetizing force producing this flux variation is

$$\begin{aligned} h = & A \sin \omega t + B \cos \omega t, \\ & + C \sin 3\omega t + D \cos 3\omega t, \\ & + E \sin 5\omega t + F \cos 5\omega t, \\ & + G \sin 7\omega t + H \cos 7\omega t. \end{aligned} \quad (4)$$

Harmonics above the seventh are of little account. The magnetizing current taken by the transformer is

$$I_\varphi = \frac{0.796 l h}{N},$$

where l is the length of the transformer core in centimeters and N is the number of turns in the winding. The effect of eddy currents is to increase the coefficient A , in some cases as much as 25 per cent. This increase is $2\sqrt{2}P10^4/fB_m$, where P , f and B_m are respectively the eddy current loss in watts per cubic centimeter, the frequency and the maximum flux density in lines per square centimeter.

In order to solve for the eight unknown coefficients, A to H , it is necessary to write eight equations. These are obtained by choosing eight points on the flux-variation curve (Fig. 1) as follows:

$\omega t = 0$	$B_1 = B_m$
$= 30 \text{ deg.}$	$B_2 = 0.866 B_m$
$= 45 \text{ deg.}$	$B_3 = 0.707 B_m$
$= 60 \text{ deg.}$	$B_4 = 0.5 B_m$
$= 90 \text{ deg.}$	$B_5 = 0$
$= 300 \text{ deg.}$	$B_6 = 0.5 B_m$
$= 315 \text{ deg.}$	$B_7 = 0.707 B_m$
$= 330 \text{ deg.}$	$B_8 = 0.866 B_m$

$$\begin{aligned} h &= B + D + F + H = H_1, \\ &= \frac{A}{2} + \frac{\sqrt{3}}{2} B + C + \frac{E}{2} - \frac{\sqrt{3}}{2} F - \frac{G}{2} - \frac{\sqrt{3}H}{2} = H_2, \\ &= \frac{A}{\sqrt{2}} + \frac{B}{\sqrt{2}} + \frac{C}{\sqrt{2}} - \frac{D}{\sqrt{2}} - \frac{E}{\sqrt{2}} - \frac{F}{\sqrt{2}} - \frac{G}{\sqrt{2}} + \frac{H}{\sqrt{2}} = H_3, \\ &= \frac{\sqrt{3}A}{2} + \frac{B}{2} - D - \frac{\sqrt{3}}{2} E + \frac{F}{2} + \frac{\sqrt{3}G}{2} + H = H_4, \\ &= A - C + E - G = H_5, \\ &= -\frac{\sqrt{3}A}{2} + \frac{B}{2} - D + \frac{\sqrt{3}}{2} E + \frac{F}{2} - \frac{\sqrt{3}G}{2} + \frac{H}{2} = H_6, \\ &= -\frac{A}{\sqrt{2}} + \frac{B}{\sqrt{2}} - \frac{C}{\sqrt{2}} - \frac{D}{\sqrt{2}} + \frac{E}{\sqrt{2}} - \frac{F}{\sqrt{2}} + \frac{G}{\sqrt{2}} - \frac{H}{\sqrt{2}} = H_7, \\ &= -\frac{A}{2} + \frac{\sqrt{3}}{2} B - C - \frac{E}{2} - \frac{\sqrt{3}}{2} F + \frac{G}{2} - \frac{\sqrt{3}}{2} H = H_8. \end{aligned}$$

Solving these equations gives:

$$\begin{aligned} A &= -2M - N - R, & B &= 2S + T + V, \\ C &= 2M - 2N, & D &= 2S - 2V, \\ E &= -M - 2N + P, & F &= S - U + 2V, \\ G &= M - N + P - R, & H &= S - T + U - V. \end{aligned}$$

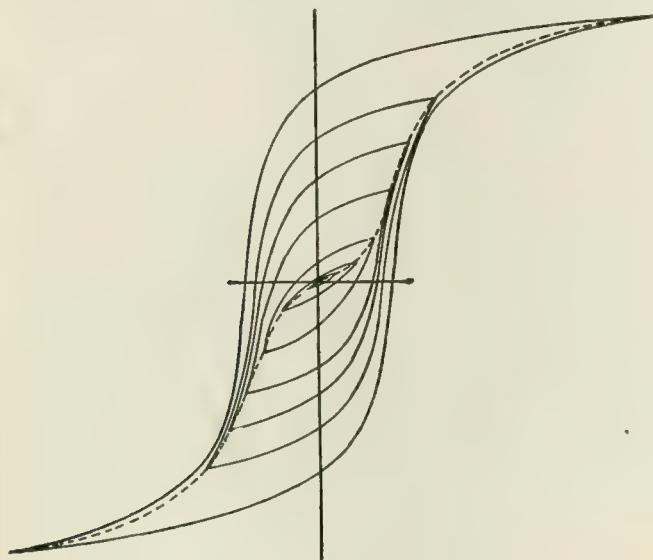


FIG. 2—COMPONENTS OF MAGNETIZING FORCE IN PHASE WITH FLUX DEPEND ON MEAN MAGNETIZATION CURVE, AND QUADRATURE COMPONENTS ON BREADTH OF LOOP

In which

$$\begin{aligned} M &= H_s/6, & S &= H_1/6, \\ N &= (H_s - H_2)/6, & T &= (H_s + H_1)/2\sqrt{3}, \\ P &= (H_1 - H_2)/2\sqrt{2}, & U &= (H_1 + H_2)/2\sqrt{2}, \\ R &= (H_s - H_1)/2\sqrt{3}, & V &= (H_s + H_1)/6. \end{aligned}$$

Care must be taken to give the abscissae H_1 to H_s their proper signs. M , N , P and R are proportional to the breadths of the hysteresis loop at the corresponding points. S , T , U and V are proportional to the abscissae of the mean magnetization curve at the corresponding points. Thus the components of the magnetizing force that are in phase with the flux depend only on the mean magnetization curve, while the components of the magnetizing force that are in quadrature with the flux depend only on the breadth of the hysteresis loop.

The mean magnetization curve, however, is not the normal saturation curve of the iron. The latter is the locus (Fig. 2) of the tips of the successive hysteresis loops taken with a constantly increasing maximum flux density. The magnitudes of the harmonics calculated from these two curves would, of course, be different. Thus hysteresis not only produces quadrature components in the magnetizing force, but also modifies the harmonics that would exist for a cyclic variation in the permeability that is determined solely by the normal saturation curve.

From the hysteresis loop (Fig. 1),

$\omega t = 0$	$B_1 = 14,000,$	$H_1 = 199,$	$M = 10.75,$
$= 30 \text{ deg.}$	$B_2 = 12,120,$	$H_2 = 62,$	$N = 8.17,$
$= 45 \text{ deg.}$	$B = 9900,$	$H = -11,$	$P = 33.4,$
$= 60 \text{ deg.}$	$B_1 = 7000,$	$H_1 = -46,$	$R = 34.5,$
$= 90 \text{ deg.}$	$B_1 = 0,$	$H_s = -64.5,$	$S = 33.2,$
$= 300 \text{ deg.}$	$B_1 = 7000,$	$H_2 = 73.5,$	$T = 50.0,$
$= 315 \text{ deg.}$	$B_1 = 9900,$	$H_1 = 83.5,$	$U = 25.6,$
$= 330 \text{ deg.}$	$B_s = 12,120,$	$H_s = 111,$	$V = 4.6.$

These points are marked by solid circles. Solving for the coefficients gives:

$$\begin{aligned} A &= -64.2, & E &= 6.3, \\ B &= 121, & F &= 16.8, \\ C &= 5.2, & G &= 1.5, \\ D &= 57.2, & H &= 4.2. \end{aligned}$$

Therefore the equation of the magnetizing force is

$$\begin{aligned} h &= -64.2 \sin \omega t + 121 \cos \omega t, \\ &+ 5.2 \sin 3\omega t + 57.2 \cos 3\omega t, \\ &+ 6.3 \sin 5\omega t + 16.8 \cos 5\omega t, \\ &+ 1.5 \sin 7\omega t + 4.2 \cos 7\omega t. \end{aligned} \quad (5)$$

Owing to the high saturation the third harmonic is abnormally large, being 42 per cent of the fundamental.

It is interesting to note that it required but sixteen minutes to compute the coefficients as given in equation (5). The average error in this equation computed at twelve points 10 deg. apart, not including those used in the original calculations, is only 1.5. The errors are about equally divided between plus and minus.

NON-HARMONIC IMPRESSED VOLTAGE

The method just outlined can also be used when the impressed voltage contains harmonics, provided their magnitude and phase are such that the time variation of the flux has but one maximum value during each half cycle. If there is more than one maximum value, the hysteresis curve contains interior loops. The term "maximum value" here indicates a mathematical maximum, i.e., $d\phi/dt = 0$ and $d^2\phi/dt^2 < 0$. Fig. 3 shows such a flux variation with maximum values at a and b . Since the voltage is zero whenever the flux variation is zero, only cases will be considered in which the voltage wave crosses the axis but once in each half cycle.

The determination of the maximum value of the flux density for which to draw the hysteresis loop may present some difficulty.

$$B_m = E_{av} \cdot 10^6 / 4NfA. \quad (6)$$

E_{av} is the average value of the impressed voltage and B_m , N , f and A are as in equation (3). If the harmonics are not all in phase with the fundamental, the simplest method of finding when the voltage wave crosses the axis is to plot it. If, for example, the voltage is zero when $\omega t = \alpha$, its average value is

$$E_{av} = \frac{1}{\pi} \int_{\alpha}^{\alpha + \pi} e d(\omega t)$$

The integration might be performed with a planimeter.

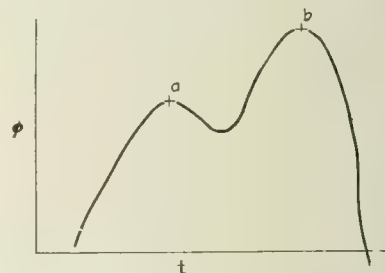


FIG. 3—FLUX VARIATION CURVE, INDICATING HYSTERESIS CURVE WITH INTERIOR LOOPS

If the harmonics are all in phase with the fundamental, the average value of the voltage is

$$E_{av} = 2\sqrt{2} [(E_1 \pm (E_3/3) \pm (E_5/5)) \pi,$$

where E_1 , E_3 , E_5 , etc., are the effective values of the harmonics. The plus signs are used when the harmonics are in phase and the minus signs when they are in opposition to the fundamental.

As an illustration of the method consider the simple case in which the impressed voltage is

$$e = \sqrt{2}E_1 \sin \omega t + \sqrt{2}E_3 \sin 3\omega t,$$

where $E_3 = E_1/3$.

The average value of this voltage is

$$E_{av.} = 2\sqrt{2}[E_1 + (E_1/9)]/\pi = E_1.$$

The maximum flux density by equation (6) is

$$B_m = E_1 10^8 / 4NfA.$$

Let the hysteresis loop, shown in Fig. 1, be drawn for this maximum flux density. For the impressed voltage considered the time variation of the flux is $\varphi = \varphi_1 \cos \omega t + \varphi_3 \cos 3\omega t$, in which $\varphi_3 = 1/9\varphi_1$ and $B = 0.9B_m \cos \omega t + 0.1B_m \cos 3\omega t$.

The maximum value of the flux density in Fig. 1 is 14,000 lines per square centimeter, while the values of the flux and magnetizing force at other points (marked by circles) on the hysteresis loop are:

$\omega t = 0$	$B_1 = 14,000,$	$H_1 = 199,$
$= 30$	$B_2 = 10,910,$	$H_2 = 13.1,$
$= 45$	$B_3 = 7920,$	$H_3 = -37.7,$
$= 60$	$B_4 = 4800,$	$H_4 = -56.0,$
$= 90$	$B_5 = 0,$	$H_5 = -64.5,$
$= 300$	$B_6 = 4800,$	$H_6 = 70.0,$
$= 315$	$B_7 = 7920,$	$H_7 = 75.5,$
$= 330$	$B_8 = 10,910,$	$H_8 = 92.$

By solving simultaneous equations for the coefficients A, B, C, etc., as before, the following equation of the magnetizing force can be written:

$$h = -71.1 \sin \omega t + 99 \cos \omega t \\ - 4.8 \sin 3 \omega t + 61.8 \cos 3 \omega t \\ + 2.9 \sin 5 \omega t + 24.4 \cos 5 \omega t \\ + 1.2 \sin 7 \omega t + 14 \cos 7 \omega t$$

The third harmonic is now 51 per cent of the fundamental and both the fifth and seventh are considerably increased.

If the phase relation of the third harmonic is reversed so that the impressed voltage is peaked instead of being flat-topped, the equation of the magnetizing force becomes:

$$h = -49.6 \sin \omega t + 176.2 \cos \omega t \\ + 21.5 \sin 3 \omega t + 44.2 \cos 3 \omega t \\ + 3.6 \sin 5 \omega t - 12.7 \cos 5 \omega t \\ - 3.0 \sin 7 \omega t - 8.5 \cos 7 \omega t$$

The accuracy of this method is not quite so good for these distorted voltage waves as it is for a sinusoidal one.

Boro-Silicon Glass

Fred M. Locke of Victor, N. Y., in patent No. 1,233,486, discloses an improvement on his boro-silicon glass, useful for high-tension insulators. The primary object of the invention is to produce an electrical insulator particularly adapted for conductors of high potential without the fusing temperature of the mass being raised to such an extent as to preclude economical production.

The following percentages of the mix are suggested:

	A	B	C
SiO ₂	71	75	70
B ₂ O ₃	28	15	13
Li ₂ O	1	1	9
Al ₂ O ₃ .....	..	5	2
Na ₂ O .....	..	4	..
Sb ₂ O ₂ .....	..	..	6

Among other things it has been discovered that the addition of a nitrate—as, for instance, nitrate of an alkali such as potassium nitrate or sodium nitrate—to the mix in manufacturing the insulator results in the production of a substantially pure-white transparent glass at lower fusion temperature.

ENGINEERING CHARGES

IN CAPITAL ACCOUNT

Allocation Attacked in Boston Street-Lighting Case—City Contends Charges Should Be Made to Operating Expenses

An interesting discussion of the assignment of engineering charges to capital account formed part of the arguments in the Boston Edison street-lighting rate case heard recently by the Massachusetts Gas and Electric Light Commission. Corporation Counsel Sullivan of Boston maintained that the Edison company practice of carrying a permanent engineering force and charging the engineering payroll and incidental expenses to property account is open to grave objections. He held that it may be proper for a company in the early stages of development to charge engineering expenses to property account, but that when the plant has been developed, the company has become a successful going concern and the installation required from year to year can be estimated with reasonable accuracy, engineering should be charged to operating account.

"If extraordinary charges are incurred in any one year," said Mr. Sullivan, "they should be prorated over a period long enough to prevent operating charges from becoming excessive in any one year."

MAKING ENGINEERING A CAPITAL CHARGE

For the Edison company, F. M. Ives of its counsel, Burdett, Wardwell & Ives, Boston, asserted vigorously that payroll expenditures which enter into cost of property should be judged by the same standards and be subject to the same tests which are applied to the property itself, and that anything which contributes to cost of property is not a proper charge to be collected in full from the consumer if it be true that the utility's duty is to provide funds for financing the investment. Where cost of street lighting was computed on the basis of unit costs plus an allowance for engineering and incidentals, the city in every case excluded any allowance for engineering.

Engineering expenses alone in rapidly growing utilities of large size form a very substantial addition to the amounts which can be legitimately assigned as part of the cost of service. In the case of the Boston company engineering expenses have varied from about \$125,000 to \$235,000 a year in five years. Even these amounts could not have been added to operating expenses without reducing the amount available for return below a fair amount after providing for all necessary intervening payments. Even if this were not the case, it must be conceded that questions of this kind ought to be decided upon merits; and from the consumer's point of view the company is certain that if the rate was sufficiently high to permit such expenses to be charged to operating account, rates should be reduced rather than kept up for collection of this unjustifiable charge. The experience of utilities has shown that the road to lower rates for existing consumers does not lie in the direction of collecting part of the cost of plant from consumers, but in developing new fields of use which have not already been fully supplied, and that more can be accomplished by reducing rates where new business can be built up which will not only pay its own cost but will help to reduce cost of existing business than by any other known method.

Inexpensive 33,000-Volt Outdoor Substations

Two Designs Have Been Worked Out by an Illinois Company That Give Greater Simplicity in Construction and Permit Greater Ease in Making Repairs—Cost Data and Bill of Materials Given

THE Southern Illinois Light & Power Company of Hillsboro, Ill., has standardized on the two types of 33,000-volt outdoor substations shown in the accompanying drawings. The two-pole type shown in Fig. 6 is used on installations as large as 150 kw. and as small as 50 kw. The four-pole type shown in Fig. 2 is for larger installations. The idea back of the design in both types was to plan a station which would be simple to construct and easy to maintain without involving too great an investment. One of the things which assisted in working out such a station was the elimination of all specially made equipment and fittings. The material used in these stations is all standard line material with but one minor exception.

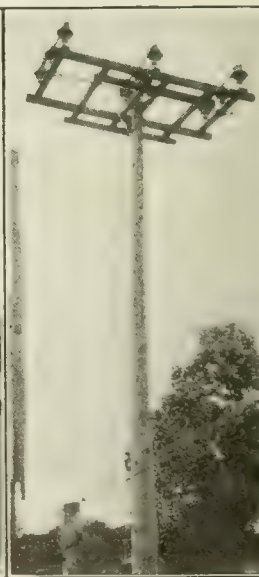
The two-pole station is used on either

used at coal mines because there are usually enough empty buildings about a mine to house the equipment. This type of station requires a space approximately 21 ft. (6.4 m.) long and 10 ft. (3.04 m.) wide.

The transformers are set on a concrete base instead of being erected on a platform. The latter plan was



FIGS. 1 AND 2—TWO-POLE SWITCH STRUCTURE AND FOUR-POLE SUBSTATION, DETAILS OF WHICH ARE SHOWN IN FIGS. 7 AND 9 RESPECTIVELY



FIGS. 3, 4 AND 5—TWO OLDER TYPES OF FOUR-POLE SUBSTATIONS AND ONE-POLE SECTIONALIZING INSTALLATION

single-phase or three-phase installations where the investment must of necessity be limited and where the apparatus is of such small capacity that the installation of electrolytic lightning arresters is not justified. It is frequently used for serving small towns, but is seldom

being made of 3-in. by 3-in. (7.62-cm. by 7.62-cm.) angle iron. It was selected for this service because it eliminates the necessity of boring extra holes in the arms, it transmits the strain equally to both of the arms, and it saves eyebolts. The fittings cost 14 cents apiece.

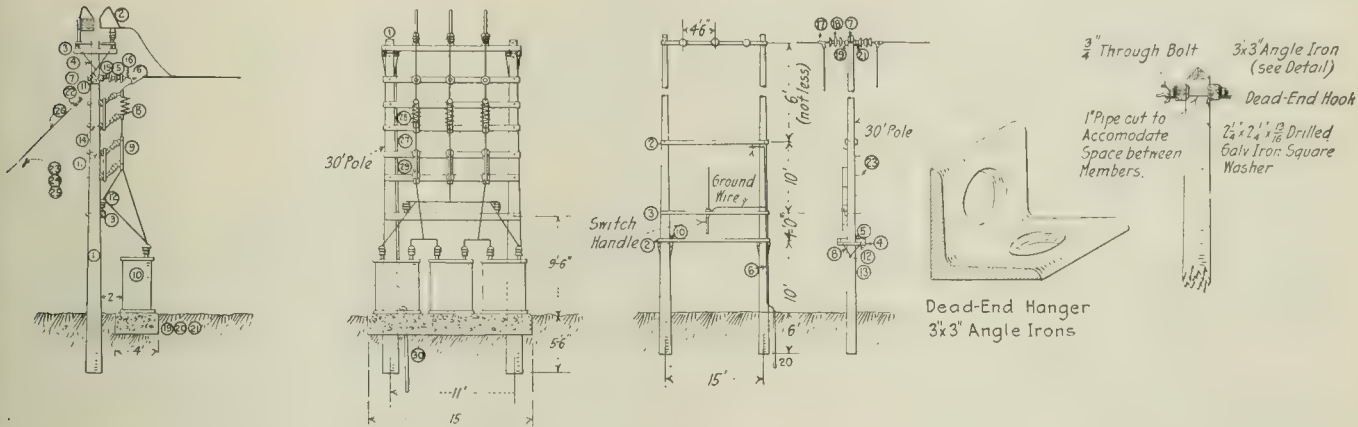
formerly used, but it was learned that the extra weight on the structure shortened its life and that repair work was unnecessarily difficult and dangerous. The character and amount of material used in this station are shown in the bill for materials on page 954. No. 2 solid copper is used on all bus work and all connections for greater mechanical strength.

A detail drawing of a dead-end hanger is illustrated in Fig. 8. It is the one item which is not standard,

The cost of a two-pole station of this type without transformers and without the switch structure, which is built separately as shown in Fig. 6, is \$773. An itemized statement of this expense is given in Table I, below.

The four-pole type of station is used where the load

serve such isolated industrial loads as coal mines if housing space were not available. The drawing and the bill of material give an adequate description of the station. It may be pointed out that the company at first used four-pin cross-arms in building the barbed-wire fence support because the arms were standard line



FIGS. 6, 7 AND 8—TWO-POLE TRANSFORMER STATION, TWO-POLE SECTIONALIZING STATION, AND DETAIL OF DEAD-END HANGER

TABLE I—ITEMIZED COST OF TWO-POLE SUBSTATION

Material	\$424
Labor	100
Superintendence	10
Interest and miscellaneous contingencies.....	40
Freight and drayage	100
Ten per cent overhead.....	63
Five per cent engineering and purchasing charges.....	36
Total	\$773

TABLE II—ITEMIZED COST OF FOUR-POLE SUBSTATION

Material	\$1,219
Labor	110
Superintendence	75
Interest and miscellaneous contingencies	50
Freight and drayage	100
Ten per cent overhead	156
Five per cent engineering and purchasing charges.....	78
Total	\$1,788

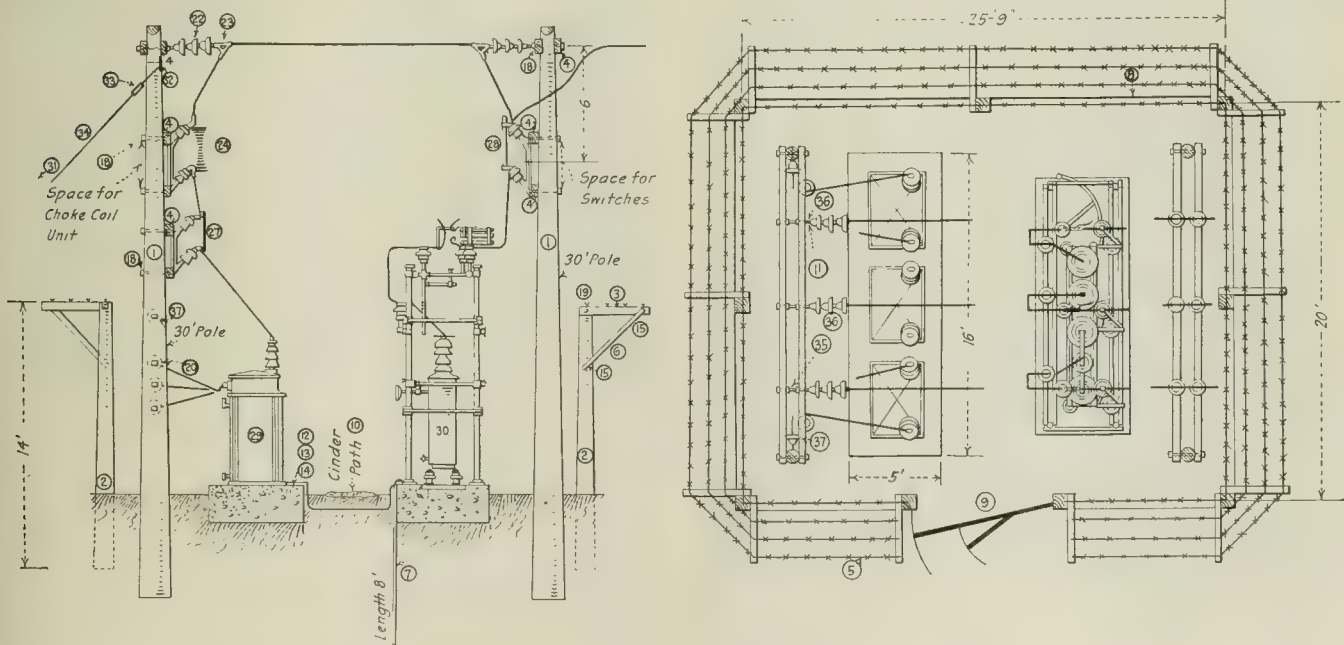


FIG. 9—ELEVATION AND PLAN OF FOUR-POLE SUBSTATION LIKE THAT SHOWN IN FIG. 2

and the character of the service required demand the use of electrolytic lightning arresters. The company has built this type of station in sizes ranging from 150 kw. to 500 kw., but there is no reason why the same design could not be employed for even larger stations. The installations which have been made to date serve towns, but stations of the same design could be used to

equipment. It has been found cheaper, however, to employ 4-in. by 4-in. (10.16-cm. by 10.16-cm.) timbers. Square posts were selected for sightliness. Building a small gate within the larger one makes for convenience under ordinary operating conditions and also at times when equipment must be moved in or out. The same special dead-end fittings are used on this struc-

ture as on the two-pole type. The cost of this station without transformers and without the separate high-tension switching structure is \$1,788. The costs are itemized in Table II.

Placed outside both of these types of station about one span distant is a two-pole high-tension switch structure. The detached location for this structure was chosen to afford plenty of clearance for working on the station dead. This same type of structure is also

BILL OF MATERIALS—FOUR-POLE STATION

POLE STRUCTURE		Quantity
Item		
1 30-ft. poles		4
4 4-in. by 6-in. hard pine		10
17 2¼-in. by 2¼-in. by 3 18-in. square washer		76
18 ¾-in. by 18-in. galvanized bolts		16
20 ¾-in. by 14-in. eye-bolts		6
31 ¾-in. by 8-ft. anchor rods		2
32 Shim plates		4
33 Three-bolt clamp		4
34 ¾-in. guy cable, ft.		75
FOUNDATIONS, ETC.		
12 Portland cement, bag		44
13 Sand, cu. yd.		4½
14 Screened gravel, cu. yd.		11
10 Cinders, cu. yd.		2
FENCE		
2 14-ft. square posts		9
3 4-in. by 4-in. 3½-ft. yard post		13
5 Barbed wire, ft.		400
6 26-in. cross-arm brace		13
8 Galvanized square-mesh fencing		96
9 Gate		1
15 ½-in. by 4-in. lag bolts		13
16 ¾-in. by 4½-in. carriage bolt		13
19 ¾-in. by 14-in. galvanized bolts		13
21 Staples		5
APPARATUS AND ACCESSORIES		
22 Ohio Brass strain disks		27
23 Ohio Brass dead-end clamps		6
24 Delta-Star type choke coil		3
27 Delta-Star fuse mount No. 8131		3
28 Delta-Star disk switch, type G		3
29 Westinghouse 200-kva., 33,000-volt to 2300-volt transformer		3
30 General Electric electrolytic arrester, type I		1
7 ¾-in. by 8-in. galvanized pipe		3
11 Angle-iron hanger		3
35 ¾-in. by 18-in. space bolts		4
36 Ohio Brass insulation hooks		3
37 2300-volt strain insulator		6
38 S. C. No. 51		4

standard for sectionalizing the company's transmission lines. They are installed for such work at intervals of 5 miles or 6 miles (8 km. or 9.7 km.), except where substations are less than this distance apart. The bill of material for this structure without apparatus is

TABLE III—COST OF SWITCH STRUCTURE

Material	\$224
Labor	50
Superintendence	5
Interest and miscellaneous contingencies	15
Freight and drayage	25
Ten per cent overhead	31
Five per cent engineering and purchasing charges	18
Total	\$368

given herewith. The apparatus used in addition to that itemized list consists of a Burke disconnecting switch with separate cast pins. This latter feature is an improvement which makes it possible to change insulators without taking the switch down. It also does away with handling small parts which linemen are apt to

drop and lose. The cost of this structure, including the switch, amounts to \$368. The cost is itemized in Table III.

The stations of these types which the company has

BILL OF MATERIALS—TWO-POLE SWITCH STRUCTURE

Item	Quantity
1 Straight cedar poles	2
2 4-in. by 6-in. by 16-ft. hard pine (long-leaf)	6
3 4-in. by 4-in. by 16-ft. hard pine (long-leaf)	1
4 Standard two-pin cross-arms	4
5 2-in. by 4-in. by 4-ft. hard pine	25
6 1-in. half-round single groove molding, ft.	12
7 ¾-in. by 20-in. spacing bolts	3
8 26-in. standard cross-arm brace	8
9 ¾-in. by 18-in. galvanized bolts	8
10 ¾-in. by 12-in. galvanized bolts	8
11 2¼-in. by 2¼-in. by 3/16-in. square washers	56
12 ¾-in. by 4½-in. carriage bolts	8
13 ½-in. by 4-in. lag screws	4
14 20-d wire nails, lb.	4
15 1-in. pipe straps	4
16 8-d wire nails, lb.	1/6
17 Ohio Brass dead-end clamp No. 6233	6
18 Ohio Brass strain disk No. 11,535	18
19 Dead-end angles	3
20 ¾-in. by 9-ft. galvanized-iron pipe	1
21 Ohio Brass hooks	6
22 No. 2 B. & S. gage copper wire, ft.	50
23 Galvanized pole steps	11

built are proving satisfactory. Practically the only important change in the first design consisted of employing strain-type insulators on the poles near the lightning arresters (Fig. 9) instead of the pin-type insulators which were first selected.

The outdoor substations described here were de-

BILL OF MATERIALS—TWO-POLE STRUCTURE

Item	Quantity
1 Straight cedar poles	2
2 Schweitzer & Conrad or Burke sphere-gap arrester	3
3 Standard 4-ft. cross-arm	4
4 26-in. cross-arm braces	8
5 Victor insulator No. 2335A or Ohio Brass No. 4535	9
6 Ohio Brass clamps No. 6233	3
7 ¾-in. by 18-in. spacing bolts	3
8 Delta-Star type G choke coil	3
9 Delta-Star type G fuse mount	3
10 Transformers	3
11 4-in. by 6-in. by 12-ft. hard pine	9
12 Thomas insulator No. 3058 or Locke No. 3512	2
13 Electric Service Supplies Co. iron pin No. 163	2
14 ¾-in. by 18-in. galvanized bolts	4
15 Locke or Ohio Brass attachments	3
16 Locke or Ohio Brass attachments	3
17 ¾-in. by 4½-in. carriage bolts	8
18 ½-in. by 4-in. lag bolts	4
19 Portland cement, bag	27
20 Sand, cu. yd.	2
21 Screened gravel	5
22 Three-bolt guy clamp	4
23 Guy thimbles	4
24 6-in. anchor rods	2
25 3-in. by 3-in. anchor washers	2
26 ¾-in. galvanized guy cable, ft.	75
27 Ground molding, ft.	24
28 1-in. pipe straps	12
29 Upper ground cable, ft.	40
30 ¾-in. by 8-ft. ground pipe	1
31 No. 2 B. & S. gage solid copper wire, ft.	60
32 ½-in. by 7-in. machine bolts	18
33 2¼-in. by 2¼-in. square washers	42
34 Schweitzer & Conrad No. 51A	3
35 Washers placed under each through-bolt head and nut	

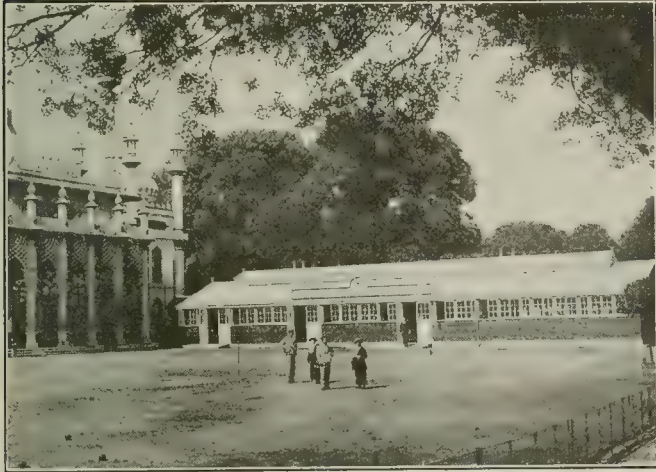
signed under the direction of W. F. Corl, general superintendent of the Southern Illinois Light & Power Company.

Electrical Training for Crippled Soldiers

Work Done in England to Fit Workers for Service in Electrical Industries—
Public Duty to Provide a Chance of Employment a
Little Better than the Average

BY DOUGLAS C. MCMURTRIE*

ELECTRICAL work in its various branches is proving a popular way in which to train soldiers crippled in the present war. It is one of the leading subjects of instruction at Queen Mary's Hospital, Roehampton, England, where there are at any one time



WORKSHOP AT PAVILION MILITARY HOSPITAL, BRIGHTON

hundreds of men with amputated limbs awaiting the fitting of artificial arms and legs and being meanwhile prepared for return to civil life—independent and self-supporting.

At the Pavilion Military Hospital, Brighton, there are likewise electrical classes, carried on in Queen Mary's Workshop, operated in conjunction with this center for the care of limbless soldiers. There is provided instruction preparatory to various openings which call for a knowledge of electrical machines, lighting, telephones and bell systems. The men are trained as electrical assistants and for attendants in private houses, theaters, hotels, business houses, workshops, mills, coal mines and so forth. There is also a special course to enable men to qualify as switchboard attendants at electric power stations.

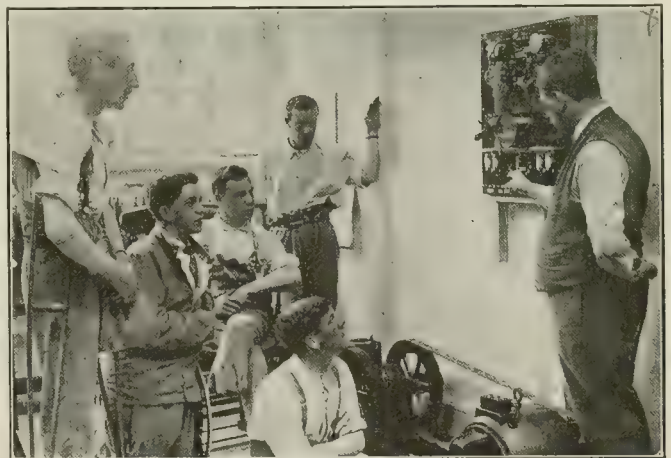
The Institution of Electrical Engineers, in co-operation with the London public educational authorities, has organized classes for training disabled soldiers and sailors as electrical substation attendants. The instruction is given at the Northampton Polytechnic Institute. Up to the present time 150 men have completed the course. The instruction comprises workshop practice in wiring and the use of simple tools, power-house demonstrations, electrical and physical laboratory work, class demonstrations in the elements of electrical engineering and of simple engineering physics, the writing of reports on demonstrations and laboratory work, and, in conclusion, an oral examination.

At the Regent Street Polytechnic in London there

are courses of a similar nature. Here are received for more advanced training men who have done preliminary work in the hospital at Roehampton. The men are first instructed in general electrical work and then passed on to the London United Tramways for experience in generating plant and substation practice. This course takes from two to three months.

At the Battersea Polytechnic in London the principal says that the second most popular course offered to crippled soldiers is that in electrical testing or switchboard work. "We have trained successfully men suffering from shell shock and nervous trouble, together with other types of disablement. A fair education is required for this work, together with ability to do simple calculations. For this work we do not mind taking men who have only partial use of an arm or hand, as it often happens that the fuller use of the arm is simply a matter of time. We do not, however, care to take those who have actually lost an arm, and we would rather not have them if they have lost a leg, although the latter is not so important as the former. We have been able to place all the men who have been through this work, and the firms are willing to take other men when they become ready for work. We think this work offers reasonable wages and conditions."

The Fife Mining School, Cowdenbeath, England, conducts a course for electric motor and switchboard operatives. Some of the men are preparing to be underground motor attendants in the mines; in these cases



UNFOLDING MYSTERIES OF DYNAMO AND SWITCHBOARD TO EAGER PUPILS

their electrical training is supplemented by preparation for a mine fireman's certificate.

A communication from the director of the school gives the following syllabus of the course:

What happens when an electric current passes in a conductor. Heating, glowing and fusing of a wire carrying a current. Use of fuses. Tests with fuse wires. Replacement of fuses.

*President of the Federation of Associations for Cripples, editor of the *American Journal of Care for Cripples*, and acting director of the Red Cross Institute for Crippled Soldiers and Sailors.

Resistances and their use in controlling currents. Measurement of electrical currents and pressures. Elementary notions of the construction of ammeters and voltmeters. Range of the instruments. Precautions to be observed in their use. Conductors and insulators. Insulated conductors of various types. Arrangement of conductors in series and in parallel circuits. Uses of porcelain, rubber, paper, slate,



ELECTRICAL WIRING AND TESTING, ROEHAMPTON

marble, etc., as insulators. Jointing. Construction and use of blow lamp and soldering iron. Making of married and T joints on conductors. Sweating of joints, thimbles and connectors. Switches of various types and their use in the control of electricity.

Motor starters and their care and proper usage.

Trip devices. General arrangements of a switchboard.

Testing. Use of test lamp and detector for sorting out circuits. Pole finding.

Electric bells and indicators.

General idea of a direct-current generator.

General idea of direct-current motors.

General idea of the construction and use of a battery of accumulators, and of how it should be cared for.

Practical exercises in operating direct-current generators and motors and in charging a battery. Some simple notions of alternating-current generators and motors and on the synchronizing of two alternating-current generators.

The conception of national responsibility to the disabled soldier, not only to pay him a pension but to re-educate him in some trade which he can follow in spite of his handicap, was recognized for the first time early in the European war. It is now realized that the cripple, while perhaps unable to take up again his former trade, is not debarred from all occupation. The effort is always to select some trade related to the former occupation of the disabled man; in this way his former experience is not lost. A competent journeyman bricklayer who has lost an arm may be prepared by a suitable course in architectural drafting and the interpretation of plans to take a position as construction foreman of a bricklaying gang. It would be idle to give such a man a course in telegraphy. But a train hand who has been all his life familiar with railroad work may most wisely be trained as a telegraphic operator, with a little commercial instruction on the side.

Instruction is of little value if it is not thorough. Nothing could be more unfortunate either for the individual soldier or for the cause of crippled men in general than to turn out into any trade classes of half-trained men. Courses should be too long rather than too short. When preparation is defective it makes for

bitter discouragement on the part of the workman and distrust of the training system on the part of the employers. Men disabled in the national service deserve the very best provision which the country can organize for them.

The authorities responsible for re-educating disabled soldiers must depend very largely for advice and assistance upon representatives of both workers and employers in any line in which instruction is given. Those in the electrical trades in this country may expect to be called upon for co-operation when there are organized in the United States training schools for the crippled men of their own forces. The nation cannot go too far along the right lines. To give the crippled soldier the best of medical care, a good artificial limb, a first-rate training to fit him for a remunerative trade, and a chance of employment a little better than the average—these constitute the real public duty. A coddling attitude should be frowned upon as actually unpatriotic, the other promoted and encouraged.

The first country to make adequate provision for the trade-training of war cripples was France, where a school was started at Lyons a few months after the opening of hostilities. Now there are hundreds of instruction centers in the various belligerent countries. Even Belgium has several schools to meet the needs of her disabled soldiers.

In Canada the work is national, being carried on by the federal government, which has established throughout the Dominion schools for war cripples.

American interest in the subject is growing daily. In New York there has been established the Red Cross Institute for Crippled Soldiers and Sailors, made possible by a gift of more than \$50,000 from Jeremiah Milbank. Committees have been formed and plans for reconstruction centers are under way in Chicago, Boston and other cities. The Surgeon General's office of the



ELECTRICAL WORKSHOP, ROEHAMPTON

War Department has announced its intention to establish training centers in connection with the great base hospitals.

But it is on the enthusiastic support and assistance of thousands of individuals, expert in various lines, that must rest the ultimate success of reconstructing the crippled men of the national army.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

THE LINEAR EXPANSION OF COPPER BUSBARS

Chart Is Arranged for the Direct Determination of the Actual Expansion of a Bus Run Over Any Reasonable Change in Temperature

In a great many central stations and industrial plants the linear expansion of busbars with change of temperature has given rise to much difficulty. In some cases this displacement of busbars due to expansion has damaged the supporting insulators and in other cases it has destroyed the alignment of switches placed in immediate connection with the bus.

The accompanying chart is arranged for the direct determination of the actual expansion of a bus run of 100 ft. (30.5 m.) in length over any reasonable range of temperature established in either degrees Centigrade or

ture range chosen. Presentation of this information in such a simple form has been made possible through the co-operation of the Bureau of Standards in establishing the varying coefficient of expansion for copper, says the General Devices & Fittings Company, which contributed this chart.

Any damage to the insulators or nearby switches may be forestalled by the judicious relief of this bus travel by means of expansion joints. It should be noted that the expansion determined from the chart is the actual expansion and is somewhat greater than the expansion of the bar relative to the supporting structure. The supporting structure has generally less expansion over any range of temperature and is not subjected to such a wide variation of temperature as the busbar itself, nor does it respond so quickly, since the temperature variation is first in the room air and not in the building material itself.

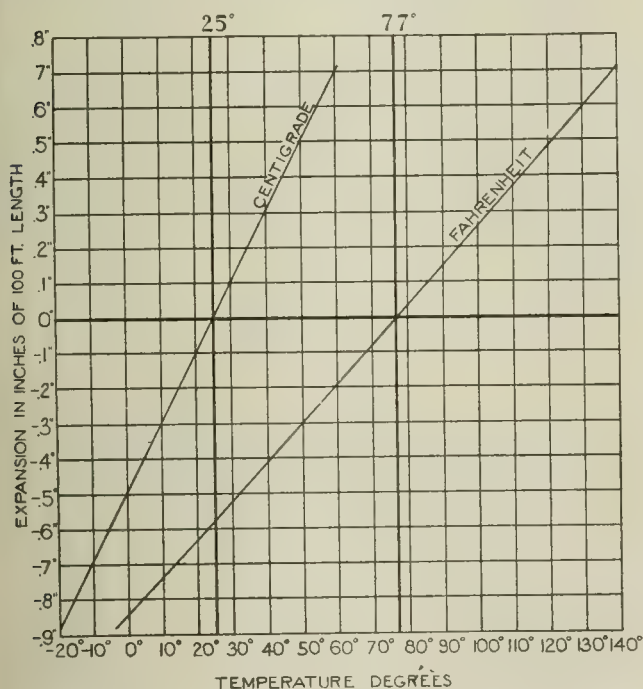


DIAGRAM OF LINEAR EXPANSION OF COPPER FOR DIFFERENT TEMPERATURES (FAHRENHEIT AND CENTIGRADE)

Fahrenheit. For simplicity the expansion is taken both ways from an assumed installation temperature of 25 deg. C. (77 deg. Fahr.), so that over all ordinary ranges the total expansion for 100 ft. (30.5 m.) of bus run will be the sum of the values shown above and below the installation length. For example, a 100-ft. (30.4-m.) length of bus on which the temperature might vary from 10 deg. C. to 55 deg. C. would contract 0.3 in. (7.5 mm.) below installation length at 10 deg. C. and expand 0.6 in. (15.5 mm.) over installation length at 55 deg. C., or, disregarding the installation entirely, would have a total change of length of 0.9 in. (23 mm.) over the tempera-

SHUNT REACTORS OFFSET HIGH-CHARGING CURRENT

Method Suggested to Compensate for Currents of This Nature Experienced on Iowa Iron-Wire Transmission Lines

BY C. J. JONES

In the opinion of the writer, the most economical and practical way to compensate for the heavy charging current experienced on the iron-wire line of the Midland Water, Light & Ice Company, Dodge City, Iowa, and pointed out by M. D. Leslie in the Oct. 13 issue of the *ELECTRICAL WORLD*, is to connect iron-core reactors across the high-tension side of the transformers at the delivery end of the line. These should preferably be provided with taps so that the lagging current drawn from the line can be adjusted to compensate for changes in the charging current. Of course, the larger the number of taps on the line the greater will be the cost of the reactors.

Under the conditions named by Mr. Leslie, 22,000-volt reactors with 1-amp. and 2-amp. taps should be sufficient. The reactors could have air gaps in their cores and the iron should be magnetized at a reasonable flux density. When the charging current on the generators is 30 amp. (3 amp. on the 22,000-volt line) and the 2-amp. taps of the reactors are connected, the latter will draw 2 amp. lagging current while the line is drawing 3 amp. leading current, making the resultant current drawn from the generator 10 amp. (1 amp. at 22,000 volts) leading, in addition to that caused by line, transformer and reactor losses.

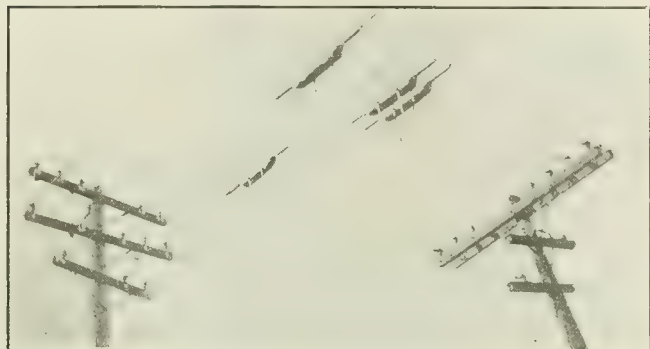
Another method of compensating for the charging current, one which is not quite so practical or economical as the foregoing, however, is the use of a specially constructed transformer taking a large exciting current.

LINEMEN'S SHIELDS ARE USEFUL IN EMERGENCIES

Interruption to Service Resulting from Accident Is
Minimized by Separating Crossed Lines
Temporarily with These Appliances

Linemen's shields may not only be used for the protection of workmen but will be found useful in emergencies to prevent crosses between lines.

In a recent automobile accident which occurred in the early evening a 40-ft. (12.2-m. pole was cut off



LINEMEN'S SHIELDS SEPARATE CROSSED WIRES TO MAINTAIN
TEMPORARY SERVICE

4 ft. (1.2 m.) above the ground line, and the splintered butt dropped to the ground. The pole remained in approximately a vertical position, however, owing to the attached lines and guys, but the 2300-volt wires carried on the top cross-arm were lowered onto the secondary wires of a cross lead. In order to maintain service with safety until a new pole could be set on the following morning the repair foreman availed himself of a supply of linemen's shields, as shown in the photograph.

MEASURING THE WATER FOR BOILER-FEED USE

How an Accurate Method for Weighing Feed Water
in a Very Limited Space Was Worked
Out at Toledo

BY ALEX. W. MORGAN

In conducting tests in the boiler room of the Toledo Railways & Light Company it was found that owing to the lack of space the ordinary method of weighing the water could not be used. Moreover, the plant had no extra pump that could be used for test purposes only. A special method of measuring the water was therefore devised.

Knowing that an orifice will pass a given amount of water under a given head, and that the amount of water passed varies as the square root of the head, a measuring tube was designed using orifices the capacity of which had been determined by actually weighing the water passed through them in a given time.

The measuring tube consisted of two 5-ft. (1.5-m.) pieces of 12-in. (30.5-cm.) flanged pipe fastened end to end and suspended vertically. Between these flanges was inserted a circular piece of 1/16-in. (1.59-mm.) boiler-plate in which four 1/8-in. (2.86-cm.) orifices had been drilled. The centers of these orifices were on a circle which divided the cross-section of the pipe into equal areas.

Down the center of the pipe was placed a 2.5-in. (6.4-cm.) lead pipe connected with the water supply. The lower end of the 2.5-in. (6.4-cm.) pipe was capped and placed about 12 in. (30.5 cm.) above the orifice plate. A large number of 1/2-in. (1.3-cm.) holes were drilled in the lower end of the 2.5-in. (6.4-cm.) pipe to change the direction of flow of the water in order to reduce to a minimum any disturbance which the water entering

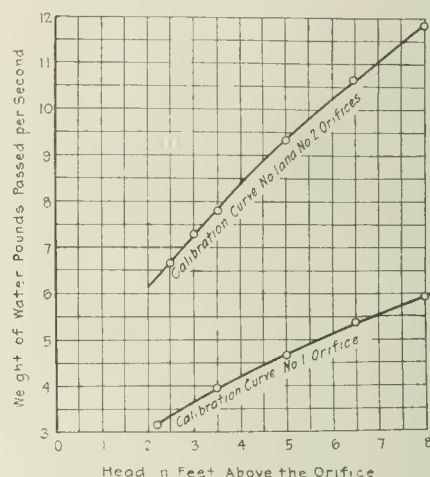


FIG. 1—METHOD OF PLOTTING CALIBRATION CURVES

might make and also to prevent the velocity head of the incoming water from exerting an influence upon the flow through the orifices. Gage glasses were attached to the outside of the 10-in. (25.4-cm.) pipe to indicate the head and a 2.5-in. (6.4-cm.) valve was placed in the water line to regulate the height of the incoming water in the 12-in. (30.5-cm.) pipe. The 12-in. (30.5-cm.) pipe was placed directly over a tank connections from which lead to the injector.

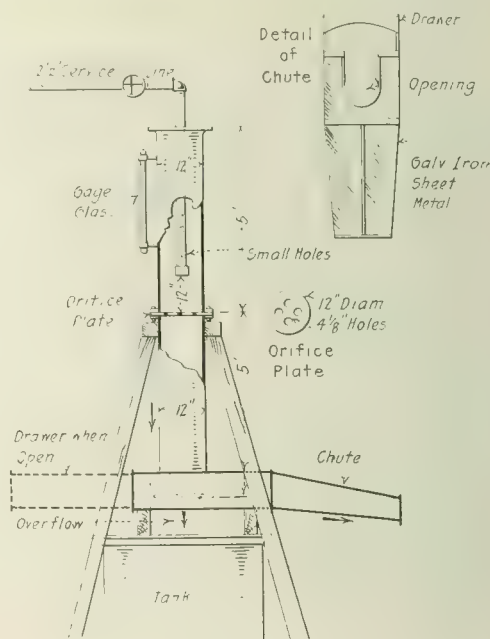


FIG. 2—CHUTE FOR REGULATING FLOW OF WATER

When calibration was undertaken it was found that some means of diverting the water in case the tank became too full should be provided. Consequently, a hollow chute was made of galvanized iron to fit snugly around the 12-in. (30.5-cm.) pipe. The upper end of the chute was left open and a sliding drawer having a

bottom, sides and back was made to fit snugly inside the chute. A hole, the diameter of the 12-in. (30.5-cm.) pipe, was cut out of the bottom of the chute, so that opening or pulling out the drawer allowed the water to flow directly into the tank and closing the drawer diverted the water. This arrangement permitted maintenance of a constant head upon the orifices and at the same time, if the tank became too full, permitted the water to be diverted for a short time.

The accuracy of this method of measuring feed water is its chief feature. The data taken in the calibration tests were plotted, using a scale of sufficient size so that they could be read to 0.01 lb. (4.5 grams) per second and 0.02 ft. (6.09 mm.) of water column. In the tests the head on the water column was read every minute and the weight of water was taken from the calibration curve. The average percentage of difference between each two sets of reading was 0.246 per cent for one orifice and 0.040 per cent for two orifices.

SIMPLE MOTOR DRIVE PERMITTED BY TURBO-GEAR

Better Grouping Attained and Considerable Floor Space Saved by This Method of Driving Units in Steel Mill

In many mill installations, especially where line-shaft drives are employed, it is very desirable to have the driving and driven shafts in the same line. This arrangement results in a great saving in floor space and permits a more convenient and better grouping of the units. An interesting application of this character is shown in the accompanying illustration of a 100-hp. motor directly connected to a line shaft in the tin-plate mill of one of the largest steel companies through a turbo-gear. The speed reduction between the motor and line shaft is 730 to 122 r.p.m.

It may be observed that the gears and motors are mounted on base plates set upon concrete pillars in



APPLICATION OF GEARS IN TIN-PLATE MILLS

such a manner that the gear shaft and line shaft are directly in line. This arrangement is feasible as the turbo-gear requires no attention or adjustment after being properly installed. The turbo-gear is manufactured by the Poole Engineering & Machine Company, Baltimore, Md.

A SAFETY RESOLVE FOR THE COMING NEW YEAR

Illinois Company Makes Use of an Effective Poster at a Time When Workmen's Minds Are Particularly Receptive

When every one was thinking and talking about New Year's resolutions for 1917 the Bloomington & Normal Railway & Light Company took advantage of the receptive condition of its employees' minds to promote safety first. The idea was carried out by using posters worded as follows:

JANUARY 1, 1917

RESOLVED

that I will do everything in my power to further the

SAFETY FIRST MOVEMENT

in view of the fact that I am the chief beneficiary.

These printed posters, which measured about 24 in. by 30 in. (60.9 cm. by 76.1 cm.), were placed in conspicuous positions about the company's property. It is said that the effect was favorable.

OPERATING HINTS FOR OPERATORS OF STATIONS

Three Maxims: Cleanliness Must Always Be Observed; Keep Pets Out of the Station; Play Safe Always

In a recent issue of the *Au Sable News*, a publication of the Consumers' Power Company of Jackson, Mich., the following hints were given for the benefit of station operators:

Have a narrow brush with a wooden handle of suitable and safe length for cleaning off the tops of oil switches. (This does not refer to high-voltage switches, which must not be cleaned while energized.) If you cannot get the right sort of brush, make a swab of wiping rags. Be very careful in wiping around oil switches not to trip them. Sometimes a slight jar will trip an oil switch.

Examine all "dustless" dusters, brushes, etc., to make sure they are not constructed of wire.

Don't paint switch hooks, insulators or anything else that is to come into contact with the high-tension circuits. Paint may contain metals or minerals that are conductors of high-potential energy.

In cleaning or dusting the back of a switchboard, touch lightly and be careful not to short-circuit a relay or meter or trip a remote-control switch.

Keep pet animals out of stations as they are liable to ground switch tanks and short-circuit wires.

Treat all wires and apparatus, whether insulated or not, as alive and dangerous to touch or approach until they are known to be dead and safe to handle.

To avoid misunderstandings, telephone messages should always be repeated.

Cleanliness must always be practiced. Use your spare time in keeping all parts of your station clean, or see that this is done by some one else.

CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

THREE PER CENT OF RESIDENCE CUSTOMERS RANGE USERS

St. Louis County Puts 1415.1-Kw. Electric Cooking Load on Lines in Fifteen Months, or 15 per Cent of Connected Load

During the fifteen months period ended July 31 last the St. Louis (Mo.) County division of the Union Electric Light & Power Company placed in operation 238 electric ranges. These were all sold singly. The total connected load of these ranges is 1415.1 kw. (manufacturer's rating), an average of slightly better than 5.9 kw. per range. These figures do not include any increases over the installed ratings that have been made by customers.

In these fifteen months over 3 per cent of the company's residence customers became electric range users. Furthermore, approximately 15 per cent of the division's connected load as of July 31 was electric range load.

Later figures show that the company had on its lines on Sept. 1 last 260 electric ranges.

COMMITTEES IN CLEVELAND HELP INTERNAL MANAGEMENT

Four Committees in the Cleveland Electric Illuminating Company Assist in Co-ordinating Work of the Various Departments

A system of committees for handling internal affairs has been established by the Cleveland Electric Illuminating Company and is proving to be helpful in co-ordinating the work of the different departments. Four committees have been formed—efficiency, production, distribution and sales. The assistant general manager is chairman of each committee. The general purpose is to effect a closer degree of co-operation between the different departments and to settle many routine matters and details of co-ordination before questions are referred to executive officials for decision.

The various committees meet twice each week at stated periods. They pass on the advisability of recommending the authorization of all expenditures of any material size. It is understood that the member who is to present a subject must have his case fully prepared in advance so that no time shall be wasted by the committee. Estimates, arguments and other necessary data must be ready for the committee and be subjected to criticism and scrutiny.

The efficiency committee analyzes the expenses of all departments, recommends the introduction of economies and considers any methods of saving money that may be suggested. It passes upon all applications for additional men in any department; it makes recommendations affecting the combination of work, reduction of labor or elimination of work in any department which it deems

not essential. These recommendations are submitted in writing to the management, and, if approved, are transmitted in an order to the department head affected. The committee is composed of the assistant general manager, ex officio; the auditor, the statistician and the head of the service department.

The production committee is composed of the assistant general manager, ex officio, the mechanical engineer and the heads of the electrical engineering, station operating and electric operating departments. This committee recommends to the management what action shall be taken in regard to contemplated work in connection with construction or extension of power houses or substations, the installation of steam or electrical machinery in power houses or substations, and, in general, the production of power. If the sales department should send a request for energy for some purpose, the matter would be referred in the preliminary stage to the production committee, which would decide whether the station or substation was in a position to carry the load at the time it was wanted. A definite recommendation as to whether or not the energy could be provided would be made by the committee. The committee is kept posted about possible large future contracts. Assuming that a new construction enterprise was approved, the head of the department concerned would get estimates or bids and submit them to the committee with his recommendation as to which offer should be accepted and a statement of the reasons for his position. If deliveries on apparatus should delay completion of construction, a member of the committee would get in touch with the manufacturer responsible and see what could be done to expedite his work. Until completion of the job the committee follows it closely. A statement of the main items on a construction job is put into written form by the committee and this is signed by every member. The jurisdiction of this committee covers operations from the coal pile to and including substations.

The distribution committee consists of the assistant general manager, ex officio; the superintendent of the construction department, which handles outside construction to the point where the service department takes it up; the superintendent of the service department, and a representative of the electrical engineering department. Its work is similar in distribution matters to that of the production committee in production questions. Each job is considered carefully and a preliminary estimate of cost is submitted to the committee before action is taken.

The sales committee considers matters affecting energy contracts, prospective loads, advertising and selling policies.

All decisions of the various committees are subject to the approval of the management. The plan is having the effect of making the different department officials more familiar with the work of other departments. It

is helping to keep the policies of the company uniform and to perpetuate practices of the past which have been found desirable. The committees find that the interchange of views brings out precedents in many cases which help to solve problems. Service can be checked with great care, and the conferences make it possible to keep every one advised promptly of affairs which affect his work.

Minutes of every meeting are recorded and filed in the general manager's office, together with copies of recommendations made and the resultant orders.

VALUE OF EMPLOYEE TO COMMERCIAL DEPARTMENT

**Company Is Able to Increase Its Business Largely
Because of the Leads Turned in by Men
in All Departments**

Labor is very scarce and is daily becoming scarcer. Evidences of this abound. In the commercial departments of central stations a definite dearth of salesmen, not an imaginary one, prevails.

A little more than a month ago the ELECTRICAL WORLD made an investigation, among other things, of this situation, and the results clearly indicated the shortage that exists. Department managers did not hesitate to say that they were short-handed.

It appears that men of higher caliber and greater integrity than the general run of salesmen are required. For that reason it is a doubly difficult problem to fill the gaps that have been made by the war or through the war. True, in some cases lighting companies have released their salesmen or part of them, but it will be found that in most cases this action was taken for certain local reasons. The fact is that for the most part the electric light and power utilities are eager and anxious to secure salesmen of high intelligence.

With this situation in mind, therefore, it has become evident to some and is becoming so to others that, in spite of the fact that the remaining men are accomplishing more work individually than they did when sales forces were complete, certain activities that the commercial department formerly pursued must be either curtailed or abandoned. This is true for two reasons—first, as indicated, the smaller force can do so much and no more; second, present conditions have developed a broadened and in many cases even more intense field for commercial activity.

It is thus plainly evident that the present force of salesmen must confine their efforts to obtaining the maximum business in the minimum time. To obtain the maximum result it is apparent that less time can be devoted to development work. Therefore some means must be devised to furnish the diminished sales force with leads of a particularly high character.

A good many plans have been tried in the past, many of which have been highly successful. One was tried out about three years ago in Minneapolis whereby customers furnishing leads that resulted in new business for the company received compensation in the form of energy-consuming devices according to a prearranged plan. The customer would arouse the desire to buy in her neighbor's mind and the company's salesmen clinched the sale. The results were considered at the time to be very satisfactory. Plans of a more or less

similar nature have been worked out for house-wiring particularly, for this line of work could easily be widened to include appliances, for which there is now a growing demand occasioned again by labor scarcity.

Another plan which is not new but which perhaps offers more in this connection than any other is that of utilizing the after-hours services of employees. By offering to employees a satisfactory inducement in the form of a commission on every lead that results in a sale a very appreciable amount of new business may be secured at a small expense in time and money. Where the plan has been tried out the results have exceeded expectations. Employees from every department have responded with good leads, and, somewhat contrary to general belief, the essentially non-commercial departments—the operating and engineering departments—have been among the most profitable in this connection.

On the whole, the class of leads secured is good. A report from one company in the Middle West for one of the summer months showed that about 70 per cent of them were productive of business.

A report from the Public Service Company of New Jersey for the month of September last shows sales amounting to \$5,320.41 resulting from leads by employees other than salesmen. It should be mentioned that gas as well as electric sales are here represented.

This business was done in twelve districts. One district did not report the amount. Following are the reports from the district managers, which show clearly two things—one, the large amount of business that resulted from a few leads; the other, the much greater amount of business that would have resulted had more strenuous efforts been made to interest more employees in this work:

The Hudson division reports sales made during September from prospects turned in by employees not regular salesmen as follows: Jersey City, \$589.86; Bayonne, \$241.18; Hoboken, \$73.15; North Hudson, \$346.05; total, \$1,250.24.

The Orange district reports sales for September resulting from leads furnished by employees other than salesmen to the amount of \$457.55. Messrs. Davis, McCormick, R. Wilson, Schoen, Masterson, Murphy, La Salle, O'Neill, Schmick, Rice, Thierbach, Beames, Ferguson, Curtis and Hostetter turned in the leads.

Fourteen prospects turned in at the Somerville office resulted in sales amounting to \$335.25. P. C. Carolan, F. A. Bourke, E. J. McWilliams, S. W. McCrea and F. W. Pierce participated in the order named.

Rutherford reports sales from leads during September by employees not salesmen to the amount of \$238.25. R. Fletcher, F. Gunther, E. Schaeffer, J. B. White and J. Kane turned in the leads.

The Montclair district reports sales made during September from prospects turned in by employees not salesmen amounting to \$482.20. Mrs. E. Hampton, E. DeNourie, E. Sinsheimer, C. Russell, C. Benz, P. Warfield, A. M. Stewart and R. Atwell contributed in the order named.

The Morristown district reports September sales resulting from leads furnished by employees not salesmen amounting to \$272.43. Harry Huyler, F. C. Michelfelder, James Cooney and F. C. Burnham turned in the leads.

The employees of the Summit district other than those connected with the sales department deserve a word of thanks and appreciation for the number of appliance prospects which have been closed through their efforts. This is a very good showing, and we are glad to see that all the employees in this district are extending all the help possible to reach our bogie on sales for 1917.

Hackensack office men not in the new-business department turned in prospects that netted sales amounting to \$119.60 in gas appliances. J. Spiers, T. Owen, D. Brown, G. Henkel, C. Broskie, W. Longstreet, G. Vetter, H. Eisen-

hauer and F. Broskie participated in the order indicated.

Ridgewood reports September sales resulting from leads by employees not salesmen amounting to \$391.25. W. Smith, M. G. Schreck, W. E. Pohlig and A. E. Seibel participated.

During the past month gas appliances to the amount of \$701.53 were sold in the Trenton district through leads turned in by employees other than those connected with the sales department. This is a very creditable showing and is certainly deserving of mention. In the same office electric sales amounting to \$185 were made from prospects.

The Burlington district reports sales resulting from prospects turned in during September by employees not salesmen amounting to \$507.51. T. P. Morris, W. C. Dannehower, Harry Kemmerle, F. J. King, F. B. Cook, W. J. Stradling and W. S. Gusrang, all collectors, participated in the order named.

The Camden district reports sales resulting from prospects turned in during September by employees not salesmen amounting to \$379.60. A. Applegate, A. Summers, H. Delacroix, S. O. Kelly, A. Stones, F. A. Lynch, R. Parker and J. Inman participated in the order named.

COMPLAINERS VIEWED IN THE LIGHT OF ASSETS

**Large Southern Property Tells Employees to Ask
Dissatisfied Friends to Send in Their Com-
plaints to the Company**

Electric service has developed to such an extent and utilities take an attitude toward the public so different from that assumed a decade or more ago that complaints are no longer numerous in well-regulated properties nor are they considered as nuisances. In fact, some properties welcome complaints because they offer an opportunity to show the service of the company and thereby to make friends. One of the properties that believe complaints to be real assets is the Birmingham (Ala.) Railway, Light & Power Company, and with this thought in mind it is counseling its employees to ask their dissatisfied friends, if they have any, to send in their complaints. Following is the company's opinion as contained in the employees' weekly paper, *The Buzzer*:

One of the greatest difficulties the company has to deal with is the lack of general understanding of its system and organization. Misunderstanding arises because the consumer does not know what lies back of his electric or gas meter; least of all does he know that ingenious safeguards have been devised to protect him against errors or injustice.

The company operates on such a small margin that even the saving of a 2-cent stamp in sending a receipt each month is an item, so it has been compelled to build service on a basis of good average performance. The average is maintained so well that probably but two or three consumers out of a thousand will have reason to complain each month. When these consumers do complain, however, the company can afford to go considerable length in investigating, because the service is likely at fault or the consumer has run into something he does not understand and it is worth while to enlighten him.

The consumer thinks his electric light or gas bill is too high this month. He says it does not seem possible that he used that much. The company does not maintain he used so much electricity or gas; it takes the stand that he appears to have done so, according to its best devices for measuring, but it will investigate. Then the machinery it brings to bear gives the consumer a liberal education in the art of keeping track of trifles.

First, there will be an investigation, and only one meter out of twelve about which consumers complain is found to be wrong, and only one out of thirty investigated is running fast, against the consumer; the others are correct or slow, against the company. If the meter is correct, then the difficulty will be to trace further. This will often fur-

nish a clew to the waste in electricity. Servants have been careless in leaving the lights on or the scrubwoman in the office will light a whole floor while she empties the waste baskets.

The dissatisfied consumer who fifteen years ago was considered a nuisance has been turned into an asset when the consumer learns how fair the company can be. He tells others. The company is not only working hard to create good will and courtesy through courteous handling of complaints and correction of misunderstanding, but is taking steps to inform the whole public about its method to forestall unfounded complaints.

LIGHTING LARGE ROOMS FROM PEDESTAL FIXTURES

**Indirect System Used with Excellent Effect to Accentuate the Architectural Beauty of Portion
of a Club House**

In designing the interior of the South Shore Country Club at Chicago it was thought desirable that the rooms should be made more pleasant in the evening hours than in daylight if possible. For this reason especial attention was given to the artificial lighting, with the result shown.

There are two garden foyers which form the terminus of the promenade, each of which measures 36 ft.



INTERIOR LIGHTING WITH PEDESTAL FIXTURES

by 72 ft. (10.97 m. by 21.94 m.). The high arched ceilings are tinted a faint sky blue. The light is all supplied from a 7-ft. (2.13-m.) pedestal which contains two 500-watt gas-filled tungsten lamps in silvered mirror reflectors. The absence of harsh shadows and glare in the room are noticeable and every detail of the decorations has been clearly brought out. The accompanying illustration is a view in the solarium, which overlooks Lake Michigan. This room is 43.5 ft. (13.25 m.) square and has a 21-ft. (6.4-m.) ceiling. The lighting is from five 500-watt gas-filled tungsten lamps in silvered mirror reflectors concealed in the 10-ft. (3-m.) pedestal in the center of the room. An intensity of illumination is secured which gives this exquisitely furnished interior an atmosphere of restfulness and refinement. The lighting of these rooms was worked out by the engineering department of the National X-Ray Reflector Company of Chicago.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

THE PROPERTIES AND USE OF FURNACE ELECTRODES

Rate of Consumption, Methods of Protecting and Cooling, Arrangements for Attaching Conductors, and Other Considerations

IN THE Sept. 21 issue of the London *Electrical Review* appeared an interesting article on the properties and utilization of electric furnace electrodes. The article, which is a continuation of a previous one, dwells on the rate of consumption of electrodes, methods of protecting and cooling, means of attaching conductors, and

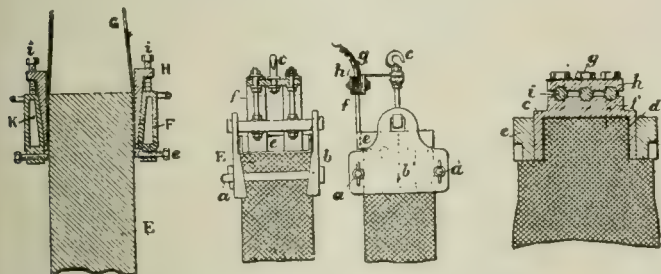


FIG. 1—SEVERAL METHODS OF CLAMPING CONDUCTORS TO FURNACE ELECTRODES

arrangements for controlling the electrodes. Extracts therefrom are given in the following paragraphs:

Consumption of electrodes is due primarily to the following causes: Dissociation by current; the working voltage may be either too high or too low; chemical combination of the electrodes with oxygen; solution of the carbon in the metal, and direct oxidation by atmospheric oxygen. The electrodes should not be burned too close to the terminal clamp nor should they be rejected as new electrodes may cost £17 (\$82.50) per ton and stumps may be worth only 32s. (\$7.35) per ton as raw material for fresh electrodes. The scrap value is thus only 10 per cent of the value new. To utilize the stumps arrangements can be made for fastening them to the new electrodes, using screw connections or lap-joined construction.

The most effective protection for electrodes consists of a sheath of incombustible material. Mixtures which have been proposed for this purpose are retort coke and sodium silicate; lime and limestone with carbon, and potassium or sodium silicate with chalk. These mixtures applied cold form a covering which is a good resistant to heat. Other protective coatings used are asbestos wool with silicates, milk of white clay, and silundum. The last is an amorphous compound resembling carborundum. It is refractory, incombustible, and, being a compound of carbon and silicon, it is useful for protecting electrodes in ferro-silicon furnaces. An iron netting may be used to support a paste of sodium silicate and clay or of kaolin and asbestos. Sometimes granular material unaffected by oxidizing gases is embedded in the surface of the electrode. Quartz, alumina

or carborundum may be used, according to the nature of the products made in the furnace. Rigid envelopes of asbestos board or sheet iron have also their uses, though care is required to prevent air circulating between electrode and sheath, which then forms a draft chimney and intensifies the damage.

In this connection Ch. Louis recommends that the electrode be protected by an agglomerate of magnesia or dolomite, 3 cm. to 5 cm. in thickness, inside a jacket of 1-mm. sheet iron. The agglomerate is heated for mixing and contains 6 to 7 per cent of pitch and 5 to 8 per cent of tar. Adherence on the electrode is increased by chipping its surface and painting it with tar. The sheath being held in place by an external mold, the agglomerate is packed tightly between it and the electrode. The mold is then withdrawn, and a joint is made at the top between sheath and electrode by a paste of silicate or refractory earth. It is not essential to rebake an electrode thus protected.

The Gin process is to embed the electrodes in a carbon agglomerate. With this end in view the electrodes are formed of several cores (say, eight or ten), and the agglomerate is a mixture of coke or ground electrode stumps with pitch or tar. The agglomerate forms simply a mechanical bond between the electrodes. It is not traversed by any considerable fraction of the current and is, therefore, at a much lower temperature than the cores and is less exposed to oxidation. Its protective action endures beyond the point in the furnace at which iron sheathing would be melted away.

It is evident that a protective coating of any sort carries its impurities into the manufactured product, and for this reason it is sometimes better to do without

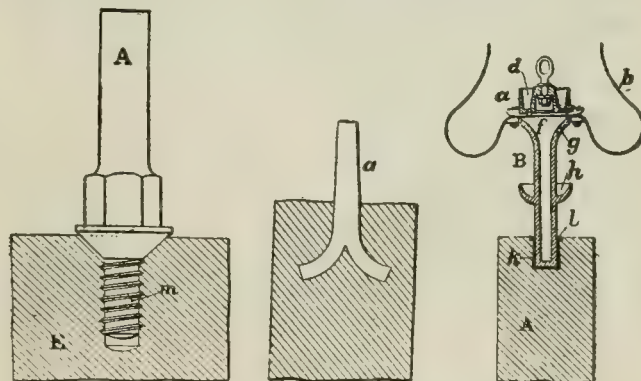


FIG. 2—METHODS OF MAKING CENTRAL CONNECTIONS TO FURNACE ELECTRODES

the coating and simply modify the shape of the electrodes.

The rate of electrode consumption referred to unit weight of product manufactured varies widely with the product concerned and with the type of furnace employed. For instance, in the manufacture of 25 per cent ferro-silicon the electrode consumption is about 3 mm. per hour, increasing to 4 mm. when a 58 per cent silicon

alloy is made. Manganese-silicon alloys involve a mean consumption of 3 mm. and calcium carbide of 2 mm. per hour. All these figures refer to covered furnaces charged continuously in which consumption is always a minimum.

In aluminum manufacture the electrode acts not only as a current conductor but also as a comburent, and its consumption is generally proportional to the quantity of metal produced—say, 700 gm. per kg. (1500 lb. per ton) of metal produced.

In steel furnaces of direct-production type, with electrodes about 2 m. long, the consumption varies with the process. The following table shows the net weight of electrodes burned effectively in various works:

Furnace	Electrode Consumption per Ton of Steel		Remarks
	Kg.	Lb.	
Stassano, Turin	7 to 10	15½ to 22	Charged cold
Girod, Urgine	11.4	25	....
Chapelet, Alleverd	11.3	24.8	....
Heroult, LePraz	17.5	38.5	....
Lindenburger, Remscheid.	2.68	5.9	Fluid charge

Allowing for stumps of utilization and starting directly from ore, the average net consumption of electrodes is now 4 kg. to 5 kg. (8¾ lb. to 11 lb.) per ton of steel. In some cases electrodes have lasted for 1200 working hours, corresponding to more than six weeks of continuous operation.

ELECTRODE TERMINALS AND COOLING ARRANGEMENTS

The manner in which electrodes are supported while being left free for up and down adjustment at will and the manner in which connection is made to the electric supply mains play an important part in the maintenance and durability of electrodes. Bad fitting may cause the electrode to become red hot at places, and this in turn leads to breakage or excessive combustion. The damage is cumulative because the resistance of carbon decreases with increasing temperature; hence current passes by preference through the overheated parts, aggravating their state and exposing them to yet more rapid depreciation.

There are several methods available for the attachment of carriers to electrodes, but the two types at present in use are clamp connections and central connections. Cooling may be secured in all cases by a water basin near the connection or by a trough of water surrounding the electrode and provided, if necessary, with radiating ribs or wings.

Several means for effecting central connections to the ends of electrodes are illustrated in Fig. 2. The bronze connector at the right is made hollow for water cooling. Fresh water is supplied at *d* in the basin *a*, and runs into the hollow stem *f*. Overflow runs into the annular reservoir *h*, whence it evaporates; no water reaches the joint between connector and electrode.

Generation, Transmission and Distribution

Electricity Supply at Redditch.—Descriptions of the alterations which were necessary in the electric service system at Redditch to permit developing the power load under proper conditions. Methods were described for overcoming difficulties imposed by the interconnection of two systems which did not employ the same form of energy or same frequency and in which the distribution systems were of different types. The extent to which the old generating stations and substations were utilized or remodeled was also outlined.

To permit paralleling a 70-cycle single-phase and a 50-cycle three-phase system a motor transformer was used, the stator of one machine being arranged so that it could be rotated relative to the other, thus permitting paralleling on either the single-phase or three-phase side. As all of the auxiliary motors of the new plant are driven by means of three-phase motors and need to be running before the turbo-generators can be put under load, arrangements were made so that the motor-transformer could be started single-phase from a small reciprocating single-phase alternator to enable starting the circulating and ventilating motors of the large three-phase turbo-generator. Owing to the large number of single-phase motors and transformers on the old single-phase system, the power factor is low, but the two synchronous motor-transformers are of considerable assistance, since by overexciting their fields it is possible to reduce considerably the idle current in the turbo-alternators. Such of the original single-phase low-tension system as was in good condition has been connected to new four-conductor cables between phase wires and neutrals, the load being balanced as evenly as possible between the phases. Similar arrangements have been made for connecting the single-phase high-tension mains.—*London Electrician*, Sept. 14, 1917.

Wires, Wiring and Conduits

Protection of Cables Against Electrolysis.—After pointing out that preventive measures are preferable to steps taken after the defect has become apparent, the author outlined methods of making regular and periodic inspections, described the apparatus to use, and suggested protective measures which can be taken. The usual procedure is to provide a conductor to carry out the current which would otherwise leak to earth. Sometimes, however, cables situated in the vicinity of conduits, metal bridges or earth saturated with sea water are positive with regard to earth, the adjacent good conductors deriving from outside the cable the large portion of the current carried to the spot with the cable in question and then by returning it again re-establishing a negative potential. In such a case the expense of installing a leakage conductor can be avoided by isolating the negative portion of the cable from the rest of the network, the continuity of the armor covering being preserved by running an isolated conductor parallel to the disconnected circuit. In some cases a leakage conductor can be replaced by guard plates which serve to drain away outside the cable the currents which would otherwise pass into the earth from its surface. This arrangement, which can be employed when a leakage conductor would prove unduly expensive and the leakage currents are not very strong, causes the decomposition to take place in the plate where it enters the soil instead of on the surface of the cable.—*London Electrician*, Sept. 14, 1917 (abstracted from *Annales des Postes, Télégraphes et Téléphones*).

Electrophysics and Magnetism

Resistance and Magnetization.—C. W. HEAPS.—This paper describes experiments made to bring out the relationship between structural changes producing magnetostriction and resistance change induced in iron and nickel by magnetization. The theory of the effect of magnetic field on resistance has been developed to cover

the cases of longitudinal and transverse magnetic fields. The theory indicates that there is a greater transverse than longitudinal effect. Experiments have been made with crystalline graphite in different forms. In compressing graphite powder the effect of a magnetic field on the resistance is greater with coarse powder than with fine. This implies that in a substance composed of large crystals the effect is greater than in one composed of small crystals. From the study of graphite it is concluded that crystal structure is an important factor to consider when experimenting on the conductivity of any substance in a magnetic field. From experiments on a specially prepared sample of cadmium it was concluded that comparisons of the longitudinal and transverse effects may be made legitimately by using an ordinary wire as a specimen. Assuming that wires of other metals are like cadmium in this respect, calculations of the number of electrons per unit volume and of the free period of the electrons have been made for several metals. This theory affords a satisfactory explanation of the behavior of all paramagnetic and diamagnetic substances which have so far been examined.—*Physical Review*, October, 1917.

Reversal of the Hall Effect in Alloys.—ALPHEUS W. SMITH.—From the results of his experiment the author concludes that there has yet been no satisfactory suggestion advanced to account for the reversal of the Hall effect under the conditions considered in his paper. The explanation of this interesting fact is probably to be looked for in the structure of the alloy, particularly in the interstices between the vibrating atoms.—*Physical Review*, October, 1917.

Color Temperature Scales for Tungsten and Carbon.—E. P. HYDE, F. E. CADY and W. E. FORSYTHE.—Working on the basis that the color temperature is greater than the true temperature of a metal and that the brightness temperature (ordinarily called black-body temperature)

temperature is given, the true temperature being unknown. The relation is also determined between color temperature and lamp efficiency in lumens per watt so that it may be possible to calculate the color temperature and also the true temperature by measurement of lamp efficiency. The relation between color temperature and watts was found within observational errors to obey

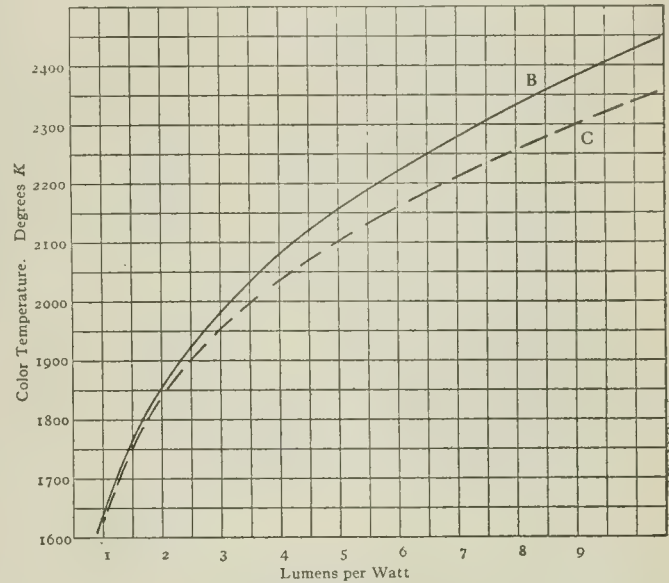


FIG. 4—RELATION * BETWEEN COLOR TEMPERATURE AND LAMP EFFICIENCY OF TUNGSTEN

approximately an exponential function. It is shown that for tungsten the exponent cannot be a constant but must decrease slightly with a change from a low to a high temperature. The apparatus and methods of conducting the tests were described, the correction determinations outlined and the experimental results discussed. The black-body color temperatures, or simply the color temperatures for tungsten and untreated carbon, are given from direct observations against the carbon-tube black-body furnace plotted against lumens per watt of the lamp.—*Phys. Review*, 1917.

Astronomical Consequences of the Electrical Theory of Matter.—A. S. EDDINGTON.—Gives present discordances between gravitational theory and observations for the four inner planets.—*London Philos. Mag. and Journal of Science*, September, 1917.

Deterioration of Muntz Metal.—Brass consisting of sixty parts copper and forty parts zinc, such as is used in condenser tubes, etc., sometimes deteriorates in such a manner that the metal changes its color to copper red and becomes very weak and brittle. This change of properties is due to selective corrosion of the alloy when exposed to the action of some electrolytes, particularly sea water. In examination of the microstructure of some samples of this metal it has been found that the zinc-rich constituent is leached out, leaving a skeleton of weak pulverulent copper in its place. Conditions which appear, from an examination of corroded samples, to accelerate corrosion are the microstructural composition of the alloy, contact with electro-negative metals, adhering deposits of zinc chloride, the thoroughness of the annealing, the temperature of the electrolyte, and the stresses to which the metal was subjected.—*Technologic Paper No. 103*, Bureau of Standards.

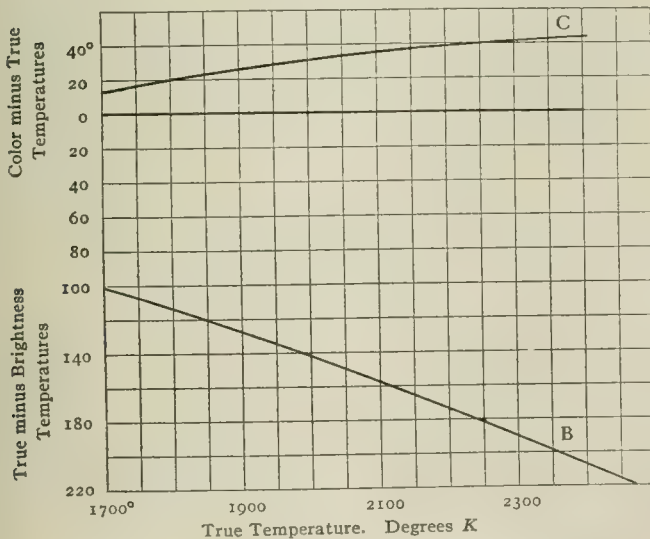


FIG. 3—RELATION * BETWEEN COLOR, TRUE AND BRIGHTNESS TEMPERATURES OF TUNGSTEN

is less than the true temperature, the latter was found for tungsten and carbon using Worthing's data. The color temperature is much nearer the true temperature than the brightness temperature. For carbon the difference between the color temperature and the brightness

*B, author's data; C, Paterson and Dudding's data.

Scientific and Industrial Research

A Department Devoted to Interchange of Ideas, Investigations Contemplated, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF

Cornell University, Ithaca, N. Y.

FACTORS TO CONSIDER IN DEVELOPING RESEARCH

Preparation of Men for Research Work—Necessity of Universities Being Acquainted with Problems—Ideals to Strive For

Industrial and scientific research has recently received a tremendous impetus due to the great war, but research is destined to play just as important a part in the reconstruction period after the war, and in the following period of international industrial life, in both its competitive and co-operative aspects.

Three kinds of research that are of use in the electrical industry are embraced by the following subjects: (1) Industrial research on specific problems mostly carried on by manufacturers, operating companies and commercial laboratories; (2) scientific research, which is the proper province of teachers and investigators in physics, mathematics, chemistry, etc.; (3) semi-industrial research, in which teachers and advanced students in electrical engineering are engaged. In order to obtain the best results there must be closer co-operation between these branches of research. A special research committee, such as was recommended at the recent Philadelphia meeting of the American Institute of Electrical Engineers, would be highly beneficial along this line, and the National Research Council can accomplish good results on a larger scale. The membership in special research committees should, as much as possible, include representatives of manufacturers, operating concerns, construction companies and men in applied and pure sciences.

Research and advance study should be considered by university managements as the duty and privilege of college teachers who are capable of productive scholarship. Such men should be afforded sufficient time and facilities to pursue research for the benefit of their students, of the industry and of the whole world. While the primary function of the university is to train men, and research results are only secondary, some professors should be skilled and devoted original investigators and scholars in order to train and inspire students in research. Broad fundamental training of undergraduate students is preferable to an early specialization. However, it is highly advisable for gifted students to spend a year or two after graduation in scientific study and research in some university.

In planning research work or courses of instruction in college the ideal to strive for is that a college should be life itself and not merely a preparation for life. The student should exercise his mental faculties and develop his character on actual life problems (Montessori system) and not merely learn abstract things for possible future use. Colleges of pure and applied science should

strive to create a background of research in their institutions by carrying on investigations and by impressing upon the students the importance of a searching, analytical attitude of mind toward things that surround them. Mathematical and general theoretical research ought to receive more attention, otherwise crude empiricism with its wasteful experiments and rule-of-thumb formulas will continue to prevail. A rational theory summarizes many experiments, makes them unnecessary, and permits the prediction of the performance of new and different kinds of apparatus.

It seems most desirable that the technical colleges should pre-eminently carry on general and not narrow industrial researches in their laboratories, researches of such a nature as may advance applied science, stimulate careful observation on the part of students, contribute to the published fund of available technical information, supply new knowledge to the teaching staffs, and train students for entering industrial research.

General problems with which the industry is confronted for the first time should be turned over to the universities as early as possible because these problems are particularly valuable in the training of future engineers for the industry. Moreover, knowing what the new problems are, the teachers are inspired for research along important lines and thus early develop important relations and data. While specific industrial research problems of manufacturing companies as a rule cannot be given over to colleges for solution, owing to the patent situation, necessary equipment, required secrecy, close connection with routine manufacturing work, etc., these limitations do not hold to the same degree with operating companies.

An ideal international system of research would be one in which the pure science colleges should lay the foundations of future industries by enlarging and disseminating the world's knowledge of the basic scientific principles. The technical colleges should do the same for applied science, while at the same time taking a share in the economic applications of science to industries. The industries themselves should undertake their own researches, under the guidance of qualified research specialists.

Summary of Investigations, Available Apparatus and Research Suggestions

INVESTIGATIONS UNDER WAY OR COMPLETED (RESEARCH WORK REPORTED SINCE OCT. 20) *

CARBON, RESISTIVITY OF.

Resistivity of carbon filaments as a function of temperature.—H. Le Chatelier, Paris, France.

CURRENT TRANSFORMERS.

A new method of comparing ratio and phase angle of current transformers.—F. B. Silsbee, Bureau of Standards, Washington. Investigation of cathodic corrosion of lead cable sheaths.—Burton McCollum, Bureau of Standards, Washington.

SUGGESTIONS FOR RESEARCH

INSULATORS.

Practicability of fused quartz insulators.—A. I. E. E. Committee on Transmission and Distribution.

RELAYS.

A system of protection which will take care of all possible troubles in a power transmission or distributing system which is fed from several power houses, each of which may feed from either one or two transmission lines to the load center. Proper relay protection should clear any line or section in trouble and not interrupt service on any other section.—E. P. Peck, Georgia Railway & Power Company, Atlanta, Ga.

*The names of individuals given after each institution reporting investigations are those of persons with whom others interested should communicate. All institutions reporting research work should give such names.

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

ELECTRICAL MANUFACTURERS DISCUSS LABOR CONDITIONS

Chief Topic Before the Electrical Manufacturers' Club at Hot Springs Meeting—L. A. Osborne the New President

The Electrical Manufacturers' Club met in semi-annual session at Hot Springs, Va., last week. The chief topic of discussion was the national labor situation. L. A. Osborne, vice-president of the Westinghouse Electric & Manufacturing Company, who is chairman of the advisory committee to the National Industrial Conference Board, which committee made a recommendation on Sept. 6 to the Council of National Defense and also a few weeks ago to the United States Chamber of Commerce at its Atlantic City convention, reviewed the present situation. Mr. Osborne drew attention to the fact that so far the recommendations of the committee had not been acted upon by the Council of National Defense. He said that these recommendations, having for their object the securing of industrial peace during the period of the war, were reasonable and had been indorsed by over 60,000 manufacturers, and it is a well-considered opinion of industry that they are the best means of insuring the continuance of essential war production.

W. L. Merritt of the Anti-Boycott Association was also a speaker. He told at some length of his work in connection with that association, with especial reference to the attempt which had been made to shut out electrical apparatus and wiring supplies in certain districts, a subject of great interest to the assembled manufacturers. He made a plea for the socialization of labor and for a general movement on the part of all elements which would have for its object the fulfillment by labor of its obligation to the nation in the present emergency. The aid and co-operation of the Electrical Manufacturers' Club were solicited to further this movement.

PROSECUTION OF THE WAR

With relation to the activities of the manufacturers of electrical apparatus and supplies in regard to the successful prosecution of the war, the Electrical Manufacturers' Council, which is composed of four members each from the Electrical Manufacturers' Club, the Electric Power Club and the Associated Manufacturers of Electrical Supplies, proposed the formation of a general war service committee of the industry. This will be made up of two members of each of the organizations named, and it will act as representative of the manufacturers of electrical apparatus and supplies before the finished products section of the War Industries Board. This proposal of the Manufacturers' Council is indorsed by the Electrical Manufacturers' Club and by the Electric Power Club. It will be brought to the attention of the Associated Manufacturers of Electrical Supplies at an early meeting, and this organization will also

indorse and act on the proposition. Through the proposed war service committee the electrical manufacturing industry will be guided.

The following officers of the Electrical Manufacturers' Club were elected for 1918: President, L. A. Osborne, vice-president Westinghouse Electric & Manufacturing Company, New York; vice-president, H. B. Crouse, president Crouse-Hinds Company, Syracuse, N. Y.; secretary, Shiras Morris, president and treasurer Hart & Hegeman Manufacturing Company, Hartford, Conn.

One of the essential objects of the Electrical Manufacturers' Club being that of the establishment of good social relations between the manufacturers, much of the time was spent in interchanging experiences and in out-of-door amusements.

ACTIVE WORK OF MR. OSBORNE

Loyall Allen Osborne, the newly elected president of the Electrical Manufacturers' Club, is an active official



L. A. OSBORNE

in various Westinghouse properties. In addition to his office as vice-president of the Westinghouse Electric & Manufacturing Company he is vice-president of the New England Westinghouse Company, president of the J. Stevens Arms Company, vice-president of the Westinghouse Lamp Company and vice-president of the Canadian Westinghouse Company.

Born in Newark, N. J., on June 22, 1870, Mr. Osborne was graduated from Cornell University with the degree of mechanical engineer. Directly after graduation he became identified with the Westinghouse Electric & Manufacturing Company, and in his subsequent continuous connection with that organization he has advanced rapidly. In 1895 he became assistant superintendent and two years later was made assistant to the vice-president. Becoming manager of works in 1899, he was made a vice-president in 1902.

DAYLIGHT SAVING AND CONSERVATION OF FUEL

Dr. Garfield Indicates that the Subject Is Receiving Earnest Attention with a View to Urging Congressional Legislation

The New York Daylight Saving Committee has decided to renew its activities and met on Nov. 13 in the office of Marcus M. Marks, president of the borough of Manhattan. It concluded to begin a campaign to secure the passage of the daylight-saving bill at the next session of Congress. This bill was passed by the Senate but not by the House of Representatives at the last session.

To a letter to Dr. Garfield, the Fuel Administrator, Mr. Marks received a reply saying:

"The subject of daylight saving is receiving very earnest attention at the present time with a view to urging upon Congress such legislation as seems to be in the interest of fuel conservation."

WASHINGTON AUTHORITIES RESTRICT SIGN LIGHTING

Order Not General and Complete Because It Is Desired to Give Opportunity to Readjust Business to New Conditions

The use of coal in the production of electricity for non-essential purposes is curtailed throughout the United States in an order issued this week by Fuel Administrator Garfield and published in full in this issue of the *ELECTRICAL WORLD*. The order will prevent the lighting of advertising signs and other outdoor electrical display until 7.45 at night. Such signs will be forced to darken at 11 o'clock at night. It is estimated by the Fuel Administration that this order will save 50 per cent of the fuel now used in maintaining this class of electrical display.

According to an announcement of the public information division of the Fuel Administration, Dr. Garfield is anxious to avoid interference with legitimate business just as far as possible, but he is determined to see that the industries essential to the conduct of the war and the domestic consumers of the country have coal.

The order makes an exception of signs maintained by small merchants for the purpose of directing customers to their places of business. These, if not of an unreasonable size, will be permitted to continue while the establishment is open for business.

Experts of the Fuel Administration have determined that at least 250,000 tons of coal per year are used for this display electric lighting. This amount, it is estimated by the Washington authorities, would keep 100,000 people warm throughout the winter. The public notice issued on behalf of the Fuel Administration says that a committee of the gas and electric service companies of the country co-operated with the Fuel Administration in determining the need for a limitation on coal consumed in supplying energy for the outdoor display lighting and that the restrictive order has the approval of this committee.

It is expected by the Fuel Administration that the restrictive order will result in an incidental reduction in addition to the 50 per cent curtailment directly ordered. With the effectiveness of the display signs

cut in two, it is regarded by the Washington authorities as probable that advertisers will reduce their use of outdoor displays.

It is announced furthermore that the restrictive order was not made general and complete because the Fuel Administration desired to give the interests involved an opportunity to readjust their business.

It is evident that the order does not apply to plants operated solely by water power.

MAKING THE SIGN ORDER EFFECTIVE IN NEW YORK

Rider to Rate Schedules Approved by Public Service Commission and Notice to Consumers Put in Daily Papers

Rapid steps were taken in New York City to make the sign regulative order of the federal Fuel Administration effective on Nov. 15. The accompanying illustration shows the advertisement published in the morning news-



Special Notice

The National Fuel Administrator, Dr. Harry A. Garfield, has issued instructions that, to meet the present fuel emergency, no coal shall be burned for electric sign advertising except between the hours of 7:45 and 11 o'clock each night. Exceptions are made as to the hours of illuminating the signs of theatres, retail stores and where electric light is used for locating doorways and the illumination of passageways. Where the illumination is for building entrances it shall not be continued after the premises are closed.

With the approval of the Public Service Commission for the First District, all contracts, rate schedules and service riders are modified in accordance with this order, to go into effect November 15th, 1917, and continue until further notice from the Fuel Administrator.

The attention of the customers of this Company is called to this order of the Fuel Administrator with the request that no electric current shall be used for the services referred to during the hours excluded by the order.

The New York Edison Company

At Your Service

Irving Place and 15th Street

papers on that date by the New York Edison Company.

A rider to the rate schedules of the company was filed promptly with the New York Public Service Commission, First District, and has the approval of that body. It reads:

"Any and all rate schedules, contracts, service riders and regulations of this company that may be affected by order No. 137 of the United States Fuel Administrator, Washington, D. C., issued under date of Nov. 13, 1917, to take effect Nov. 15, 1917, are hereby modified and amended so as to comply in all respects with said order and as modified shall remain in effect until further notice."

Order of the United States Fuel Administrator Regulating the Use of Coal for the Purposes of Generating Electricity for Use in Operating Illuminated Advertisements, Notices, Signs, Etc.

IT APPEARING to the United States Fuel Administrator that it is essential to the national security and defense, the successful prosecution of the war and the support and maintenance of the army and navy, and to lessen or prevent the waste of coal which at the present time is and during the continuation of the war will be, in the judgment of the United States Fuel Administrator, needed for the purposes aforesaid, and to secure an adequate supply and equitable distribution, and to prevent, locally and generally, scarcity of coal, and to facilitate the movement of coal for the purposes aforesaid, that the use of coal in the manner and for the purposes hereinafter set forth, and that the employment for such use of the present facilities, already inadequate for the prompt and sufficient shipment, transportation and delivery of coal needed for the purposes aforesaid, should be limited and restricted, in order that the essential purposes first hereinbefore referred to may be carried out, and that so far as possible the production, sale, shipment, distribution and apportionment of coal among dealers and consumers, domestic and foreign, may be maintained to the extent sufficient to meet the governmental, commercial and domestic requirements for coal,

THE UNITED STATES FUEL ADMINISTRATOR, acting under authority of an executive order of the President of the United States, dated Aug. 23, 1917, appointing said Administrator, and in furtherance of the purpose of said order and of the act of Congress therein referred to and approved Aug. 10, 1917,

HEREBY ADJUDGES that in his opinion the use of coal for any of the purposes hereinafter described except to the extent hereinafter indicated is wasteful, and that any person using any coal for such purposes except as aforesaid is engaging in a wasteful practice or device in handling or dealing with coal, and that the use of coal for such purposes except as aforesaid is prejudicial and injurious to the national security and defense and a cause of scarcity, locally and generally; and

HEREBY ORDERS AND DIRECTS that until further or other order of the United States Fuel Administrator and subject to modification hereafter from time to time and at any time:

1. Upon and after the fifteenth day of November, 1917, no corporation, association, partnership or person engaged in whole or in part in the business of furnishing electricity for illuminating or power purposes, and no corporation, association, partnership or person maintaining a plant for the purpose of supplying for their own use electricity for illuminating or power purposes, shall use any coal for the purpose of generating, producing or supplying electricity, or supply or use electricity generated or produced, in whole or in part, by the consumption of coal, for the purpose of providing, maintaining, lighting or operating before the hour of 7.45 p. m. or after the hour of 11 p. m., electrically illuminated or display advertisements, notices, announcements, signs, designation of the location of an office or place of business or of the nature of any business, electric searchlights or (external) illumination or ornamentation of any building, except in the interior of buildings, and except as in special cases hereinafter further or otherwise provided or limited, namely:

(a) This order shall not apply to the United States government, the government of any commonwealth or state of the United States, or to any city, county, town or other governmental subdivision in any such commonwealth or state;

(b) This order shall not apply to the maintenance of street lights by any city or town or within any city or town under a contract with the officials thereof for such maintenance, or to the maintenance of any lights for any purpose by, or in compliance with orders of, any public authorities;

(c) Electric signs affixed to the street fronts of buildings over the street entrances thereof or over the street entrances to stores, shops or other places of business therein, or extending therefrom over the sidewalks, for the purpose of announcing the name or business of a retail shop or store, or the name and location of a theater or other place of amusement or of a hall or other place of public assembly, together with the name of the play or other entertainment given therein, or of the purpose of any public assembly to be held therein, as the case may be, may be lighted or illuminated or operated by electricity generated or produced by the use of coal, during the period from one-half hour after sunset until such time, not later than 11 o'clock in the evening, at which time in the case of a place of business the same is closed for the conduct of business therein in the same manner and to the extent that such business is conducted therein during the daytime business hours, and in the case of places of amusement and public assembly hereinbefore referred to until one-half hour after the time fixed for the beginning of an entertainment or of the meeting or other public assembly, as the case may be, provided that the size of any such sign and the amount of electricity needed to operate and illuminate the same shall be reduced at any time upon direction of the State Fuel Administrator of the state within which such sign is located;

(d) This order shall not apply to porch lights upon houses or hotels, or at the entrances to buildings occupied or open for ingress or egress during the nighttime, or to lights upon private driveways, walks or in the grounds of any hotel, manufacturing establishment or residence, or upon the platform of railroad stations, approaches thereto or in railroad yards or grounds, or to lights to mark the location of fire escapes or exits, or to lights for any similar purposes when authorized by any State Fuel Administrator of the state within which such lights are located, provided, however, that the number and power of any such lights by this paragraph (d) permitted shall be reduced at any time upon direction of the State Fuel Administrator of the state within which such buildings or grounds are located;

(e) Nothing herein shall be construed to extend the length of time, fixed by agreement or otherwise, between any person and a State Fuel Administrator for which any such sign or illumination may be displayed or operated.

2. The State Fuel Administrators within the several states are hereby directed and authorized to see that the provisions of this order are observed and carried out within their several states, to report violations thereof to the United States Fuel Administrator, and to recommend to the United States Fuel Administrator action to be taken by him with respect to the sale, shipment, distribution and apportionment of coal to the corporations, associations, partnerships or persons so found to be acting in violation of this order.

H. A. GARFIELD,

United States Fuel Administrator.

November 13, 1917.

THE ABSOLUTE MAXIMUM OF POWER

If we are true friends of freedom—our own or anybody else's—we will see that the power of this country, the productivity of this country, is raised to its absolute maximum and that absolutely nobody is allowed to stand in the way of it.

When I say that nobody is allowed to stand in the way, I don't mean that they shall be prevented by the power of the government, but by the power of American spirit. If we are to do this great thing and show America to be what we believe her to be, the greatest hope and energy of the world, then we must stand together night and day until the job is finished.

Now to "stand together" means that nobody must interrupt the processes of our energy, if the interruption can possibly be avoided without the absolute invasion of freedom. To put it concretely, that means this: Nobody has a right to stop the processes of labor until all the methods of conciliation and settlement have been exhausted; and I might as well say right here that I am not talking to you alone. You sometimes stop the courses of labor, but there are others who do the same. And I believe that I am speaking of my own experience not only, but of the experience of others, when I say that you are reasonable in a larger number of cases than the capitalists.

[From the address of President Wilson before the American Federation of Labor, Buffalo, on Nov. 12.]

ELECTRIC POWER CLUB IN SUCCESSFUL MEETING

Trade Relations, Cost Accounting, Trade Acceptances, and, What Is Now Uppermost, Co-operation with the Government in the War

The Electric Power Club, which now embraces in its membership manufacturers turning out 99 per cent of the motors, transformers and control apparatus of the country, held a very successful meeting on Monday and Tuesday of this week at Hot Springs, Va. Few of the meetings of the club have been so well attended or have had so much of interest for the industry.

Having rounded out in a measure the great work of standardization for which the club was primarily organized, attention is being focused on the larger problems confronting manufacturers involving trade relations, cost accounting, trade acceptances and, what is now uppermost in the minds of all manufacturers, active co-operation with the government in the successful prosecution of the war. It was due to the initiative of the Electric Power Club at its last session at Washington that the Department of Commerce modified its proposed methods of determining costs in letting war orders on a cost plus percentage basis and finally adopted a cost-accounting system more adequate and more in keeping with good commercial practice. In this work the club had the active support of the Electrical Manufacturers' Council.

SCARCITY OF LABOR

The scarcity of labor is a matter of concern to electrical manufacturers as well as to others, and there was free and frank discussion on this subject extending over the two days the club was in session. W. L. Merritt outlined the general trend of developments in

the labor market and suggested that a remedy for many difficulties would be forthcoming as soon as there was a greater socialization of labor and employer. Mr. Merritt felt that this could be accomplished through a system of educational publicity. S. L. Nicholson of the Westinghouse Electric & Manufacturing Company read for the information and guidance of the club the report of the National Industrial Conference Board to the Council for National Defense on the labor situation of the country.

The feature of Monday's session, covering as it did the wider outlook for the Electric Power Club, was the presidential address of Clarence L. Collens of Cleveland, Ohio, which will appear in a later issue.

COST ACCOUNTING FAVORED

The cost-accounting committee of the club in its report showed that the national government does not desire the sale of manufactured goods below cost, quoting freely from the addresses of Edward N. Hurley on that point, but that it is anxious for manufacturers to be conservative and inclusive in ascertaining the cost of producing and selling. Emphasis was placed on the following facts:

1. That ignorance of costs depresses selling values.
2. That lack of uniform accounting induces price cutting.
3. That uniform and conservative cost accounting should prevent selling articles at less than cost.

The committee outlined the relation between costs and accounting, the relation between labor difficulties and profits and the need of adequate cost accounting with any further extension of price regulation by the government. It believes that sufficient reasons existed prior to the war for the adoption by the electrical industry of uniform and conservative cost-accounting systems and that the entry of the United States into the war has brought about conditions which make mandatory the immediate adoption of such cost system. It recommends the installation by the beginning of the year of the cost-accounting system approved by the Electrical Manufacturers' Council, and this recommendation was favorably acted on by the club.

C. E. Patterson of the General Electric Company, who is chairman of the cost-accounting committee, reported on the work of his committee with the representatives of the Department of Commerce since the Electric Power Club meeting in Washington last summer.

An interesting scheme of sales compensation and sales accounting was outlined to the club by Walter Robbins of the Wagner Electric Manufacturing Company on Monday night. In this plan advantage is taken of the selfish interests of sales managers, district managers and salesmen to promote profitable business. In brief, his plan of compensation to sales managers is a fundamental salary payable monthly plus a bonus consisting of a certain percentage of the net profits of the district and payable in a lump sum annually, and a further bonus comprising a lesser percentage of the profits of all offices operating upon this same basis. Many representatives of other manufacturing companies took part in a general discussion of the plan outlined.

WAR SERVICE COMMITTEE

It is the expectation that the manufacturers represented in the Electric Power Club will be called on to assist the government with equipment as the war

progresses, and in order that prompt and effective aid may be rendered the board of governors of the club was constituted a war service committee with power to act in conjunction with a general war committee representing the electrical manufacturing industry. This latter committee will keep in close touch with the newly created electrical division of the finished products section of the War Industries Board of the national government.

Next January the executive members of the club will hold a one-day session in New York City at the time of the war convention of the National Industrial Conference Board.

The meeting closed Tuesday night with reports by various sub-committees of technical standing committees.

TRADE ACCEPTANCES INTEREST ELECTRICAL SUPPLY JOBBERS

Cincinnati Convention Recommends Early Use of This Facility—W. L. Goodwin Talks—Co-operation with the Government

Trade acceptances were the most absorbing topic discussed by the Electrical Supply Jobbers' Association at the regular semi-annual meeting held on Tuesday, Wednesday and Thursday of this week at Cincinnati.

Mr. Du Brul, president of the Miller, Du Brul & Peters Manufacturing Company, Cincinnati, member of the local trade acceptance council, made the chief address, explaining the advantages of trade acceptances to both seller and buyer, especially as a trade stabilizer and as a means for furnishing liquid assets against the excess profits tax due next spring. Great interest was aroused in the proposition as presented by Mr. Du Brul, bringing out a most suggestive discussion on its practical application. At a late session the Supply Jobbers' Association adopted a resolution suggesting that the individual jobber put the use of trade acceptances into practice at the earliest possible moment. Similar action had already been taken by the Atlantic division of the Electrical Supply Jobbers' Association.

The meeting was the best ever held by the Electrical Supply Jobbers' Association in both attendance and interest.

It was the first meeting of the association at which electrical contractors were invited to be present.

Meetings were also held by the central and Atlantic divisions where trade conditions were discussed, growth of small-order business especially receiving attention. In addition reports were made concerning underlying conditions on a new basis of staple electrical supplies.

At the Wednesday morning session W. L. Goodwin explained the plan for harmonizing the various electrical interests, showing the relation between manufacturer, central station, jobber and contractor-dealer in the distribution of merchandise to the ultimate consumer and emphasizing the duty of each to the other. To avoid conflict between the various interests in the industry, Mr. Goodwin suggested preferential discounts in accordance with services performed. He also voiced the need of a code of ethics for the entire industry and the necessity that the three other branches contribute to the development of the contractor-dealer so that the industry may attain maximum efficiency.

The plan was well received, and it is anticipated that

individual jobbers will carry out the spirit of the movement in their respective territories.

The supply jobbers are anxious to render all the service they can to the government in the successful prosecution of the war and have empowered their executive committee to offer the resources of any jobber in securing to the various government departments such electrical supplies as are required in any district, believing that such co-operation, particularly in the matter of small quantities, will result in better deliveries and prices to the government.

Considerable interest was displayed throughout the sessions and confidence was expressed in the stability of the jobbing business, although many went to the meeting for the express purpose of exchanging views on the outlook in view of the feeling that gradually as the war progresses the government will demand of industry more and more of its output. The national situation is exercising more influence over local conditions than ever before.

SHORTAGE OF 50,000,000 TONS IN NATION'S COAL SUPPLY

Dr. Garfield Says That Coal Demands of Public Utilities Plants Have Increased by 33 1-3 per Cent

A statement issued this week by Dr. H. A. Garfield, the Fuel Administrator, says that the war needs of the nation for fuel have developed to a point where the demand threatens to outstrip the supply. It says:

Through the efforts of the Fuel Administration and other agencies the annual output of coal has been increased by approximately 50,000,000 tons. But the consumption of coal, it is estimated, has increased by approximately 100,000,000 tons, leaving a gap of 50,000,000 tons to be bridged.

Practically the entire increase in coal consumption is due to the necessities of war. Munitions plants, running twenty-four hours a day at full capacity, with continuous demands from the government for increased production, are using from 33 1/3 to 50 per cent more coal than they were a year ago. For instance, the Bethlehem Steel Company demands an increased coal supply of approximately 250,000 tons a month, or 3,000,000 tons a year.

The direct demands of the government for coal, including the requirements for the actual fighting forces of the army and navy, have increased by 300 per cent. Where 2,000,000 tons supplied the government under normal conditions, the demand is now 8,000,000.

The coal demands of public utilities plants, particularly in the industrial sections of the country, have increased by about 33 1/3 per cent. Practically all of this increase is due to increased power furnished to munitions plants and to other war industries.

To close up the gap of 50,000,000 tons between the production and consumption of coal the Fuel Administration will take steps to increase production, facilitate transportation and enforce the most economical use of the available coal supply. The Fuel Administration is determined that war industries, public utilities and domestic consumers shall be supplied. To this end the co-operation of every coal user of the country will be necessary. The Fuel Administration will use all of its authority to prevent the waste of fuel and the unnecessary use of coal. Domestic consumers will be urged to conserve their supplies.

Wherever the unnecessary use of coal in industry threatens to embarrass war industry the Fuel Administration will see that the war needs are filled. All activities which are unnecessary to the maintenance of economic or military efficiency will have to give way by curtailment to the necessities of war, and this must be accomplished without undue curtailment of the domestic supply.

Handling Labor Problems in Great Britain

Members of Special Mission of the British Ministry of Munitions to the United States Point Out Ways in Which War-Time Problems Affecting Labor Are Met

COMPLETE ADDRESSES ON LABOR PROBLEMS SENT ON REQUEST.—Electrical manufacturers, engineers, central station executives, engineering contractors and other employers of labor who are readers of the *ELECTRICAL WORLD* will find special interest in the addresses by Sir Stephenson Kent, K. C. B., member of the Council of the Ministry and director general of the labor supply department; H. W. Garrod, deputy assistant secretary of the labor regulation department; G. H. Baillie, chief technical dilution officer of the labor supply department, and Capt. Cyril Asquith, director of the artificers' allocation of the labor supply department, touching upon questions of labor supply, labor shortage, wages and the substitution of women for men in munitions and allied industries of England.

The first three gentlemen addressed a representative body of American engineers at a dinner given in honor of the special mission by the United Engineering Society. The addresses of all four and a summary of the discussion as presented on the same day at a luncheon given in their honor by the editorial conference of the New York Business Publishers' Association have been reprinted by the McGraw-Hill Publishing Company, and the editors of the *ELECTRICAL WORLD* will be glad to send to any reader interested a copy of the pamphlet containing these important contributions to the solution of our own labor problem.

MEMBERS of the special commission of the British Ministry of Munitions were entertained at luncheon on Tuesday, Nov. 13, by the editorial conference of the New York Business Publishers, Inc., and at a formal dinner in the evening of the same day given by the United Engineering Society.

Sir Stephenson Kent, the chairman of the mission and member of the Council of the Ministry and director general of the labor supply department, in an address before the editors, said in part:

We recognized in England, after our first few months of very bitter experiences, that the organization of a nation's industries on a war basis is even more important than having an army.

My government called together, before the Ministry of Munitions existed, capital and labor—federations of employers and the heads, the executive chiefs, of our trade unions. We differ from you in that respect. The labor that is engaged principally in the engineering trade, in the manufacture of munitions, in its widest sense, is very highly organized. I think it is no exaggeration to say that in the engineering trade 80 per cent of the labor is trade union labor.

My government had two ideal bodies to negotiate with—the committees of these federations of employers, who were fully representative of capital's voice; the trade unions officials, who fully represented labor's voice.

That conference ended in what is known as the treasury agreement. That treasury agreement was embodied in the munitions of war act. The principal features in regard to that act are as follows:

In the first place, the Minister of Munitions definitely had power and definitely limited the profit made in any establishment that was engaged in the manufacture of munitions. In the second place, the wage of the labor in those controlled establishments was fixed.

The committee on production was set up, whose function it was to ascertain what, if any, the increased cost of living amounted to and to issue a national award in regard to that labor whose wage had been fixed, so as to meet the increase in the necessities of life that that labor might find. That committee meets three times in a year and has the necessary statistics laid before it, receives representa-

tions from trade unions and from any one else who has a voice or should have a voice in the matter, investigates the case very carefully, then gives instructions that this labor should receive so much extra per week to meet that increased cost.

My government induced—it required very little inducement—the trade union leaders in my country to agree to waive all the restrictive practices that had been common in the manufacture, on the civil side (what now is the munition side), from the point of view of output or of engagement of labor on war work, for the period of the war. On the government's side it pledged itself to restore the pre-war conditions in any factory where by that agreement the normal conditions had been varied.

We take the view that to-day, above all other times, it is absolutely vital to exercise economy from every point of view—economy from the point of view of food—yes; but economy from the point of view of the materials that are essential to the winning of this war, economy from the point of view of the use of man power. We look upon it to-day in England as a very serious crime if steel or copper or lead or iron or any of these raw materials of which we never had a sufficiency is used for any purpose other than to help to win the war. We look upon the misuse by an employer or the army or a government department of the skill of any mechanic or any citizen as really a mistake and a crime and something that it is our duty to put right.

It is absolutely impossible to exaggerate the importance, the overwhelming importance, that labor plays in war. Without labor, without that industrial peace of which I spoke, this war cannot be won. It is the basis of the war. Your man power at the front, your man power at home, all turns on labor's activities and the solution of the problems that war brings in regard to labor.

DILUTION OF LABOR

G. H. Baillie, chief technical dilution officer of the labor supply department and well known as an electrical engineer in England and on the continent, described the two schemes and gave several most interesting examples of how England met the shortage of labor. One scheme is known as the "dilution" of skilled labor with unskilled, and the other the substitution of women for men. Both of these schemes, said Mr. Baillie, were contrary to trade union practice and trade union custom before the war, but were put into effect by mutual agreement as explained by Sir Stephenson Kent. The whole agreement referred to munitions work only. Employers made use of this agreement in several ways:

First, an unskilled worker was brought into the plant to do an easy job. The man so displaced was put on the more skilled work, and the man displaced was again promoted, and so on until there had been an upgrading of skill throughout the whole shop.

Another method adopted was to draw unskilled men from the non-essential trades, unskilled men who were either over military age or of low medical category. Watchmakers were brought into the tool rooms to do gage making. Our building industry was largely closed down, and we took sanitary plumbers from there and trained them up to do lathe turning for our explosive factories. We also drew from the building industry carpenters and joiners and sent them into the shipyards to act as shipwrights and shipjoiners.

We took mechanics, textile mechanics, from the textile industries, accustomed only to rough work, and trained them up to the better work of munitions. A third way was by confining the fully qualified mechanic to the highest forms of skilled work. If the mechanic normally had been

on a job that would be split up into two or more parts of varying degrees of skill, the mechanic was confined to the part requiring the most skill, and we trained up men and women to do the less skilled parts.

Those schemes we called the "dilution of skilled labor," because we made the very little skill we possess go a very long way by diluting it with as much unskilled labor as possible.

But this method fell far short of producing enough workmen, so women were employed. It was agreed that a woman undertaking work which previously had been done by a skilled mechanic should receive the same day rate as the skilled man; if she was on piece work, she was to receive the same piece rate. It was only when she was on unskilled or semi-skilled work that the woman's wage could differ from that of the man, and then her wage was regulated by an order which fixed a minimum wage, a wage, roughly speaking, two-thirds that of the unskilled man.

As a result of the good wages that women have been able to earn on munitions work, we have never been short of applicants for any kind of work, and our employment of women at present is limited only by our facilities for training them. We have now on munitions work only more than a million women.

WORK DONE BY WOMEN

Mr. Baillie outlined several classes of unskilled work successfully done by women, mentioning that in many lines of work 90 per cent was performed by women. Continuing, Mr. Baillie said:

Coming to more highly skilled work, the percentage of women employed is, on the average, a good deal lower. But there are individual cases in which our percentages reach very high figures. We have a shop engaged on breach mechanism for howitzer guns in which every machine tool is operated by women who set and grind their own tools, and the tools themselves are hardened and ground by women.

H. W. Garrod, deputy assistant secretary of the labor regulation department, speaking to the engineers, pointed out that the war demanded three kinds of sacrifice—sacrifice of life on the battlefield with the world's plaudits and one's own conscience a driving force, sacrifice of wealth with the honor and satisfaction that generosity brings, and sacrifice of prejudice, the most difficult of all. In solving the labor and capital problem Mr. Garrod pointed out that the last sacrifice was the most important and the hardest the war demanded. Mr. Garrod said:

Alone and in his own office the employer may sacrifice to patriotism his prejudices as to his rights, without applause and often against his own class, and similarly the workman in the shop must give up his prejudices. Truly this is an American program.

SKILLED MEN FOR ARMY WORK

Capt. Cyril Asquith, director of the artificers' allocation of the labor supply department, speaking before the editors, said:

Artificer is a name we have in the army for skilled men. It is nothing more or less than a skilled machinist. I think it would probably surprise you to know how large those demands are. The technical branches of the army—that is to say, like the Army Corps, Royal Flying Corps, Royal Engineers, and so on and so forth—compose altogether about half the total number of the armies. I don't say those corps consist wholly of skilled men, but they are filled with them to a greater or to a lesser extent.

Just to give you some notion of the magnitude of the demands which they make, I may mention that as we left England a demand was presented by the War Office for 40,000 skilled men to work on the railways behind the lines in France, and that about three or four weeks ago we heard that a further demand for 15,000 highly skilled machinists had been presented.

We are embarrassed in our attempts to meet those de-

mands by the fact that, in common with practically every other European power, we made the mistake in the first year of the war of permitting the enlistment in infantry and other regiments of highly skilled machinists who would have been much better employed either in civil life upon munitions or in these technical branches of the army to which I refer.

We look to you, gentlemen, to avoid that mistake, and we look to you with the utmost confidence. In fact, we know already that your War Department has taken steps to avoid it. It is about the only mistake we think you should avoid. We have been immensely impressed in the course of our tour with the enormous reservoir of ability and energy and resource which America contains. It gives us high hopes of a certain and not far distant victory.

CAMPAIGN FOR GIFTS FOR ELECTRICAL CHRISTMAS

The Society for Electrical Development Issues a Special Poster as Part of the Movement for the Holiday Season

The Society for Electrical Development, which is planning a nation-wide Christmas gift campaign, has had a special Christmas poster designed. This poster will be available for window displays, store cards,



AN "ELECTRICAL CHRISTMAS" POSTER

poster stamps and window cards. A transparency suitable to the holiday spirit, with special reference to electrical gift suggestions, will be available for windows and doors. A set of special display and price cards have been designed, each card directing attention to the one appliance shown.

A new motion-picture feature has been prepared. Two human-interest scenarios have been produced for the society by the Universal Film Manufacturing Company. The stories show the actual operation of electrical appliances with strong suggestions to "Give something electrical this Christmas."

ACUTE SITUATION OVER NIAGARA POWER SUPPLY

Appointment of Controller of Distribution and Production of Canadian Niagara Energy—American Industries Depend on Canada

Sir Henry Drayton, chairman of the Dominion Railway Commission of Canada, recently appointed royal commissioner to investigate the exportation of Canadian Niagara power to the United States, has been commissioned as controller of the distribution and production of electrical energy in the Province of Ontario.

Vigorous efforts are being made by industries on the American side of the Niagara River to overcome any effort on the part of the Dominion government to place an absolute embargo on the exportation of power. Acting on the suggestion of electric power interests in western New York, Secretary Baker has arranged for a conference between the American and Canadian authorities on the subject.

Former Congressman Robert Bulkley of Cleveland has been designated by the War Department as the American representative. It is expected that the conference will result in the adoption of some sort of a priority arrangement so that if power is cut off from the Canadian side of the river it will not interfere in any way with the manufacture of war supplies for either country. The British war mission, which has been investigating conditions in the United States, was impressed with the necessity for power for American munition factories.

BANKERS STRONGLY URGE WATER-POWER UTILIZATION

Committee on Public Service Securities of Investment Bankers' Association Speaks for Recognition of the Needs of Utilities

A report of the committee on public service securities, presented before the Investment Bankers' Association at Baltimore on Wednesday of this week, calls attention to the incalculable value of water-power development. It says that the regulating commissions have responsibilities which they should meet by allowing utilities to charge rates high enough to develop their plants properly, particularly under the severe conditions during the war crisis and post-war competition. O. B. Willcox, vice-president of Bonbright & Company, New York, is acting chairman of the committee. The report in part follows:

Water powers available on the navigable streams of the country and on the public domain of the United States, of total capacity estimated at 25,000,000 hp. to 50,000,000 hp., are under the jurisdiction of the national government. Development of this asset is impossible under the existing acts of Congress, not so much because of impracticable or unworkable conditions or regulations imposed as because the laws do not permit the acquisition of such title or tenure as will secure the capital necessary for development. The failure of Congress to enact laws encouraging the development of the water powers under the jurisdiction of Congress is due only to ignorance of the value to the nation of the utilization of this undeveloped resource and misconceptions of the conditions required for development occasioned largely by the mistaken arguments of narrow and perverted advocates of what has improperly been called conservation. A mass of impracticable proposals on the subject has been introduced in Congress, further complicating and confusing the subject. Excellent bills have been introduced in both

houses providing for the development of national water powers under conditions amply protecting the public interest, but these have invariably been lost in committee. Every banker interested in the welfare of the country must strongly urge upon his senators and representatives in Congress the immediate adoption of a rational policy for the utilization of the power of our rivers and streams, so useless and utterly wasted without development, which if made available would be of incalculable value to the growth of national industry and wealth, particularly at this time when conservation of coal and labor are of the first importance.

ELECTRICITY A GREAT AID IN BUILDING DESTROYER PLANT

Construction of Nine-Million-Dollar Naval Producing Unit at Squantum, Mass., Will Be Rushed with the Help of Electric Service

Electrical construction is proving an important factor in erection of the nine-million-dollar United States destroyer plant of the Fore River Shipbuilding Corporation at Squantum, Mass., near Boston. This essential addition to naval production facilities of the country is enlisting the patriotic co-operation of both utility and contracting interests as well as of the engineering and manufacturing organizations responsible for it.

Energy is being supplied by the Edison Electric Illuminating Company of Boston over a system of temporary lines, including a submarine cable feeding a 4600-volt substation on the site, and at present about 400 kw. in lighting and power service is being utilized. Herbert S. Potter of Boston is fulfilling contracts for all temporary electrical construction at the plant, and all pole line work on the premises, general yard lighting and miscellaneous power work is being installed by his organization. This contractor's force at Squantum now consists of about 100 men, and wiring has been under way for one month. He has received contracts for wiring the plate and angle shop, angle smith shop, assembly building, boiler house and substation. The Lundin Electric & Machine Company of Boston has just been awarded a contract for a twenty-five-panel switchboard to be installed in the substation. The general contractor on the work is the Aberthaw Construction Company of Boston, the consulting engineers being Monks & Johnson, Boston.

Erection of buildings began on Monday of this week. The yards of the destroyer plant are being equipped with a great variety of electrically driven machinery, including concrete mixers, portable band saws, drills and other tools used in rushing the outside work. From a temporary substation on the grounds energy is being distributed for construction purposes by single and three-phase 2300-volt circuits carried on wooden poles. The motors thus far placed in service range from 0.5 hp. to 30 hp. in rating. Grounds and streets are being illuminated by type C gas-filled multiple lamps, usually of 400 watts rating, and interior lighting for construction purposes has been standardized for the present at 100 watts, with gas-filled units. Four lamps per pole is the usual arrangement for outside lighting. Transformers have been loaned by the Boston Edison company to permit rapid installation and early use of tools and building structures, and the Boston Elevated Railway is building a bridge across the Neponset River to provide a cut-off service to the plant with special loop for local use.

Women for Drafting.—The Byllesby engineering department force has been depleted considerably by the entrance of draftsmen into government service. To meet the situation a new policy has been inaugurated of employing women in the drafting room. A start in this direction has been made.

Detroit Edison Company to Authorize Debenture Bonds.—A special meeting of stockholders of the Detroit Edison Company has been called for Nov. 22 to vote on a proposal to authorize \$9,000,000 debenture bonds. The company recommends this so that it may have means of providing for its financial needs should occasion arise.

Christmas Boxes for Edison Soldiers.—Electra, an organization of the women employed by the Commonwealth Edison Company of Chicago, is providing a Christmas box this year for each former employee who is now a sailor or soldier. Five hundred and twenty-nine company employees have entered the service to date.

Increase in Electric Rates in England.—The electricity committee of the borough council of Stepney, England, has reported on the further increases necessary in electric rates owing to increased cost of production. Its recommendation has been adopted that, subject to the statutory limitation of charge (an average of 16 cents per unit), all charges made in respect of and relating to electricity supplied to consumers, including meter rentals, except in those cases where there are special contracts, be increased by an additional 16.67 per cent, making a total increase on pre-war rates of 50 per cent.

Study of Street Lighting.—Work has been begun by the United States Bureau of Standards on an extensive program of measurements which are designed to furnish first-hand information for use in a street-lighting circular to be issued by the bureau. Among the early features of the work were the measurements made on two types of street arc lamps to determine the distribution of the light and the variation of the candlepower and efficiency with current. The circular in which the results are to be published and which is in the course of preparation is a part of the public utility work of the bureau.

Increase in New Power Customer Rates in Seattle.—The Washington Public Service Commission has granted the Puget Sound Traction, Light & Power Company, Seattle, permission to advance power rates. The advance applies to new power customers, and not to lighting rates. Under the new schedule the minimum rate for 100 hp. or more is increased from 0.5 cent to 1 cent per kilowatt-hour, and the minimum rate for from 21 hp. to 100 hp. is changed from 0.9 cent to 1½ cents. The commission approved cancellation of a special rate that had been in effect for some time providing for a reduction of 33 1-3 per cent on all offpeak loads. Other special rates that had been in effect were also cancelled by the order of the commission.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Ohio State University School of Military Aeronautics.—A new building is being erected for the use of the Ohio State University School of Military Aeronautics. This will be used for laboratories and recitation rooms. It is of permanent character and will eventually form part of the Robinson Laboratory, in which are the departments of mechanical and electrical engineering. Immediately east of the Robinson Laboratory a temporary wooden barracks, capable of housing 400 aviation students, is being erected. Several members of the teaching force are participating in the work of this school, which is one of those established by the United States government to train men for the aviation section of the Signal Corps.

Law Against Keeping Explosives.—Any person in the United States found with explosives in his possession in future, and who does not have a license issued by the federal government showing the purpose for which the explosives are to be used, will be arrested at once and fined up to \$5,000 or sent to prison for one year. If the circumstances warrant, the person may be fined \$5,000 and in addition be sentenced to the year in prison. This is the principal clause in a war measure passed by the last Congress which is now being put into effect by the Bureau of Mines, Department of the Interior, which has been charged with its enforcement. Francis S. Peabody of Chicago has been appointed by Secretary of the Interior Lane to act as assistant to the Director of the Bureau of Mines, Van H. Manning, in enforcement of the law.

"The Nerves of the Army."—The Illinois State Council of Defense has appointed an advisory committee of the electrical industry to determine ways and means by which the members of this industry in Illinois may assist the army, the navy and other government departments. Upon investigating the recruiting situation, as applied to the Signal Corps, this committee has found a need for directing the thought and effort of electrical men toward the Signal Corps. The committee has prepared a Signal Corps folder, "The Nerves of the Army." This is not a call for volunteers. The folder is designed to appeal to the men subject to the draft. The committee is desirous that electrical firms apply for copies of the poster to display on bulletin boards and to forward to male employees between twenty-one and thirty-one years. While this movement as yet has to do entirely with Illinois, it is believed that it will probably become general as its usefulness is appreciated.

Educational Offer to Commonwealth Edison Employees.—The Commonwealth Edison Company of Chicago is making a special offer to 5500 employees in regard to the educational courses offered by the committee on education of salesmen of the Commercial Section of the National Electric Light Association. The circular issued by the company says in part: "Are you aware of the increasing demand for trained men at all times, and particularly at the present time? Are you preparing yourself to take advantage of these increasing opportunities? The company believes in you. Do you believe in yourself? The company backs up this belief in you by the following offers: The company, upon application to the paymaster, will advance to the association the cost of your course, to be paid back to the company by you on the partial payment plan, in accordance with the schedule herein contained. The company agrees to refund to you one-half of the tuition fee upon your presenting a certificate from the association showing satisfactory completion of the course. The Chicago Central Station Institute will conduct, without charge, a monthly class in each of the courses, and will take up and discuss each lesson in its regular order." Fred R. Jenkins states to the ELECTRICAL WORLD that it is expected that a large number of employees will take advantage of these offers and that the benefits will be mutual to the men and the company.

Examination for Officers in Engineer Corps of Naval Reserve Force.—An examination will be held at the Bureau of Yards and Docks, Navy Department, Washington, D. C., to establish a list of eligibles for enrollment in the Civil Engineer Corps of the United States Naval Reserve Force. This examination will close at noon Dec. 31, 1917. A descriptive circular giving detailed information will be sent to interested parties upon request to the Chief of the Bureau of Yards and Docks, Navy Department, Washington, D. C. The candidate must be an American citizen and an engineer in active practice of the profession of civil, electrical or mechanical engineering or some business directly connected with these professions. The age and experience requirements are: For ensign, not less than twenty-four years of age with not less than two years of active professional practice; for lieutenant (junior grade), not less than twenty-seven years of age with not less than five years of active professional practice; for lieutenant, not less than thirty years of age with not less than seven years of active professional practice, during at least three years of which the candidate must have had responsible charge of work as principal or assistant. Those now in the United States Naval Reserve Force, civilians and any one who is now in the army, either volunteer or drafted, including those directed to appear before an exemption board, may make application, but those in the army, either volunteer or drafted, must obtain their discharge before they can be enrolled.

Chicago Section, A. I. E. E.—The Chicago Section of the Institute will hold a meeting on Nov. 25. Bert H. Peck will present a paper on "Engineering Data for the Determination of an Electric Rate Problem."

Historical Lighting of Independence Square.—E. F. Kingsbury presented a paper on the "Historical Lighting of Independence Square" at a meeting of the Philadelphia Section of the Illuminating Engineering Society on Nov. 16.

San Francisco Jovian League.—At the Nov. 7 meeting of this society, instead of the usual speaker of the day, four speakers gave very brief talks, two on "Co-operation," the third on "How to Play Safe," and the fourth on "What the Inspector Expects." The speakers were C. G. Hardy, city electrician of Oakland; Arthur Kempston, city electrician of San Francisco; John R. Brownell, superintendent of safety, State Accident Commission, and Robert L. Eltringham, safety engineer, State Accident Commission.

Philadelphia Section, A. I. E. E.—William F. Johnson of the Philadelphia Electric Company addressed the Philadelphia Section of the American Institute of Electrical Engineers on Nov. 12 on "Methods of Standardization Employed by a Utility to Insure Accurate and Dependable Means for Determination of Power Distribution and Consumption." At the Nov. 1 meeting of this section W. F. G. Swann, chief of the physical division, department of terrestrial magnetism, Carnegie Institution of Washington, spoke on the subject of "Atmospheric Electricity."

Louisville Jovian League.—Members of the Louisville (Ky.) Jovian League assembled at a luncheon on Oct. 26 to bid farewell to F. V. Gantt, president of the organization. Mr. Gantt for six years has been manager of the Louisville branch of the General Electric Company and is promoted to be the head of the sections handling central station and railway supplies at the division headquarters in Cincinnati, Ohio. A handsomely engraved cigarette case was presented to Mr. Gantt in behalf of the Louisville men. The presidency devolves on Walter S. Clark of the James Clark, Jr., Electric Company, who has been vice-president.

Grand Rally Meeting of the Electrical Men of Greater New York.—The Electrical Contractors' Associations of Greater New York plan to hold a grand rally meeting of all the electrical men of the city and vicinity at the Garden Theater, Madison Avenue and Twenty-seventh Street, New York City, at 8 p. m., Tuesday, Nov. 20. It is expected that from 3000 to 5000 electrical men will attend. The main purpose of the meeting is to launch the "Goodwin plan" of organization for the electrical industry in the metropolitan district. W. L. Goodwin, originator of the "Goodwin plan," will discuss the general subject "Organization." Other well-known men of the electrical industry will address the meeting, among them being James H. McGraw, president of the McGraw-Hill Publishing Company.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Cleveland Section, A. I. E. E.—"Lighting, Its Use in Warfare," is the subject of a meeting to be held on Nov. 19 by the Cleveland Section of the Institute.

Electric Arc Welding.—A. M. Candy presented a paper on "Electric Arc Welding" at a meeting of the Pittsburgh branch of the American Institute of Electrical Engineers held on Nov. 13. The annual banquet will be held Dec. 8.

Jovian Electric League, Los Angeles.—A talk on "The Darkest Days in History," dealing with conditions in Turkey, was made at the Nov. 7 meeting of the Los Angeles Jovian Electric League by J. P. McNaughton, who has just returned to this country after residing in Turkey for twenty-eight years.

Welfare and Efficiency Conference.—The fifth annual Pennsylvania welfare and efficiency conference will be held in the hall of the House of Representatives at Harrisburg on Nov. 21 and 22. These conferences are held annually for the purpose of stimulating discussion on the problems of industry and labor, with especial attention to reducing the vast number of industrial accidents.

Association of Iron and Steel Electrical Engineers.—A joint meeting of the Pittsburgh Section and the Cleveland District Section of the Association of Iron and Steel Electrical Engineers will be held at the Hotel Courtlandt, Canton, Ohio, Nov. 24. Two papers will be presented, the first on "Central Station Power," by W. A. Hornlein, and the second on "Electric Furnaces," by J. D. Donovan.

American Institute of Electrical Engineers.—The three hundred and thirty-fourth meeting of the American Institute of Electrical Engineers was held in the auditorium of the Engineering Societies Building, 33 West Thirty-ninth Street, New York, on Nov. 9. The paper of the evening was entitled "An Experimental Method of Obtaining the Solution of Electrostatic Problems with Notes on High-Voltage Bushing Design," by Chester W. Rice of the General Electric Company.

Pacific Coast Jobbers Meet in Southern California.—The quarterly convention of the Pacific Coast Electrical Supply Jobbers' Association was held at the Beverly Hills Hotel, near Los Angeles, Cal., Oct. 25, 26 and 27. At the open meeting an address was made by Albert H. Elliot outlining the effect which the new federal tax law would have on corporations. An important action taken at the meeting was the appointment of a committee of jobbers' credit men instructed to prepare for

submission at the next meeting a report on the credit situation on the Pacific Coast. The committee will give special consideration to trade acceptances, cash discounts and interest on overdue accounts. The next meeting will be the annual convention, held at Del Monte in January.

San Francisco Jovian League Holds Annual Smoker.—The annual smoker and general jollification of the San Francisco Jovian League was held on Nov. 1. To promote the "get-acquainted" movement the program was made up to a large extent of talent from among the membership. There was also a talk on the modern machine gun, together with a demonstration of how its parts are assembled and the gun is served, and an address by Merle Smith, who described the work being done by the army Y. M. C. A. in American training camps and on the European battlefield.

New York Electrical Society.—A joint meeting of the Engineers' Club and the New York Electrical Society was held at the Engineering Societies Building, New York City, on Nov. 15. Lieut.-Col. Ivor Thord-Gray, late in command of the Eleventh Northumberland Fusiliers, British Expeditionary Force, France, gave a short informal talk on "Some Phases of Trench Warfare." After this address Captain P. Corcoran, late in command of the Thirty-seventh Divisional Signal Company, B. E. F., spoke on "Electrical Communication in Modern Warfare." Captain Corcoran gave an illustrated survey of the composition of a modern army, the relative positions of the different units on the battlefield, the different methods of communication between units by radio, by telephone and by telegraph, and the maintenance of connection between the fighting forces and the staff during an engagement.

Electrical Credit Association.—The Electrical Credit Association of Chicago arranged the program to be given at its twenty-second annual meeting at the Hotel La Salle, Nov. 15 and 16, as follows: Reports of officers; reports of territorial chairman; election of officers; address by member of Federal Reserve Board on "Trade Acceptances"; "Effects of War on Collections, Etc.," T. J. Whearty; "Trade Acceptances, Merits and Faults," W. J. Burton; "Business Conditions," E. W. Wolfstyn; "Should Interest Be Charged on Overdue Accounts?" Davis McMakin; "How to Handle Collection Correspondence," J. W. Meriam; "The Necessity for Observance of Terms at This Time," A. T. Bellis; "The Exchange of Trade Information and Credit Losses," open; "Possible Assistance Given Sales Departments by Credit Departments in Securing Desirable Business," W. S. Long; "Passing the Order and Helping Customers, Instead of Turning Them Down and Making Them Pay," E. T. Martner; "Experience of Members with Customers Called to the Colors," Miss Eva G. Hansen; dinner addresses, "Our Country's Call," by Clarence S. Darrow, and "Some Spiritual Gains of the War," by Horance J. Bridges.



J. D. NICHOLSON

J. D. Nicholson, the president-elect of the Kansas Public Utilities Association, has been superintendent and manager of the electric property at Newton, Kan., continuously since Dec. 25, 1893. During that period the power plant and distribution system of the company have been rebuilt several times under the direction of Mr. Nicholson. In 1911 the property was sold by him to the Kansas Gas & Electric Company of Wichita. During Mr. Nicholson's service with the Newton company the gross sales for electrical energy have increased from \$290 per month in 1893 to \$5,500 a month in 1917.

F. T. Morrissey has been transferred from the position of manager of the Duquoin (Ill.) office of the Saline Electric Company to the Eldorado office of the company. Mr. Morrissey will have charge of the company's operations in Eldorado, Ridgway, Equality, Junction City, Shawneetown and Enfield, Ill.

Chester N. Chubb, formerly manager of the Northern Indiana Gas & Electric Company at South Bend, Ind., has been made general manager of the People's Light Company, which operates in Davenport, Buckingham and Bettendorf, Iowa. Prior to going to South Bend Mr. Chubb was vice-president and general manager of the Michigan City (Ind.) plant belonging to the Northern Indiana Gas & Electric Company.

M. S. Sloan has resigned as vice-president and general manager of the New Orleans (La.) Railway & Light Company to become connected with the New York Edison Company as a general aid to Vice-president John W. Lieb. Mr. Sloan is a graduate of the Alabama Polytechnic Institute and from 1906 until late in 1913 was employed by the Birmingham (Ala.) Railway, Light & Power Company. He rose from chief engineer to assistant to the president in 1910, when he assumed supervision over all departments. His first position with the New Orleans property was as assistant to the vice-president. He became manager of the electric and railway properties a few months later and was made vice-president of the company only a few months ago.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

Marshall J. Spivery has been transferred from the Eldorado (Ill.) office of the Saline Electric Company to the Duquoin office.

Boyd Hammond, district manager for the Great Western Power Company at Sacramento, Cal., has joined the United States Signal Corps.

B. E. Waltz, president and manager of the Corry City (Pa.) Electric Light Company, has been elected a director of the Corry Board of Commerce.

F. L. Converse, electrical engineer of the Midvale Steel Works, Coatesville, Pa., has resigned to become connected with the Tacony Ordnance Company, Philadelphia.

G. B. Sanford has been transferred from district manager of the Great Western Power Company at Rio Vista to district manager at Sacramento, Cal., succeeding Boyd Hammond, who has joined the United States Signal Corps.

J. R. Murphy, vice-president, manager and contract agent of the Great Bend (Kan.) Water & Electric Company, has resigned. Mr. Murphy went to Great Bend in the latter part of 1912 as manager of the company, having formerly been contract agent and superintendent of the Hoisington (Kan.) Electric & Ice Company. At the same time he was chosen manager of the Hoisington company, but made his headquarters at Great Bend, Kan. A year or more later Mr. Murphy was made vice-president of the Great Bend property.

William E. McClintock, who has been with the National Utilities Company for the last two years as consulting engineer in charge of the reorganization of various gas and electric light properties, will sever his connection with that company about the first of the year and will resume consulting practice, with offices in New York City. Among the properties which Mr. McClintock has reorganized for the National Utilities Company are the Lambertville Public Service Company and the New Hope Electric Company of Lambertville, N. J.; the Newton Gas & Electric Company of Newton, N. J., and the New Jersey Gas & Electric Company of Dover and Wharton, N. J. At the present time he is in Port Arthur, Tex., in temporary charge of the work of reconstruction of the Port Arthur Gas & Power Company. He practiced law in the State of Massachusetts for a number of years before taking up publicity work. Mr. McClintock intends to make a specialty of examinations and reports on utility properties, commission work and reorganizations.



WALTER ROBBINS

Walter Robbins, vice-president of the Wagner Electric Manufacturing Company of St. Louis, has been selected to organize the newly created electrical division of the finished-products section of the War Industries Board. This division will act in an advisory capacity to the various purchasing committees of the government. Mr. Robbins, who is chairman of the transformer committee of the Electric Power Club and one of the most energetic members of the club, will establish himself at Washington soon to take up his new work. Mr. Robbins, who was born in Marquette, Mich., and graduated from the University of Michigan in 1896, was for several years connected with the Western Electric Company in Chicago, entering the employ of the Wagner company in 1905 as assistant general manager and being elected vice-president in 1915. He took a leading part in the formation of the League of Electrical Interests of St. Louis.

E. A. Wright, manager and contract agent of the Manhattan (Kan.) Ice, Light & Power Company, has been appointed successor to J. R. Murphy as manager of the Great Bend (Kan.) Water & Electric Company and the Hoisington Electric & Ice Company. Mr. Wright is a graduate electrical engineer and was for several years in the engineering department of the Allis-Chalmers Company, Norwood, Ohio, which position he resigned to become manager of the Manhattan properties in 1912.

Obituary

John M. Winslow, one of the pioneer telephone builders of the State of Washington, recently died at his country home near Silver Lake, at the age of sixty-one years. Mr. Winslow was born in Philadelphia. As a civil engineer he was engaged for a number of years in Mexico. Going to the Pacific Northwest, he settled in Tacoma, and fifteen years ago he went to Seattle to reside. He held the position of secretary-treasurer of the Puget Sound Telephone Company and was active in the company's affairs up to the time of his death.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

AMALGAMATION OF LARGE HEATING-DEVICE INTERESTS

Edison Electric Appliance Company to Be Formed to Acquire Domestic Electric Heating-Device Business of Three Companies

Three of the largest manufacturers of domestic electric heating devices have consolidated their interests into one company to be known as the Edison Electric Appliance Company. This company will be organized to acquire the domestic electric heating-device business of the General Electric Company, the Hotpoint Electric Heating Company and the Hughes Electric Heating Company.

The purpose of this amalgamation is to secure a large volume of production of domestic electric heating devices and also more standardized designs. The new company, it is felt by the organizers, will also be able to secure more complete and thorough distribution of its output than could be done by the individual companies acting separately.

The new company will be licensed under the Marsh patent to use nickel-chromium in its resistance units.

W. H. Booth of the Hotpoint company will be chairman of the boards of the new company, and George Hughes of the Hughes company will be president. A. K. Baylor and H. C. Houck of the General Electric Company will be on the board of directors. Mr. Richardson and Percy Booth, both of the Hotpoint company, will be associated with the manufacturing and commercial departments of the new company respectively. An announcement of the capitalization of the new company will be made at a later date.

For the time being the new company will use the factories of the Hotpoint company at Ontario, Cal., and the Hughes company at Chicago. The domestic heating-device manufactures of the General Electric Company will be moved from Pittsfield, Mass., to the new factories.

This contingent is likewise face to face with the labor scarcity.

Shortages more or less acute are reported in lamps of all sizes, deliveries being back from six to eight weeks. This is accounted for by the factories being short-handed. In fact, this is true of all forms of glass used in the electrical trade. There is a fair supply of sockets with some jobbers and a dearth with others. Wire is hard to buy in any quantity. Manufacturers advise the jobbing establishments that this condition will continue indefinitely unless the governmental embargo goes off on copper. On these specialties orders have been accepted and filed subject to future developments at the factory end. Briefly, orders for almost anything in staples from dealers may be had for the asking, and not infrequently they are thrust upon the none too willing jobber in a quandary as to how the merchandise in question is to be corralled.

Jobbers in this section are, as a rule, very much interested in the so-called Goodwin movement. Many are of the belief that a great many, if not the entire train, of so-called evils from which both they and the dealers suffer will take wings and fly away when this effort to concentrate and consolidate the trade is finally consummated. An important "rally meeting" of contractors, jobbers and dealers, to further the welfare of buyer and seller, is to be held at the Garden Theater, New York City, during the evening of Nov. 20. As one jobber, in referring to the event in anticipation, said, "it will be the biggest thing ever pulled off."

THE ASBESTOS MARKET SITUATION IMPROVING

Prices Are Generally Lower than Last Year, While Production Has Caught Up with Demand in Some Lines of Material

Asbestos in the various forms employed by the trade is and has been for some time, as a market proposition, in an unsettled condition. Prices are up and down, but as a rule are on a lower scale than a year ago. Changes have occurred in the meantime, and in some instances the advances are sharp. Deliveries are reported as good as might be expected under the present abnormal circumstances, but few delays of over two weeks are heard of, according to the shippers—including jobbers, distributors and manufacturers. When shipments fail to reach destination at a later date than prescribed, freight congestion, which is a nightmare to many, is blamed for non-deliveries.

The situation is improving, though governmental commitments, which are given primary consideration at every stage, have interfered with the prompt attention usually accorded orders from private sources. The demand has greatly increased, and a wider use is found for stock or standard goods. The call for specialties to meet specified requirements is also expanding in a marked degree. Recently business has been caught up with in some lines, orders have been filled and shipment completed, and the future, an unknown quantity in several respects, is now being considered. Labor troubles are a factor of importance, but the visible supply of material seems to be ample.

Listing or woven tape, 0.015 grade, is selling for from \$4 to \$6 a pound, according to deliveries, the latter being figured as a controlling condition. Asbestos paper for fire-proofing and switch boxes, formerly quoted at 4 cents a pound, is now 13 cents, with a strong stock available. Tubing, flexible and rigid, commands a special price, dependent upon diameter and quantity, ranging from \$2.85 to \$3 a pound. This represents an advance of 100 per cent

THIS YEAR A BIG ONE FOR EASTERN SUPPLY JOBBERS

Although Building Construction Has Fallen Off Almost to a Minimum, Other Business Continues in Considerable Volume

Notwithstanding the extraordinary slump throughout the territory in and about New York City in building operations, which almost closes an important sales outlet, jobbing houses are having a volume of business quite surprising. One firm's branches in Brooklyn and the Bronx, specializing for building contractors, are almost at a standstill. The high prices and intermittent delivery of goods from the factories in no wise dampen the spirit of the progressive members of the trade. Leading concerns testify cheerfully to these facts, fortifying their statements in some instances by the declaration that it is the best selling year since the breaking out of the European war.

Obtaining stocks is the main trouble, but even at that the fact of having more orders on their books, from dealers of unassailable credit standing, is a source of satisfaction all around. Next to the difficulty of accumulating stock of any considerable size, the price situation is an ever-disturbing element with jobbers figuring on contracts or future quotations to dealers. Prominent houses are of the opinion that the peak has been reached, and that prices will remain on that level for some time to come. Freights are bothersome, being slow and uncertain, and the difficulty of arranging for material on a definite basis is causing anxiety among those jobbers who are also manufacturers.

as against normal figures. One manufacturer says that former prices under old contracts with jobbers still govern; otherwise current figures, which are subject to change, prevail.

AN ADVERTISING POLICY WHICH IS BROAD-MINDED

Lamp Manufacturer Preparing Books on Industrial Lighting to Overcome Indifference on the General Subject of Illumination

A new plan of advertising of broad character has been adopted by the Westinghouse Lamp Company in its industrial lighting campaign. Believing that its advertising problem is not to sell an industrial plant manager Westinghouse lamps, but rather to overcome his indifference on the general subject of lighting, the company has had two books prepared and has in the course of preparation others in which lighting is almost a secondary consideration. In these books the problems of the industrial plant manager are treated, showing the relation of good lighting to them.

Each volume takes up a different class, with the exception perhaps of the first one, by Harry Franklin Porter, entitled "Successful Industrial Management," in which the problems of the general industrial field are considered from the standpoint of the executive, manager and superintendent. Other volumes will take up particular industries. Thus there has already been printed a volume entitled "Increasing and Improving Production," by R. T. Kent, devoted to the metal-working field, and there will shortly be available a volume on textile mills. These books are each compiled by a recognized authority in his own field, thus giving to each volume a stamp of value.

This policy, tried as an experiment, is now believed by the company to be a success. Within two months after the first announcement there were 750 direct requests for the metal-working book and 1000 for the general book.

METAL MARKET SITUATION

Copper a Bone of Contention on Price—Holders in a Peculiar Position with Government as Arbiter

Differences of opinion exist between the manufacturers, jobbers of finished goods and producers of copper. A number of the former, prominent companies, are inclined to believe there is a reserve stock of the metal being held for still higher premium prices than are occasionally quoted. Producers and statisticians emphatically declare a shortage is in sight and that no relief is to be expected until spring. Holders of copper are not openly offering it because of the fixed official price, and even if a high figure is proffered by a manufacturer in order to fill a contract it is difficult to obtain the needed supply. Dealers are receiving the copper they bought earlier in the year, for which the contract price ranges from 25 to 29 cents, but they have been authoritatively instructed not to sell at a higher price than 23.50. Very few changes have been made in other metals. Aluminum, tin, brass and lead are higher.

NEW YORK METAL MARKET PRICES

	Nov. 5			Nov. 12		
	£	s	d	£	s	d
Copper:						
London standard spot.....	110	0	0	110	0	0
Prime Lake	Govt. price	23.50		Govt. price	23.50	
Electrolytic	Govt. price	23.50		Govt. price	23.50	
Casting	Govt. price	23.50		Govt. price	23.50	
Wire base	30.00	to	31.00	30.00	to	31.00*
Lead, trust price.....	6.00			5.50		
Nickel, ingot	50.00			50.00		
Sheet zinc, f.o.b. smelter.....	19.00			19.00		
Spelter, spot	7.67½			7.50	to	8.05
Tin, Straits	68.00			71.00		
Aluminum, 98 to 99 per cent....	33.00	to	35.00	34.00	to	36.00

OLD METALS

Heavy copper and wire.....	21.50	to	22.50	22.00	to	22.50
Brass, heavy	14.00	to	16.00	14.15	to	16.00
Brass, light	10.50	to	11.00	10.50	to	11.25
Lead, heavy	5.00	to	5.25	5.25	to	5.75
Zinc, old scrap.....	5.00	to	5.50	5.00	to	5.50

*Nominal.

THE WEEK IN TRADE

WITH the exception of the Pacific Coast region no marked effect is observable in the curtailment of buying on account of the recent regrettable war reverses in Italy and Russia. Inquiries from the Orient are noted, with Japan an important factor. Shipbuilding enterprises in the Northwest Coast States present new developments on a large scale. The demand for electrical apparatus, appliances and supplies is so large in consequence that the shortage is causing uneasiness in the trade. Conduit and lighting fixtures are becoming scarce, with deliveries continuing uncertain. In the Middle West the sale of supplies is restricted on account of the low ebb in building operations; otherwise the buying is normal, if not active. In the East labor troubles are paramount, but business is quite satisfactory. Conditions in the South show a steady increase in the buying of staples and holiday goods of utility rather than mere novelties.

Collections are on a firm basis, with credits being carefully scrutinized. In some quarters there is a disposition to take up with the authorities the "red-tape" delays which at times occur in connection with the settlement of bills for work for the Government.

NEW YORK

Labor shortage, especially of skilled factory workers, is having a marked effect in every line, being reflected concretely in threatened further delivery delays and probably advanced prices on some classes of electrical merchandise. It is the general opinion, however, that prices have reached peak and will remain there for some time, with recessions a remote possibility.

With the curtailment in the supply of the main lines, jobbers and dealers are stocking generously on household specialties, heating appliances and holiday goods. Trade promises to be far above last year's record in this particular.

Collections are followed with assiduity and success, and credits are closely looked after.

COLLECTIONS.—Manufacturers are looking after collections closer than for years. The usual sixty days' dating allowed established jobbers is still in vogue, but a 5 per cent discount for spot cash is promptly accepted in settlement of bills. Credits with the smaller jobbers and contractors are tightening appreciably.

LAMPS.—A shortage is reported in 10-watt and 220-watt nitrogen lamps, the latter being called for by the War Industries Board. Deliveries are behind sixty days and longer with other types. A curtailment in the supply of bulbs, bowls and globes may also account to some extent for this condition, as blowers and other skilled operatives are needed.

INSULATING PAPER.—In common with other products prices on insulating papers and fabrics have been advancing from time to time. Material which at one time cost 7 cents a pound is now selling above 50 cents; other basic constituents have jumped up 100 to 200 per cent. On account of an accumulation of stock deliveries are quite satisfactory.

FANS.—Distributors and jobbers are now figuring on the supply of fans for 1918. The new prices are usually ready early in December, if not sooner. Manufacturers are hampered by the outlook for brass, and a liberal output is problematical. With the recollection of last summer's acute shortage jobbers and dealers will make every effort to secure all the fans possible. A sharp advance is anticipated.

HEATING SPECIALTIES.—A liberal inquiry continues for heating appliances, percolators, chafing dishes, etc., and other specialties, but in all these lines complaint is heard from dealers regarding the difficulty of obtaining supplies in satisfactory quantity. The jobbing houses are preparing for a large volume of business, and heavy orders are awaiting delivery, merchandise going out as rapidly as received. No further price advance is looked for prior to Jan. 1.

LABOR.—In every quarter the growing scarcity of skilled workmen is the cause of more than passing uneasiness. With the large distributors of electrical goods, not to mention the manufacturers, the loss of many experienced heads of departments has necessitated "doubling up" and extra hours to enable the concerns affected to keep abreast of orders. At the factories the situation is acute. For instance, one of the large electrical manufacturing companies reports that its complement of skilled workers is far from being full. The company would put on 10,000 additional men at one of its plants if they could be had. The equipment of the same concern's new factories, which are to begin operation shortly, is a difficult undertaking in respect to obtaining a sufficient working force. Conditions are far more serious in the East than in the Middle West.

MOTORS, ETC.—There is an improvement in the delivery of small motors, but that certain sizes of generators or transformers may be figured on a definite basis is purely conjecture. That the situation is bettering is freely believed locally. It is frankly admitted, however, that the main disturbance now is the growing shortage of labor—it is everywhere in evidence. Further, the force at work is improving every chance, in view of the lack of men, to make fresh demands of one sort or another. This is becoming decidedly embarrassing and perplexing when it comes to figuring factory costs and deliveries.

CHICAGO

There is not much change in the general business situation in the Chicago territory. In the building line residential construction has been dead and gives no evidence of reviving. The industrial demand continues strong. Just at this time of the year there is always some expansion in the trade due to the fact that this is the fall lighting season, and this normal expansion is at present noticeable in just about the amount which was anticipated. So, while business is somewhat better this month than it has been, this cannot be taken to mean that business is getting markedly better, but rather should be interpreted as indicating that the normal expansion due to the season is at hand. Jobbers report that the adverse war news of the last few weeks has had little noticeable effect on buyers. The trade which patronizes jobbers does not keep its finger on the pulse of Wall Street so closely as do other people in the trade.

COPPER WIRE.—Rubber-covered copper wire is holding steady on a 35-cent base. The wire is hard to get and the demand is good. The jobbers cannot get wire at a price which will let them sell lower than 35-cent base.

CONDUIT.—There is little activity in the conduit field at present. Conduit, especially of the larger size, is difficult to get, owing to the demand made upon the mills for merchant pipe of the larger sizes. There is no indication of a decline in prices, because of the fact that the mills can make more money by selling merchant pipe than by treating it and selling it as conduit.

PORCELAIN INSULATORS.—In some respects the insulator situation is somewhat better than it was six months ago, although this cannot be taken as a sweeping statement. On the 33,000-volt pin-type insulators the manufacturers are still "up against it" to make deliveries. On the suspension type there are probably enough orders booked to run the mills for four or five months, but it is possible for a rush order to receive more prompt attention if it calls for this type of equipment. Orders for immediate delivery are off just now, owing to the season, but booking orders are coming in in good shape. Some of the mills have experienced a little difficulty, due to the early cold weather, which cut off the gas supply at a time when it was difficult to buy coal. The situation as regards malleable castings which go into insulators has eased up considerably.

AUTOMOBILE HEATERS.—The early cold weather has given automobile heater manufacturers an opportunity of doing a good business in these devices this year. The articles were widely advertised in the United States and Canada, but last year's sales were not up to expectations on account of the warm fall weather. Expectations for this season are high.

BOSTON

Business activity remains at a high pitch in the North-east, and in most lines of electrical interest trade is brisk. The flood of government orders shows little sign of abatement. Collections are a little slow, especially in the contracting field. Credits are not improving, but the situation is not very disquieting as yet, the fundamental soundness of the electrical industry being as plain under war conditions as could be asked. Prices are firm and high, costs away up, but the public is meeting the situation with courage and determination to see the war through to a successful finish. High-class buying is much in evidence, notably in the latest Oriental styles of portable lamps. Storage batteries are in very heavy demand, and vacuum cleaners are moving well. Central station power business is very large, especially in the munitions field, there being no signs of curtailment to be found here. Labor troubles are disturbing, but the President's speech at Buffalo Monday will have a good effect upon the rank and file of the workers, who are unquestionably patriotic at heart. Uncertainty is growing as to the effect of the Western Electric strike at South Boston, which still continues, upon the maintenance of satisfactory telephone service in the Boston district.

APPLIANCES.—Increasing interest is seen in portable lamps, especially of the new Oriental styles, high cost apparently being no argument against purchase. Low-priced portables of this class are also moving faster, and the prospects for the holiday trade are excellent. At the moment other appliances appear to be in reasonable demand; but, unless vacuum cleaners and washing machines are excepted, no special boom is to be seen.

STORAGE BATTERIES.—Stocks are almost exhausted in the alkali type, and deliveries are in excess of normal on the lead type, though customers are being cared for very well, thanks to factory enlargements and the foresight of distributors. The demand, especially from government or related sources, is enormous. Prices are steady. The recent upward turn in lead is not expected to attain the former maximum.

ARC LAMPS.—The demand is substantial, although nothing in the way of a boom is being handled. Floodlight business is excellent, although below the rush of late spring. Factory stocks are accumulating for immediate shipments, and there is some prospect of a future increase in prices, according to current opinion.

INCANDESCENT LAMPS.—Complaints as to scarcity are rife among the smaller dealers and jobbers. The larger dealers are unable in many cases to obtain deliveries in large quantities at present, a fairly strict control being exercised at the factories on production and shipments. It is a poor time to insist on special lamps if early delivery is desired.

SOCKETS.—A heavy demand is noted for shipyard service and for mill use. On a recent large order the manufacturer is to make immediate shipment of 50 per cent of the number required, balance in two weeks.

ELECTRIC SIGNS.—New business has been dull for several months, and the fuel-saving restrictions, which went into effect Monday, have produced little effect on the trade as yet. Low-wattage lamps, of course, will be somewhat more plentiful if the restrictions remain in force many months.

CONDUIT.—Jobbers' stocks are about as full as six or eight weeks ago, and a fair supply of smaller sizes is coming in up to 0.5-in.; but 1-in. conduit and over is difficult to obtain. A fair delivery is reported on a former order, but in the main deliveries are unsatisfactory.

ATLANTA

Business continues good, and there has been virtually no change in general conditions during the past week. The demand for all goods in the jobbing line is steady, with a slight increase in the volume of sales covering a few specialties.

Jobbers are placing more substantial orders than they did during the previous four or five weeks. This is due, no doubt, to the fact that the buying element realizes that no material reduction in price, if any, can be expected on steel

products for some time. On the whole, the jobbers are in good shape, and their financial position is getting better every day. They report collections as being excellent, showing an improvement over last month.

Inquiries and the demand for electric signs have been very strong up to the present, but this line is bound to suffer if final approval is given to the order turning off all signs for the duration of the war. As the movement is directed at this time only at the source of energy supplied by coal and coke, it is not definitely known what the fate will be of signs served from hydroelectric sources; but from information at hand it appears that Fuel Administrator Garfield has no intention, at least for the present, of dimming signs fed by hydroelectric power, unless the coal-saving order is followed by another having as its object the saving of energy to be used industrially.

The Southeastern States, then, are fortunately situated to the extent that their large centers of population, it is hoped, will not be affected, inasmuch as the cities of Atlanta, Augusta, Columbus and Macon, Ga.; Birmingham, Ala.; Nashville, Knoxville and Chattanooga, Tenn.; Charlotte, N. C., and many others are served from interconnecting transmission systems supplied from hydroelectric plants.

FIXTURES.—Jobbers handling this line report a very heavy business covering the entire Southeastern States. In addition to the normal demand a big market is opening up in the rural districts, where farm lighting outfits are being sold. The most popular demand from this source seems to be for the standard shower-type fixture. Activity in apartment and residence building is picking up in Atlanta's burned section, and especially in those cities where camps are located. This has favorably affected fixture sales, and an unprecedented demand has been created for all types. A comparison of orders filled for shipment to the larger cities indicates a strong leaning toward the semi-indirect and candelabra type. The lack of labor for assembling and hanging, also the slowing up in deliveries, has kept the dealers from making even larger sales.

METERS.—The demand for single and polyphase meters continues steady. Manufacturers are giving comparatively prompt deliveries on the single-phase type and report an improvement in deliveries on the polyphase.

TRANSFORMERS.—One manufacturer reports a marked improvement on the delivery of standard 2300-volt distributing-type transformers up to 25 kva.

SEATTLE

The electrical jobbers of Seattle report a noticeable increase in buying along some lines. During the week five to twelve of the biggest increases emanated from the Puget Sound Navy Yard, Bremerton, and other government sources. These orders and the demand for the shipyards are rapidly causing a shortage, which exists and is expected to become more pronounced. Range business and sales of energy-consuming devices have dropped off slightly, owing, it is believed, to the approaching holiday buying. These lines are expected to sell heavily in the weeks preceding Christmas, and dealers have planned accordingly. Shortages in materials and equipment mentioned in the last two dispatches still obtain, with no signs of abatement. Conduit shipments are coming through about the same, and the lowness of stocks in this particular line is causing some worry. Government demands for conduit are increasing. Freight conditions are about the same as last week. Prices steady.

The Seattle school board will shortly let a contract for motors and transmission apparatus to be used in the manual-training centers. The week was featured by a letting of contracts to general contractors in the Northwest for cantonment buildings at Fort Worden, Casey and Flagler, in the Puget Sound coast artillery district, involving about fifty buildings. The contract for a building for an amusement zone at the American Lake cantonment involves 300 buildings and the expenditure of \$1,500,000. A complete lighting system for the zone is also included in this contract. Local dealers expect considerable business in the sale of lighting equipment from the above contracts.

Two Seattle shipyards were incorporated last week for the construction of steel ships, involving an expenditure of

\$32,000,000. The deal is the largest awarded to any concern in the Northwest and adds the sixth steel shipyard to the Seattle industry, involving an immediate expansion of the well-established plants. It is understood locally that the contracts for the major portion of the steel and equipment to be used in this steel ship construction enterprise have been awarded to Eastern concerns. However, local jobbers are making arrangements to care for the large increase in business expected from shipbuilding sources next year. The increase in the demand for electrical equipment in the cities, excepting Tacoma, is at a decidedly low ebb. Portland reports show that the cost of building is more than 42 per cent higher than last year. It is believed that these figures will apply to other large cities in this section.

The settlement of the strike in the shipyards at Olympia has been effected. The workers are promised a raise in wages dating back to Aug. 1. Other points at issue will be arbitrated. President Wilson's mediation board, which is handling the adjustment of the strike of the employees of the Pacific Telephone & Telegraph Company in Oregon and Washington, is expected to arrive shortly to treat directly with the employees. In the meantime the telephone service in Seattle and other Northwestern cities remains demoralized, with no signs of improvement.

The lumber production for the week was within 15 per cent of normal, with orders keeping pace. A shortage of logs is feared.

SAN FRANCISCO

The reverses along the Italian line have brought conviction of a longer war period, and with this has come a readjustment of affairs in accordance with that view. Equipment and supply orders that have been held under advisement have been released or canceled, according as they deal with the production of war supplies or business depressed by the war. War conditions have made burdensome the low light and power rates common in the West, and a very general effort toward relief is being made. The California Railroad Commission's annual report, just issued, says: "The increasingly large number of applications by the public utilities for authority to increase rates is based on increases in prices of labor, fuel, oil, materials and supplies." Labor and fuel-oil prices particularly have absorbed the funds of smaller companies that would normally go into other channels. To a considerable extent, therefore, the market is affected by rate readjustments.

The Oriental market is undergoing changes of much interest, although under present conditions there is little opportunity for this country to profit from trade opportunities there. From Japan and insular and mainland territories of the Orient generally comes a strong demand for electrical supplies of all kinds, caused by a desire to extend industrial plants and increase productions. This business has to be refused. For example, Australian wheat now comes here for milling and has to be transshipped to England because Australian mills cannot get the equipment to increase their capacity. Japan is making strenuous efforts to supply Oriental markets and has been filling large orders for electrical supplies in India and Russia. Very recently a quotation of nine months' delivery was made by an American manufacturer of 100,000 ft. of No. 18 lamp cord for Russia. The order was secured by a Japanese factory, which promised delivery in ninety days.

LAMPS.—The local manufacturing capacity plus the receipt of Eastern shipments is just sufficient to supply the demand for lamps; and even this condition is maintained only by the careful scrutiny of orders, rejecting or postponing delivery on those where lamps are not actually needed at once.

PROJECTORS.—Floodlighting projectors are moving more rapidly. Many government orders are being received. Recent Italian war news seems to have released orders on floodlighting equipment previously held for consideration.

ELECTRICAL RANGES.—Prospects for next year's range sales are already spoken of as unusually good, provided that the companies can then supply the power. The increasing price of other fuel is directing attention effectively toward the electric kitchens.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	195.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor

No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single Conductor

Less than coil.....	List net to \$61.00
Coil to 1000 ft.....	—5% to \$59.17
Less than coil.....	List net to \$71.00
Coil to 1000 ft.....	—15% to \$68.87

Twin-Conductor

Less than coil.....	List net to \$105.00
Coil to 1000 ft.....	\$70.00 to 10%
Less than coil.....	List net to \$135.00
Coil to 1000 ft.....	—10% to \$130.95

DISCOUNT—CHICAGO

Single-Conductor

Less than coil.....	+10%
Coil to 1000 ft.....	—10%

Twin-Conductor

Less than coil.....	+10%
Coil to 1000 ft.....	—10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10% to list net
1/5 to std. pkg.....	15% to 20%
Std. pkg.....	28% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+20% to 12%
1/5 to std. pkg.....	List to 20%
Std. pkg.....	28% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.31 to .32
Barrel lots.....	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31 to .3175	.32 to .3275
Barrel lots.....	.28 to .2875	.29 to .2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List Per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp.....	\$75.00	\$66.00 to \$69.75
3/4-in. d. stp.....	75.00 to 78.75	68.25 to 72.00
1/2-in. s. stp.....	100.00	88.00 to 93.00
1/2-in. d. stp.....	100.00 to 105.00	91.00 to 96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip.....	\$75.00	\$63.75
3/8-in. double strip.....	78.75	71.25-71.75
1/2-in. single strip.....	100.00	85.00
1/2-in. double strip.....	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	2.....	.47
5/8.....	.15	2 1/2.....	.55
3/4.....	.18	3.....	.65

NET PER 1000 FT.—NEW YORK

	Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$25.00-\$55.00	\$20.50-\$24.75	\$20.00-\$22.00
1/4-in.—	\$28.00-\$60.00	\$22.50-\$27.00	\$22.00-\$24.00

NET PRICE 1000 FT.—CHICAGO

	Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$36.69-\$55.00	\$27.50	\$24.75
1/4-in.—	\$40.00-\$60.00	\$30.00	\$27.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List Elbows, List

1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.60
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb....	4% to 6%	7% to 9%
2500 to 5000 lb....	6% to 8%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb....	3.4% to 4.8%	6.4% to 7.8%
2500-5000 lb....	5.4% to 6.8%	8.4% to 9.8%

(For galvanized deduct six points from above discounts.)

FLAT IRONS

NEW YORK

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

CHICAGO

List.....	\$5.00 to \$6.00
Discount.....	25% to 30%

FUSES, INCLOSED

	250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100		\$0.25
35-amp. to 60-amp.....	100		.35
65-amp. to 100-amp.....	50		.90
110-amp. to 200-amp.....	25		2.00
225-amp. to 400-amp.....	25		3.60
450-amp. to 600-amp.....	10		5.50

	600-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100		\$0.40
35-amp. to 60-amp.....	100		.60
65-amp. to 100-amp.....	50		1.50
110-amp. to 200-amp.....	25		2.50
225-amp. to 400-amp.....	25		5.50
450-amp. to 600-amp.....	10		8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.00 to \$5.75
1/5 to std. pkg.	4.50
Standard package, 500.	List, each, \$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500.	List, each, \$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List. Each
Regular, clear:		
10 to 40-watt—B.	100	\$0.27
60-watt—B.	100	.36
100-watt—B.	24	.65
75-watt—C.	50	.65
100-watt—C.	24	1.00
200-watt—C.	24	2.00
300-watt—C.	24	3.00
Round bulbs, 3 1/4 in., frosted:		
15-watt—G 25.	50	.50
25-watt—G 25.	50	.50
40-watt—G 25.	50	.50
Round bulbs, 3 3/4 in., frosted:		
60-watt—G 30.	24	.72
Round bulbs, 4 1/4 in., frosted:		
100-watt—G 35.	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$30.00 to \$33.98
Coil to 1000 ft.	25.50 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$36.24 to \$36.56
Coil to 1000 ft.	27.18 to 27.42

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	\$20.00 to \$29.00
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CHICAGO

Net per 100	\$19.00 to \$25.75
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OUTLET BOXES

Nos.	List, per 100
101—A, A 1/4, 4 S.C., 6200, 320.	\$30.00
102—B.A., 6200 S.E., 300, A.X., 1 1/2, 4 S.	30.00
103—C.A., 9, 4 R, B 1 1/2.	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list.	20% to 37%	25% to 32%
\$10.00 to \$50.00 list.	30% to 45%	20% to 40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list.....	40%	35%
\$10.00 to \$50.00 list.....	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80 to \$38.00
1/5 to std. pkg.	13.60 to 19.00
Standard package, 2200.	List per 1000, \$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80 to \$20.54
1/5 to std. pkg.	14.80 to 19.24
Standard package, 2200.	List per 1000, \$20.

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net	Std. Pkg.	4000
5 1/2 N.C.—Solid Nail-it—N.C.			
Less than 1/5 std. pkg.	\$20.00 to \$29.00	\$23.20 to \$30.75	
1/5 to std. pkg.	13.50 to 15.60	18.70 to 24.20	

CHICAGO

	Per 1000 Net	Std. Pkg.	4000
5 1/2 N.C.—Solid Nail-it—N.C.			
Less than 1/5 std. pkg.	\$11.85 to \$30.75		
1/5 to std. pkg.	11.10 to 11.40	24.20	

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/2-in. cap key and push sockets	500	\$0.33
1/2-in. cap keyless socket.	500	.30
1/2-in. cap pull socket.	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:		
30-amp. S. P. S. T.		\$0.80
60-amp. S. P. S. T.		1.20
100-amp. S. P. S. T.		2.25
200-amp. S. P. S. T.		3.48
300-amp. S. P. S. T.		5.34
30-amp. D. P. S. T.		1.20
60-amp. D. P. S. T.		1.78
100-amp. D. P. S. T.		3.38
200-amp. D. P. S. T.		5.20
300-amp. D. P. S. T.		8.00
30-amp. 3 P. S. T.		1.80
60-amp. 3 P. S. T.		2.68
100-amp. 3 P. S. T.		5.08
200-amp. 3 P. S. T.		7.80
300-amp. 3 P. S. T.		12.00
Low Grade:		
30-amp. S. P. S. T.		0.42
60-amp. S. P. S. T.		0.74
100-amp. S. P. S. T.		1.50
200-amp. S. P. S. T.		2.70
30-amp. D. P. S. T.		0.68
60-amp. D. P. S. T.		1.22
100-amp. D. P. S. T.		2.50
200-amp. D. P. S. T.		4.50
30-amp. 3 P. S. T.		1.02
60-amp. 3 P. S. T.		1.84
100-amp. 3 P. S. T.		3.76
200-amp. 3 P. S. T.		6.76

DISCOUNT—NEW YORK

Less than \$10 list.	List net to + 5%
\$10 to \$25 list.	Net to 11%
\$25 to \$50 list.	14% to 15%
Less than \$10 list.	5% to 10%
\$10 to \$25 list.	10% to 16%
\$25 to \$50 list.	14% to 25%

DISCOUNT—CHICAGO

Less than \$10 list.	+ 5%
\$10 to \$25 list.	11%
\$25 to \$50 list.	14%
Less than \$10 list.	5%
\$10 to \$25 list.	16%
\$25 to \$50 list.	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole.	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole.	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point.	100	.54
10-amp. three-point.	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole.	100	\$0.45
10-amp. three-way.	50	.70
10-amp. double-pole.	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+ 20% to net
1/5 to std. pkg.	Net to —15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

	List, Each
Union and Similar—	
No. 155.	\$0.34
No. 160.	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list	List to list net	List net to + 10%
\$2.00 to \$10.00 list	10% to 20%	5% to 10%
\$10.00 to \$50.00 list	20% to 30%	15% to 20%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list	25% to 50%	20% to 40%
\$2.00 to \$10.00 list	25% to 50%	20% to 40%
\$10.00 to \$50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price.	\$5.00 to \$7.50
Discount	25% to 30%

CHICAGO

List price	\$4.50 to \$6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools.	\$0.44 1/4 to \$0.65
No. 18, full spools.	0.43 1/4 to 0.55

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	\$0.57 1/2 to \$0.65
No. 18, full spools.	0.50 1/2 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No.			
11.	\$15.00-\$18.00	\$13.00-\$14.00	\$11.25-\$12.00
12.	23.25-27.09	21.30-23.22	19.35-20.55
10.	32.40-37.80	29.70-32.40	27.00-29.25
8.	45.70-53.34	41.90-45.73	38.00-41.38
6.	72.40-84.42	66.35-72.40	60.30-65.50

CHICAGO

	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No.			
14.	\$18.00	\$13.50	\$12.00
12.	25.21-27.37	21.30-27.37	17.40-23.46
10.	35.29-38.25	29.82-32.72	24.35-30.60
8.	49.91-54.27	42.18-46.43	34.45-43.42
6.	78.95-92.61	60.85-79.23	51.15-74.09

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$35.25 to \$40.00
25 to 50 lb.	35.25 to 39.00
50 to 100 lb.	34.25 to 38.00

CHICAGO

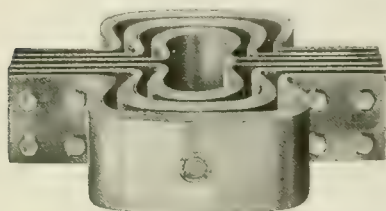
	Per 100 Lb. Net
Less than 25 lb.	\$40.00 to \$40.50
25 to 50 lb.	39.00 to 39.50
50 to 100 lb.	38.00 to 38.50

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Expansion Joint for Copper Busbars

To forestall the difficulties arising from busbar expansion one of the manufacturers has produced an expansion joint identical in principle with that previously made up and used by



LARGE-SIZE EXPANSION JOINT

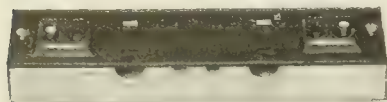
several companies. These joints bolt into the bus and impose no poor connection or reduction of bar stack conductivity. These elements are furnished for stacks of any number of bars of all the bar sizes and spacings common to present practice. The conductivity of the joint is equal to or greater than that of the bar stack which it joins and is very flexible because of its thorough lamination, it is pointed out.

These joints are produced in all sizes by the General Devices & Fittings Company of Chicago.

Dead-Front Panel Switches

The Bryant Electric Company of Bridgeport, Conn., announces an addition to its line of dead-front panel switches. Devices of this character, both in the rotary and push-button types, have been in use for some time. These, however, have been fitted with connections for plug fuses. Now, where the conditions do not permit of the use of plug fuses, as, for instance, on circuits above 125 volts, a Bryant panel unit can be had with connections for cartridge fuses.

Each unit is complete in itself, consisting of a substantial porcelain base, upon which are mounted two demount-



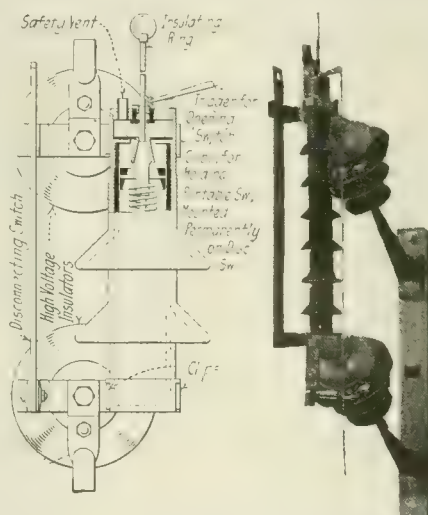
EACH UNIT IS COMPLETE IN ITSELF

able switch mechanisms with fuse connections, all ready for connecting to the circuits. Aside from the feature of convenience, the method of affording safety against shock to the operator is pointed out. The entire front of each unit is fully protected by substantial

sheet fiber. This effectively covers and protects all live parts so that it is impossible for a careless or thoughtless operator to "get a shock," it is claimed.

Portable High-Voltage Switch

A portable high-voltage switch, which consists essentially of circuit-breaking contacts, opened by a strong coil spring and inclosed in an insulating tube filled with an arc-extinguishing dielectric liquid, is shown herewith. The switch is held in a closed position, against the pull of the spring, by means of a catch at the top. When this catch is tripped by a string or rod the contacts are disengaged, and the spring pulls the lower contact down into the



MAY BE USED INDOORS OR OUTDOORS

liquid, which is forced on the moving terminal by means of the liquid director immediately below the moving contact. The switch is placed in special clips mounted on the disconnecting switch by means of a special insulating pole. The pole is provided with two hooks which engage bales on the upper and lower terminals fitted to the insulating tube. When the unit is used as a portable switch it is closed manually by means of an insulating rod fastened to the moving terminal and extending through the top of the switch. In places where the switch would be operated frequently—that is, once a day or once every few days—and where the expense of a permanent installation is warranted, a similar unit is installed and is provided with two sets of strings or cords, so that it can be both closed and opened without removing it from the contact clips.

In permanent installations automatic operation on overloads can be obtained

by means of primary relays or a special arrangement of fuses. When the switches are permanently installed and are equipped for automatic operation in outdoor installations the mechanism at the top is protected from snow, ice and sleet by means of a simple shelter.

These switches, for either portable or permanent installations, can be furnished for all voltages from 2000 to 110,000. They can be used indoors or outdoors, on pole tops or in manholes. The switches are rugged, light and simple, all of which tends to reliable service, it is pointed out. They are manufactured by Schweitzer & Conrad, Inc., 4431-39 Ravenswood Avenue, Chicago.

Globe and Refractor

A glass globe and an improved Holophane refractor have recently been added to the General Electric Novalux street-lighting fixtures. The new Holophane dome refractor, of corrugated glass, collects more upward light than other designs and throws this light downward and out into the street at an angle of 10 deg. below the horizontal. It practically does away with a reflector and makes the lamp far more efficient, it is pointed out.

The glass globe also added to this Novalux fixture is of clear glass stippled on the inside. It diffuses the light over a large area and at the same time absorbs very little more light than a clear globe. The globe also eliminates any dazzling point of light, producing a glowing effect that spreads a flood of light evenly over the street.

This fixture, made by the General



ELIMINATES ANY DAZZLING POINT OF LIGHT

Electric Company of Schenectady, N. Y., with the stippled globe and dome refractor, takes the gas-filled type C tungsten lamps in all sizes from 250 cp. to 1000 cp.

Washing-Machine Motor

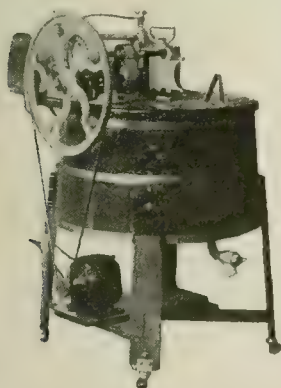
The St. Louis Electrical Works, 4060 Forest Park Boulevard, St. Louis, Mo., are manufacturing an especially designed washing machine motor rated at 1/6 hp. Patented skeleton construction makes the motor exceptionally light and at the same time rigid in construction. Laminations are made of special electrical iron, which, in combination with a patented winding, allows a very low iron loss and therefore high efficiency.

The rotor is keyed solid on the shaft, which is mounted on ball bearings. The motor is entirely inclosed and will operate continuously under full load with a temperature rise of not more than 38 deg. C., and will stand a 50 per cent overload for intermittent service. The motor is waterproof.

The windings are made of enameled wire with a treated cotton covering. The motor is of the split-phase type. The contacts of the centrifugal starting switch are of tungsten. The starting winding is of comparatively large wire and has a separate resistance unit to prevent burn-outs. With the specially designed rotor and stator winding, the starting torque has been made high for a motor of this type. The pull-up torque is 133 per cent of the full-load torque, and the pull-out torque is 200 per cent of the full-load torque. The actual starting torque from a dead standstill is even greater than the pull-up torque.

Washer for Home Use

The important feature of a washer, it is pointed out, is the agitator which imparts motion to the clothes and water. In the machine shown here this is a disk of wood about three-quarters the diameter of the tub. To the lower surface are fastened six cleats, 2 in. (5.08 cm.) deep. These take firm hold on the clothes and will not catch in such a way as to tear them. The weight of rocker shaft and dasher is not great enough to pack the clothes down and prevent the water from circulating freely as the mass is worked back and



TWO TYPES OF WRINGER CAN BE FURNISHED

forth against the corrugated sides and bottom of the tub. Two types of wringer are furnished—one having a safety quick-release feature, the other without it.

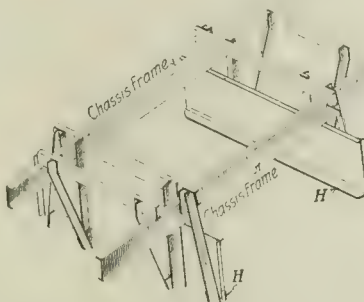
Cypress wood is used in the tub, which is corrugated inside by grooves cut in the wood. It is held together by three hoops of galvanized steel and has a drain spigot in its bottom. On a platform below is mounted a Westinghouse 1/6-hp. splash-proof motor, which can be supplied for direct current or alternating current. This is belted to a fly-wheel to which is geared the rocker shaft. This is of square section so that it can move to accommodate a varying quantity of clothes in the tub.

The washer is made by the Miller Manufacturing Company of Meyersdale, Pa.

Interchangeable Battery Compartment

W. P. Stone & Company of South Boston, Mass., have developed an interchangeable battery compartment, consisting essentially of a structural steel frame fastened to the truck chassis and provided with shelves on which are suspended duplicating units holding the batteries. An isometric view of the framing is shown herewith.

The frame is suspended from the



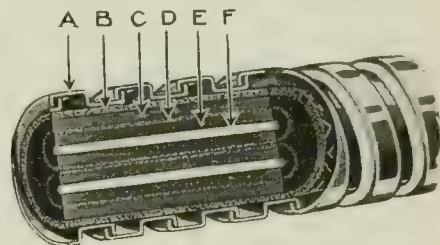
FRAMEWORK OF BATTERY COMPARTMENT

chassis frame by suspending, bracing and trussing irons bolted to channels and designed to provide a rigid support for the duplicating unit, the latter being held in place with the aid of 1 1/8-in. (2.8-cm.) dowel pins seated into 1 3/16-in. (3-cm.) holes in the shelves H. These dowels complete the truss action on the chassis frame itself, thereby strengthening it at a vital point and giving a wider distribution of the battery load than would otherwise be feasible. Lips are provided on the upper ends of the main hangers to support a part of the weight, and this lessens the strain on the rivets between vertical and horizontal members. Gusset plates connecting the main hangers and braces extend outward under the shelves.

The battery compartment, when assembled, is locked into place automatically by gravity. In four minutes two men with an elevating truck can remove the entire battery and replace it with another fully charged. No jacks, wrenches, levers or other tools are required, and one man can readily handle the smaller sizes of compartment alone. For the cleaning, inspection, flushing or repairing of a battery the compartment affords advantages, as there are no upstanding walls attached to the duplicating platform units. No wheels or rollers are required.

Portable Lamps with Protected Cord

A line of portable lamps is now being marketed by the Inland Electric Company of Chicago designed to lessen the fire and accident hazard of portable wires. The cable is of an unusual type; a cross-section of it is shown herewith. Each conductor has a rub-



CROSS-SECTION OF PROTECTED CORD

ber jacket with braid, which in turn is covered with another rubber jacket surrounding both conductors. An outer braid binds the insulation together. The outer braid is saturated with a waterproof compound which protects the rubber from oil and water. Over this braid is a special armor formed from a No. 30 gage steel ribbon with interlocking flanges which give it strength and flexibility. It can be formed in a loop less than 15 in. (38.1 cm.) in diameter. Its tensile strength is over 160 lb. (72.57 kg.). The cable will not kink or tangle and will lie flat on the floor. An 8-ton (7.25-t.) solid-rubber-tired automobile truck has been run over the armor on a concrete floor without injuring it, it is said. Iron-wheeled trucks will flatten the cable. The attachment plug is screwed on a bushing which is sweated to the armor. The cap of the plug is filled with a compound which keeps the wires from buckling and foreign matter from entering the cable.

The fixture itself is composed of a strong wooden handle with a strong steel guard. At the handle end of the fixture there is additional steel armor which absorbs the strain at this point.

Two types of these fixtures are manufactured. One is a vapor-proof fixture and the other of the open type. In addition to these two fixtures an extension cable is made for portable electric drills. The fixtures have the approval of the National Board of Fire Underwriters.

Christmas Tree Outfit

A prominent feature of the electric Christmas tree outfit now being marketed by the Import Sales Company, 324 East Thirty-second Street, New York City, is the parallel cord with which it is equipped. This type of flexible connection abides by the recommendations in the National Electrical Code. Each outfit is tested before shipment, and the packing is so arranged that the dealer may make his own test without removing the lamps from the case. Sets of these decorative lamps are supplied with eight, sixteen, twenty-four and thirty-two lights, with either tungsten or carbon bulbs.

Trade Notes

I. D. MILBURN has joined the sales force of the Page & Hill Company, Minneapolis, Minn.

H. F. BARDWELL has been appointed New York district manager for the Vanadium-Alloys Steel Company of Pittsburgh and Latrobe, Pa., with offices at 30 Church Street, New York City.

A. L. SMITH, JR., has taken a position with the Rathbone Sard Electric Company as New England representative, with an office at 65 High Street, Boston, Mass. Mr. Smith was range specialist for the Edison Electric Illuminating Company of Boston for a number of years.

J. ANDREWS, JR., has been appointed manager of the industrial division of the Pittsburgh office of the Westinghouse Electric & Manufacturing Company to succeed F. C. Albrecht, who is now in the Ordnance Officers' Reserve Corps, stationed at the Frankford (Pa.) arsenal.

LOUIS J. GROSSMAN of the Grossman Electric Company, Allentown, Pa., having been drafted into the National Army, has closed his local office as well as the one at 115 North Sixth Street, Philadelphia. Henceforth mail for him should be addressed to 503 Tasker Street, Philadelphia.

I. E. LYNCH of the Page & Hill Company, Minneapolis, Minn., is at present acting as general superintendent of stores for the American International Shipbuilding Corporation, Philadelphia. Mr. Lynch is on leave of absence and expects to return to his organization as soon as his present duties are completed.

R. J. MORGAN, who resigned from the Midvale (Pa.) Steel & Ordnance Company, has been appointed supervisor of sales of the American Steel Export Company, New York City. Prior to his connection with the Midvale company Mr. Morgan was for thirteen years with the Carnegie Steel Company, Pittsburgh, Pa.

ARTHUR E. ALLEN, manager of the supply department in the New York district office of the Westinghouse Electric & Manufacturing Company who is a Canadian, has resigned to join the Royal Engineers. He has been succeeded by Charles E. Stephens, formerly in charge of the illuminating and rectifier section at East Pittsburgh, Pa.

J. W. WHITE, from 1906 to 1912 with the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., and from 1913 to 1916 with the Bullock Works of the Allis-Chalmers company, Milwaukee, Wis., as special agency representative in charge of dealers and jobbers, has been made manager of the power and railway division of the Detroit office of the Westinghouse company.

THE CHAMBER OF COMMERCE, New York City, has published an address on "Property Rights and Trade Rivalries," by George E. Roberts, assistant to the president of the National City Bank. The address was delivered before the national conference upon the foreign relations of the United States under the auspices of the Academy of Political Science in the city of New York.

TIFFANY, HALL & COMPANY, INC., New York, N. Y., are erecting a twenty-five thousand-dollar fireproof brick building, 100 ft. by 60 ft., at Seventh and Adams Streets, Hoboken, N. J. The structure is a single-story, modern mill-type structure, on the unit system, special attention being given to the lighting effects. It will be finished and ready for occupancy Dec. 1 and will be devoted exclusively to the overhauling and handling of used motors.

THE GOLDSCHMIDT THERMIT COMPANY, New York City, has opened a new office, repair shop and storeroom at 1427 to 1429 Western Avenue, Pittsburgh, Pa. The branch will be under the direction of H. D. Kelley, who has represented the company in the Pittsburgh district for years. It will also be the headquarters of H. G. Spillsbury, metallurgical engineer, and Edwin B. Bloom, who has been representing the Thermit company for some time in Ohio and western Pennsylvania.

THE BOND FOUNDRY & MACHINE COMPANY, Mannheim, Pa., has recently purchased, as a going concern, the plant and good will of the Queen City Foundry Company, Toronto, Can. In the future this new acquisition will be operated as the Bond Engineering Works, Ltd. Besides making gray iron castings, it will manufacture power-transmitting specialties. New buildings will be erected to take care of the increased business. The Canadian works will be under the management of H. M. Lee.

GEORGE A. PAFF, formerly superintendent of the rod and wire mills at the Aliquippa Works of the Jones & Laughlin Steel Company, Woodland, Pa., is now general superintendent at the Monessen Works of the Page Steel & Wire Company. Mr. Paff served in the former capacity eight years, previous to which he was superintendent for five years in the rod and wire mills at the Sharon Works of the American Steel & Wire Company.

Trade Publications

POPPET-VALVE ENGINE.—The Modern Poppet Valve Engine is illustrated in a bulletin prepared by the Nordberg Manufacturing Company of Milwaukee, Wis.

SOCKETS AND RECEPTACLES.—Pass & Seymour, Inc., of Solvay, N. Y., has issued a leaflet announcing a change in the standard length of chain on its pull sockets and receptacles.

SWITCHES.—Alternating-current motor-starting switches for front and back connections are illustrated and described in a leaflet prepared by the Trumbull Electric Manufacturing Company of Plainville, Conn.

HOLDING DRUMS.—The Blaw-Knox Company, Pittsburgh, Pa., has ready a folder on "Blaw Holding Drums and Their Limitations" that is considered a "little bit different from the general run of advertising literature."

AUTO LIGHTS.—The Anderson Electric Specialties Company, 562 West Van Buren Street, Chicago, has prepared leaflet No. 102, descriptive of its "Autoreelite," a dirigible searchlight and automatic extension inspection lamp.

CONDENSATION PUMPS.—Bulletin No. C-5000, descriptive of electrically driven condensation return pumps for automatically returning condensation to boilers in low-pressure steam-heating systems, has been prepared by the Yeomans Brothers Company, 231 Institute Place, Chicago.

ELECTRIC FURNACES.—Electric furnaces for melting non-ferrous metals and alloys are illustrated and described in an illustrated catalog prepared by the Electric Furnace Company of Alliance, Ohio. This company has also prepared a bulletin descriptive of its Bailey electric furnaces for heating or heat-treating steels and for melting, heating and annealing non-ferrous metals.

SEWER CONSTRUCTION.—A reprint from the *Journal of the Western Society of Engineers* has been issued by the Blaw-Knox Company of Pittsburgh, Pa. This describes the intercepting sewer construction in the northern part of the Sanitary District of Chicago and includes the methods of work and cost data. The paper was prepared by H. R. Abbott, assistant engineer of the Sanitary District of Chicago.

NEW HOUSE ORGAN.—The Lux Manufacturing Company of Hoboken, N. J., has prepared a new house organ known as "Lux Side-Lights." This house organ, which is to be a monthly, is to promote a spirit of co-operation among the various employees of the company even to a greater extent than that which at present exists. In later issues the editors intend to incorporate general data which will be useful to the various distributors of and dealers in Lux lamps and to give sales helps.

NEW ZEALAND TRADE.—"Electric Goods in New Zealand" appears in Special Agents Series No. 147, written by Special Agent Lundquist of the Department of Commerce, Bureau of Foreign and Domestic Commerce. Burrell S. Cutler, chief of the bureau, describes the criticisms of the author as thoroughly constructive and the result of careful study on the spot. Copies of the report for a nominal price—5 cents each—may be obtained from the Superintendent of Documents, Washington, D. C.

MOTOR INSTALLATIONS.—Typical single-phase and polyphase motor installations are illustrated and described in a carefully prepared and well-illustrated bulletin of the Wagner Electric Manufacturing Company of St. Louis. The illustrations in this book show much that is useful to those who are interested in motor drives and to those who are contemplating such installations, and offer in addition proof of fitness of Wagner motors for various installations. This bulletin shows only a comparatively small number of Wagner installations, but these few are chosen as representative of Wagner motor applications and give some idea of the scope and the method of drive and mounting, the distribution of this company's motor installations throughout the country, the type of concerns using these motors, etc.

New Incorporations

THE ELECTRIC VEHICLE COMPANY of Seattle, Wash., has been chartered with a capital stock of \$5,000. The incorporators are O. L. Willett and M. M. Preber.

THE HOLDINGFORD (MINN.) ELECTRIC LIGHT COMPANY has been incorporated with a capital stock of \$15,000 by T. C. Gordon of Little Falls and others.

THE NORTHWESTERN LIGHT & POWER COMPANY of Mount Prospect, Ill., has been incorporated with a capital stock of \$5,000 by William Busse, Edward Busse, Henry J. Ehard, Ralph L. Peck and Henry Beigel.

THE LAWTON (OKLA.) ELECTRIC & GAS COMPANY has been incorporated by John C. Keys, J. M. Young and A. H. Keys. The company is capitalized at \$300,000 and proposes to construct and operate an electric-light and power plant.

THE H. & S. ELECTRIC COMPANY of Charleston, W. Va., has been chartered with a capital stock of \$50,000 by Joseph Herzstam, Sidney Kusworm of Dayton, Ohio; H. R. Stapp, K. Stapp and Howard W. Linard, all of Charleston.

THE POLHAMUS COMPANY of Fort Wayne, Ind., has been chartered with a capital stock of \$100,000 by Albert Z. Russell, H. and M. J. Polhamus. The company proposes to manufacture oil generators, automobile accessories and tools.

THE ELECTRICAL METALS & MANUFACTURING COMPANY of Youngstown, Ohio, has been incorporated with a capital stock of \$150,000 by Frank P. Pyle, Paul H. Stambaugh, William M. Henderson, H. H. Wickham and William Schneider.

THE STANDARD SIGNAL CORPORATION of New York, N. Y., has been incorporated with a capital stock of \$1,500 to manufacture and deal in signal devices. The incorporators are: Frank T. Jackson, George A. Lermann and Carl A. Lermann.

THE DOMESTIC RIDGLEY LIGHT & ICE COMPANY of Ridgely, Tenn., has been chartered with a capital stock of \$10,000 to construct and operate an electric-light plant and ice factory. The incorporators are: G. S. Riely, J. T. Foster, G. F. Richardson and others.

THE ADAMS-HOLLAND ELECTRIC COMPANY of Revere, Mass., has been incorporated with a capital stock of \$25,000 to manufacture and deal in machinery, etc. The officers are: James Buchanan, Jr. of Chelsea, Mass., president; Alfred T. Timanien of Revere, treasurer and clerk.

THE DOMINION BATTERY COMPANY of Montreal, Que., has been incorporated by Eldon Moir, John Campbell, Donald L. McDonald and others. The company is capitalized at \$200,000 and proposes to manufacture dry batteries, flashlights, lamps, electrical goods, machinery, etc.

THE ERNALDSON MANUFACTURING COMPANY of St. Pauls, N. C., has been chartered with a capital stock of \$25,000 to do a general electric-lighting and power-supply business. The incorporators are: A. R. McEachern, W. D. Johnson, G. T. Fisher and A. A. McEachern of St. Pauls.

THE IGNITION REPAIR & SUPPLY COMPANY of Toronto, Ont., has been chartered with a capital stock of \$40,000 to manufacture engines, motors, batteries, magnetos, etc. The incorporators are: Lawrence J. Pashler, 9 Grafton Avenue; Bertrand T. McAvoy, M. P. Van der Voort and others.

M. J. O'BRIEN, LTD., of Ottawa, Ont., has been incorporated with a capital stock of \$20,000,000 to take over the smelter, electric plants, etc., owned by Michael J. O'Brien at Renfrew. The incorporators are: Michael J. O'Brien, Joseph L. Murray, both of Renfrew; John A. O'Brien and others of Ottawa.

THE UNION CARBIDE & CARBON CORPORATION of Niagara Falls, N. Y., has been incorporated by W. H. Billings, E. G. Johnson, E. W. Burdick and C. K. G. Billings, 30 East Forty-second Street, New York, N. Y. The company is capitalized at \$15,000,000 and proposes to manufacture calcium carbide, and gas-producing materials and electric batteries.

THE GAROGA (N. Y.) ELECTRIC POWER COMPANY has been incorporated with a capital stock of \$200,000 by John T. Norton, William A. Dunne and George C. Lecomte. The company is capitalized at \$200,000 and proposes to generate and distribute electricity for lamps and motors and to do a general transportation business. Post office address, Garoga, Johnstown, N. Y.

New England States

SKOWHEGAN, ME.—Plans are being prepared by the Central Maine Power Company of Augusta for a water power development at Skowhegan of from 4000 to 20,000 hp. It is estimated that 25,000 hp. can be developed at a cost of \$1,000,000. The plans provide for raising the dam at Skowhegan Falls 7 ft. Half of the present dam is concrete; the other half will be rebuilt with concrete. Other details have not yet been decided upon.

LACONIA, N. H.—A petition has been presented to the City Council asking for an extension of the street-lighting system on Pleasant Street.

RUTLAND, VT.—The Rutland Railway, Light & Power Company is installing a new waterwheel at its Pittsford station. Two new 1000-kw. transformers will be installed in the West Rutland station of the company.

VICTORY, VT.—The Essex Power & Electric Company (a new corporation) has applied to the Public Service Corporation to condemn certain property in Victory, on the headwaters of the Moose River, where a large dam may be constructed.

BEVERLY, MASS.—The Board of Aldermen has voted to instruct the city solicitor to draw up a bill to be presented to the State Board of Gas and Electric Light Commissioners asking for the right of the city of Beverly to maintain a municipally owned electric plant. The board voted to remove a number of large arc lamps in different sections of the city and install incandescent lamps.

NEWPORT, R. I.—Plans are being prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a large power plant at the local naval station, to cost about \$900,000.

NEW HAVEN, CONN.—The installation of ornamental lamps on Grand Avenue is under consideration by the Board of Aldermen. The plans provide for the erection of 30 lamps from Olive Street to the railroad crossing, near the Second Precinct at East Street.

NEW LONDON, CONN.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a large power house and shop building at the local navy station, to cost about \$200,000, to Bigelow & Nichols, 45 East Forty-second Street, New York, N. Y.

PINE MEADOW, CONN.—At a special meeting of the Pine Meadow Fire District it was voted to instruct the executive committee to enter into a contract with the New Hartford Electric Company to furnish not more than 25 street lamps.

WATERBURY, CONN.—The Housatonic Power Company has awarded contract for its new power house, about 60 ft. by 95 ft., to Tracy Brothers, 52 Benedict Street, Waterbury, at about \$40,000.

Middle Atlantic States

ALBANY, N. Y.—The Hudson Power Corporation has petitioned the Pacific Service Commission for permission to erect electric transmission lines between Rensselaer and Poughkeepsie to build an electric generating station in Greenport and to exercise the franchise granted by the town of Greenport. The plans of the company provide for supplying electricity for lamps and motors in all the cities, villages and small towns along the upper Hudson and the Catskills. It will also furnish energy to the Albany Southern Railroad Company. The cost of the entire project is estimated at about \$1,000,000.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company has completed the erection of its new transmission line to the plant of the Endicott-Johnson Company and has inaugurated operations with an initial load of 500 hp., which will be materially increased upon the completion of the new leather board factory of the Endicott company. The power company is preparing to start work at once on increasing the voltage of the tie line to 11,000 volts, the line being constructed for 2300-volt service.

BROOKLYN, N. Y.—Bids will be received by Robert Adamson, fire commissioner, eleventh floor, Municipal Building, New York City, until Nov. 20 for furnishing and installing electric-lighting systems as follows: (1) At the quarters of engine company No. 237; (2) engine company No. 246, borough of Brooklyn. Blank forms and further information may be obtained at the above office.

BUFFALO, N. Y.—The Vulcan Steam

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

Forging Company is building a power house at Reno Street and the Lackawanna Railroad.

BUFFALO, N. Y.—Plans have been prepared by the McClintic-Marshall Construction Company, Pottstown, Pa., for the construction of a new power house on the sea wall strip, about 50 ft. by 85 ft., for the Empire Engineering Company, Marine Bank Building, Buffalo.

CHENANGO FORKS, N. Y.—The Binghamton Bridge Company, Press Building, Binghamton, is reported to be considering the construction of a new hydroelectric plant at its local works.

GAROGA (P. O. JOHNSTOWN), N. Y.—The Garoga Electric Power Company, recently incorporated with a capital stock of \$200,000 to generate and distribute electricity for lamps, heat and motors and to do transportation business, is planning to take over the property of the Rockwood (N. Y.) Manufacturing Company, which has built a large dam at Rockwood and established a power house at Garoga Village, 1 mile below, connected by pipe line. The new company, it is understood, proposes to supply electricity to large consumers in central New York. John T. Norton, William A. Dunne and George C. Lecomte, all of Troy, are interested in the Garoga company.

SYRACUSE, N. Y.—Preparations are being made by the Dyneto Electric Corporation, 301 Wolf Street, manufacturer of electrical apparatus, to increase the output of its plant. A four-story brick building, about 75 ft. by 100 ft., has been acquired by the company in Park Street.

TONAWANDA, N. Y.—The Fore River Shipbuilding Company, 57 East Howard Street, Quincy, Mass., has awarded the Aberthaw Construction Company, 27 School Street, Boston, Mass., a contract for the construction of a one-story power house and machine shop at its local works on Vulcan Street.

UTICA, N. Y.—Work has begun on the construction of a new one-story factory about 100 ft. by 400 ft., on Mortimer Street near St. Vincent Street, for the McCoy Iron Works of Perth Amboy, N. J. The plant will manufacture steel and iron products, and will be equipped with considerable electrically operated machinery.

ELIZABETH, N. J.—The Board of Health has recommended to the City Council that the two fuel engines in the city sewage-pumping station be replaced with two electrically driven engines. The Council will be asked to approve an expenditure of \$7,500 for the proposed improvement.

MORRISTOWN, N. J.—Preparations are being made by the Morris & Somerset Electric Company for the installation of a new street-lighting system in Green Village. The company will also supply energy for the street-lighting system of the township of Chatham. Work has begun on the erection of the new lines, which will cover a distance of about 2 miles.

NEWARK, N. J.—The United Color & Pigment Company is planning to erect a power plant, 46 ft. by 90 ft., one story, on Evergreen Avenue, near the Pennsylvania Railroad.

NEWARK, N. J.—The Board of Freeholders has granted Piper Brothers, 112 Brunswick Street, Trenton, permission to transfer their contract for alterations and improvements in the power plant at the county hospital at Overbrook to Henderson & Company, 935 Springfield Avenue, Irvington, owing to their plant having been taken over by the government.

NEWARK, N. J.—Plans are being prepared by the Wallington Leather Manufacturing Company, 42 Kent Street, for the construction of a new power house, 48 ft. by 115 ft., in connection with its new plant at 317-325 Frelinghuysen Avenue. The cost of the initial works is estimated at \$40,000. Later it is proposed to construct a second unit, with large building for power station, the entire plant to cost approximately \$150,000.

ALTOONA, PA.—Bonds to the amount of \$53,000 have been issued by the Altoona & Logan Valley Electric Railway Company, the proceeds to be used for improvements, extensions, etc.

CHESTER, PA.—Work has begun on the erection of the electric transmission lines of the Philadelphia Electric Company to

Philadelphia. These lines will carry energy generated at the new local station, now under construction, to the central station in Philadelphia.

EASTON, PA.—The Pennsylvania Utilities Company has completed improvements to its Dock Street station which have doubled the output of the plant, including the installation of a new 5000-kw. turbine and two boilers. Two additional boilers and a new feed-water heater will be installed immediately. Improvements have also been made to the South Side plant.

ERIE, PA.—A permit has been granted for the erection of a power house at the new steel plant of the Erie Forge Company, to cost about \$75,000. The building will be about 47 ft. by 252 ft., built of concrete, steel and brick.

HAZLETON, PA.—Plans are being considered by the Weatherly Foundry & Machine Company for the construction of a new electric power plant.

LANSDALE, PA.—The Borough Council has approved an agreement with the officials of Chalfont under which the municipal plant will supply electricity for lighting Chalfont for a period of 15 years. A new turbo-generator set has recently been installed in the municipal plant, at a cost of about \$12,000.

MORRISVILLE, PA.—The Borough Council is considering the construction of a new municipal electric-light and gas plant.

PHILADELPHIA, PA.—Plans are being prepared by the Philadelphia & Reading Railroad Company for the construction of a new power house at Emerald and Tulip Streets.

PHILADELPHIA, PA.—The Philadelphia Suburban Gas & Electric Company has announced a bond issue of \$171,000, the proceeds to be used for improvements to its system.

PHILADELPHIA, PA.—Bids will be received until Nov. 20 for lighting the streets of the city for a period of one year, from Jan. 1 to Dec 31, 1918. George E. Dateman is director.

PHILADELPHIA, PA.—Winfield S. Barnes & Company, 1614 Cherry Street, is contemplating the construction of a power house at its new plant, in the Frankford section, at a cost of about \$75,000.

PHILADELPHIA, PA.—Plans have been prepared by E. A. Poth & Sons, Thirty-first and Jefferson Streets, for the construction of an addition, 40 ft. by 50 ft., to its power plant. Charles H. Casper, 925 Chestnut Street, is architect.

PHILADELPHIA, PA.—The Philadelphia Electric Company has petitioned the Public Service Commission for permission to acquire the controlling interest in the Delaware County Electric, the Bala & Merion Electric and the Cheltenham Electric Light, Heat & Power Companies.

PHILADELPHIA, PA.—Plans have been filed by the Hulton P. & P. Dyeing Company, Frankford Junction, for the erection of a new power house, 35 ft. by 110 ft., at Coral and Wagner Streets, to cost about \$8,000. F. Compton & Brothers, 4814 Oakland Street, Philadelphia, have been awarded contract.

PHILADELPHIA, PA.—The Badenhansen Company, which will furnish many boilers for the merchant fleet now being built by the Emergency Fleet Corporation, is making extensions and improvements to its plants, involving an expenditure of about \$300,000. Machine-tool equipment has recently been purchased for its works at Bound Brook, N. J., known as the Bound Engine & Manufacturing Company, which will build 18 triple-expansion marine engines for merchant ships. The shops at Norristown and Bridgeport, Pa., are being enlarged. An entirely new plant is being built at Cornwells, Pa. A boiler shop, 200 ft. by 275 ft., is the first unit of the Cornwells plant.

POTTSVILLE, PA.—The new ornamental lighting system, which is nearing completion, may not be put into operation until after the war, because of the necessity of saving fuel.

READING, PA.—The Metropolitan Edison Company has recently secured a contract from the Reading Fire Brick Company to furnish 150 hp.

READING, PA.—Bonds to the amount of \$3,000,000 have been issued by the Reading Transit & Light Company for improvements and extensions to its system.

READING, PA.—The Metropolitan Edison Electric Company has been awarded a contract by the Prospect Dye Works to furnish electrical service to operate its plant.

WEATHERLY, PA.—The Weatherly Foundry & Machine Company is contemplating the construction of a large power plant in connection with its works.

WILLIAMSPORT, PA.—Plans are being considered by the United States Rubber Company for the construction of a large power plant at its local works.

NEW CASTLE, DEL.—Contract has been awarded by the Wilmington Fibre Specialties Company for extensions and improvements to its power plant to Harry Lynch, 715 Tatnall Street, Baltimore, Md.

ANNAPOLIS, MD.—Plans are being prepared by the Navy Department, Washington, D. C., for the erection of a high-power radio station at Greenbury Point, across Severn River from Annapolis. The cost of plant and connections is estimated at \$1,000,000. Right of way for pole line over the county roads has been secured from the Commissioners of Arundel County. The line will carry 6600 volts. Electricity for the proposed station will be supplied by the Washington, Baltimore & Annapolis Electric Railway Company of Baltimore, Md.

BALTIMORE, MD.—Plans are being prepared for the construction of a new three-story power house addition at the plant of Cockran, Hill & Company at Sixth Street and Wilkens Avenue.

BALTIMORE, MD.—Contract has been awarded by the Crown Cork & Seal Company, Guilford Avenue, to the West Construction Company of Baltimore for the construction of an addition to its power house at Highlandtown.

LEYTONA, W. VA.—The Laurel Branch Coal Company of St. Albans, recently incorporated with a capital stock of \$50,000, is contemplating developing 700 acres of coal land, which it is estimated will have a daily capacity of from 500 to 1000 tons. A power plant and mining machinery will be installed. Meredith Moore of St. Albans is vice-president and manager.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 26 for two electrically operated and one steam-operated locomotive jib crane of 50 gross tons capacity for the dry docks at the navy yards, Norfolk, Va., Philadelphia, Pa., and New York, N. Y. Drawings and specifications (No. 2666) may be obtained on application to the above bureau or to the commandants of the navy yards named.

North Central States

DETROIT, MICH.—The Board of Supervisors of Wayne County has instructed the county auditors to include in their 1917 estimates \$110,000 for an independent light and power plant to supply electricity to the county buildings.

ONSTED, MICH.—A company has been organized by local residents to construct and operate an electric-light plant in Onsted. The company is capitalized at \$8,000. The officers are: Dr. G. W. Ross, president; B. A. Onsted, secretary, and L. L. Curtis, treasurer.

ATHENS, OHIO.—The Central Electric Producing Company has recently completed an addition to its electric producing plant and contemplates the installation of additional equipment.

CLEVELAND, OHIO.—The Cleveland Illuminating Company has applied to the Public Service Commission for permission to issue \$3,500,000 in bonds, and surrenders the right to issue \$1,039,000 in common stock, which was granted some time ago.

COLUMBUS, OHIO.—The plant of the Ohio Dairy Company is reported to have been purchased by the Blue Valley Creamery Company of Chicago, Ill. The latter company contemplates the construction of a new building, to cost about \$50,000, for which refrigerating equipment will be required.

YOUNGSTOWN, OHIO.—The Mahoning & Shenandoah Railway & Light Company has sold \$500,000 in bonds, the proceeds to be used for completion of the 20,000-hp. addition to the Lowellville power house, which the company expects to put in operation about Jan. 1, 1918.

ZOAR, OHIO.—The County Commissioners have granted the Zoar Battery Company a franchise to erect electric transmission lines along the highway between Zoar and Mineral City to supply electricity in the latter city for both municipal and commercial purposes.

LOUISVILLE, KY.—The American Tobacco Company, 900 South Eighth Street, has awarded contract to Sanford Vaughan, Paul Jones Building, Louisville, for remodeling its power house.

OWENSBORO, KY.—The plant of the Owensboro Ice Company was recently destroyed by fire, including boiler room, causing a loss of from \$25,000 to \$30,000.

OWENSBORO, KY.—Preparations are being made by the Rapier Sugar Feed

Company, Second and Clay Streets, for the installation of electric motors and other electric equipment in its new plant now under construction.

MALTA, ILL.—The installation of an electric-lighting system in Malta is under consideration by the City Council.

ALMA, WIS.—The property of the Alma Electric Light Company has been purchased by the Wisconsin-Minnesota Light & Power Company of Eau Claire.

EAU CLAIRE, WIS.—The Gillette Rubber Company, which recently completed its new plant, will erect a boiler and transformer house, 65 ft. by 81 ft., with a 175-ft. concrete stack, 15 ft. in diameter. The equipment will include two 315-hp. Stirling boilers, hydraulic pumps, open switchboard and overhead coal bunkers of 650 tons capacity, equipped with automatic stokers. R. B. Gillette is vice-president and general manager.

FOND DU LAC, WIS.—Work has been begun on the installation of a new 500-hp. boiler at the plant of the Eastern Wisconsin Electric Company on West Rees Street. An addition 44 ft. by 31 ft. will be erected to provide space for the new boiler, which will be fed by automatic underfed stokers. The smokestack will be 183 ft. in height.

GRESHAM, WIS.—At special election held recently bonds to the amount of \$14,000 were voted, the proceeds to be used for the purchase of the electric-lighting plant and water-works system owned by Richards Brothers.

MANCHESTER, MINN.—Preparations are being made for the installation of an electric-lighting system in Manchester for which \$8,000 in bonds has been voted.

ST. PAUL, MINN.—Plans are being prepared by Oscar Claussen, city engineer, for extensive river improvements, which will involve an expenditure of \$1,200,000 and include an electric belt line, warehouses, cold storage, grain elevator, dockage, etc., and a municipal electric-light plant. The cost of the electric plant is estimated at \$200,000, to be erected on the river front; it will utilize Illinois coal and furnish electricity to the city departments only. The proposal to issue \$1,200,000 in bonds for the work will be submitted to the voters in 1918 if the project receives the approval of the War Department.

CEDAR RAPIDS, IOWA.—Contract has been awarded by the Quaker Oats Company to the Leonard Construction Company for the construction of a substation, 81 ft. by 42 ft., on C Avenue, between Fifteenth and Sixteenth Streets, East, to cost about \$8,000.

CORWITH, IOWA.—Bids will be received by the board of education of the consolidated district of Corwith until Nov. 26 for construction of school building, to cost about \$70,000. Separate bids to be submitted on heating, plumbing and electric wiring. Proudfoot, Bird & Rawson, Hubbell Building, Des Moines, Iowa, are architects. W. C. Oelke is secretary of board.

KESWICK, IOWA.—The local electric-light plant, it is reported, was recently destroyed by fire.

MIDDLETOWN, IOWA.—Preparations are being made for the installation of an electric-lighting system in Middletown. A transmission line will be erected from Burlington to transmit electricity generated at the Keokuk dam here. It is expected to have the system completed by the latter part of the month.

SIOUX CITY, IOWA.—A permit has been granted to the Sioux City Gas & Electric Company for the construction of an addition to its plant, to cost about \$25,000. The building will be 27 ft. by 37 ft. and will provide space for a new electric generator.

STRAHAN, IOWA.—Bids will be received by the board of directors for the consolidated school district of Strahan until Nov. 30, including electric, heating and plumbing works. Plans and specifications may be obtained at the office of W. F. Gernandt, Keeline Building, Omaha, Neb., for which a deposit of \$20,000 will be required for "A," covering general contract, including electric work; "B," deposit of \$10, covering heating, ventilating and plumbing. The cost of the building is estimated at \$50,000. H. Kayton is secretary of board.

KANSAS CITY, MO.—Preparations are being made by the Missouri & Kansas Interurban Railway Company for the installation of coal-burning equipment. When this is done the company will generate electricity to operate its car lines outside of the city limits of Kansas City. At present the company gets its energy, both inside and outside the city, from the Kansas City Railways Company, putting into service in emergencies a gas-burning plant at Overland.

BANTRY, N. D.—Arrangements have

been made to install an electric-lighting system in Bantry. A small plant has been installed temporarily, which will be replaced by a larger one as soon as machinery arrives.

CRARY, N. D.—A franchise has been granted to John W. Ebert to install and operate an electric-lighting plant in Crary for a period of 20 years.

TOGA, N. D.—The Council is considering an issue of \$6,000 in bonds for the installation of an electric-lighting system in Toga.

OCONTO, NEB.—An election will soon be held to vote on the proposal to issue \$3,900 in bonds for the installation of a municipal electric-light plant (initial unit).

ORD, NEB.—The contract for construction of the proposed municipal electric-light plant has been awarded to the Merkle Machinery Company of Kansas City, Mo., at \$27,000.

ARKANSAS CITY, KAN.—Preparations are being made for improvements to the local plant of the Kansas Gas & Electric Company of Wichita. The plans provide for doubling the output of the plant. The work will be in charge of the Phoenix Construction Company of Wichita.

HURON, KAN.—Preparations are being made by B. R. Hinchman of Lancaster to install an electric-lighting system in Huron. Mr. Hinchman, it is said, will tap the electric transmission line which extends from Atchinson to Everest and erect an extension to Huron.

LAWRENCE, KAN.—The general contract for construction of administration and liberal arts building at the University of Kansas at Lawrence has been awarded to Olson & Johnson, Omaha, Neb., at \$208,390. Separate contracts will be awarded for heating, plumbing, electric wiring, electric fixtures, etc., later, part to be installed by day labor. The cost of the building complete is estimated at about \$300,000. J. A. Kimball of Topeka is business manager of board of administration.

MCCRACKEN, KAN.—Bonds to the amount of \$12,000 have been voted for improvements to the municipal electric-light plant and water works system. W. B. Rollins & Company, Railway Exchange, Kansas City, Mo., are engineers.

MANHATTAN, KAN.—The plant of the Rocky Ford Milling & Power Company, located on the Blue River near Manhattan, has been purchased by a company organized by A. D. Jellison, Harry Pierce of Junction City, D. A. Rogers and C. L. Brown of Abilene. The new owners, it is understood, will remodel and double the output of the plant. Work has begun on the extension of the transmission lines of the Riverside Power & Light Company of Abilene to connect with the lines of the Rocky Ford Company, which furnishes electricity to Camp Funston.

Southern States

ELKIN, N. C.—The Chatham Manufacturing Company is contemplating building an addition to its plant, 300 ft. by 80 ft., three and five stories high, to cost about \$65,000. One hundred looms and accompanying equipment, including a steam power plant, will be installed, at a cost of about \$200,000.

CHARLESTON, S. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 26 for power plant improvements, including piping and accessories, coal bunkers, structural steel foundations, induced-draft fans and miscellaneous work in connection with the installation of new equipment in the power plant at the navy yard at Charleston. Drawings and specifications (No. 2661) may be obtained on application to the above bureau or to the commandant of the navy yard named.

COLUMBIA, S. C.—The City Council is considering the installation of motor-driven pumps to increase the water supply. A report submitted by F. C. Wyse, engineer and superintendent, estimates the cost of installing one 3,000,000-gal. and two 5,000,000-gal. electrically driven pumps, with necessary equipment and building, at \$30,000. Bids for the above, it is understood, will be asked by the Water Works Department.

ATLANTA, GA.—The Pratt Engineering & Machine Company has contracted with the Georgia Railway & Power Company for energy to operate its entire plant. About 400 hp. will be required. The Pratt company is in the market for one 500-cu. ft. motor-driven air compressor, one 100-kw. motor-generator set, pumps and cupola blower; service 550 volts, three phase, 60 cycles.

ATLANTA, GA.—The Department of Justice, Washington, D. C., will build a weave shed, 457 ft. by 210 ft., for the United States Penitentiary cotton duck mill. The building will be equipped with 500 light and medium looms, with 1050 hp. electric power drive. An appropriation of \$129,500 has been made for this plant. Lockwood, Greene & Company, Healy Building, Atlanta, Ga., and Boston, Mass., are architects and engineers.

DECATUR, GA.—The Georgia Railway & Power Company of Atlanta is planning to extend its high-tension transmission line from Emory University to the Decatur plant, a distance of about 2 miles. The company has a contract to furnish electricity to operate the pumping station of the municipal water-works system.

MEMPHIS, TENN.—The W. G. Simmons Company, it is reported, is in the market for second-hand machinery, including 1-ton to 2-ton alternating-current, electrically driven hoist, 220 volts, 60 cycles, and a 100-hp. portable boiler in good condition.

BIRMINGHAM, ALA.—The contract for the construction of nurses' home, help's cottage, power house, sewage disposal, water-works and outside wiring for hospital has been awarded to the Inglenook Construction Company of Birmingham. Other contracts were awarded as follows: For generators, motor, switchboard and storage batteries to the McClary-Jemison Machinery Company of Birmingham; oil engine, shafting and belting, McBee Engine & Implement Company of Memphis, Tenn.; refrigerating plant to the United Iron Works Company of Springfield, Mo. B. Price, Empire Building, Birmingham, is architect.

DECATUR, ALA.—Bonds to the amount of \$50,000 have been voted for the installation of a municipal electric-lighting plant in Decatur.

NATCHEZ, MISS.—The Natchez Manufacturing Company, recently incorporated with a capital stock of \$50,000 to operate the Natchez cotton mills, is planning to equip the mills for electrical operation throughout.

BUFFALO, ARK.—The Standard Zinc Company is reported to be contemplating the construction of a hydroelectric plant on Buffalo River.

MOUNTAIN HOME, ARK.—The Hait Orchard & Development Company, it is reported, is contemplating a large water-power development on the Northfork River. The project includes a tunnel through a narrow neck of a large bend, which is 6 miles around and about 1500 ft. through. The company proposes to use the power in the smelting of iron ore. C. E. Kimberlin is a representative of the company.

BRISTOW, OKLA.—The Council is considering the purchase of the electric plant of the Bristow Ice & Light Company, to be owned and operated by the municipality. If this plant cannot be purchased it is proposed to construct a municipal plant.

LAVERNE, OKLA.—An election will soon be held to vote on the proposal to issue \$13,000 in bonds for the purchase of the property of the Laverne Light, Power & Ice Company. Extensions will be made to the system if taken over by the city.

LAWTON, OKLA.—The Lawton Gas & Electric Company, recently incorporated with a capital stock of \$300,000, proposes to construct and operate an electric light and power plant. John C. Keys, J. M. Young and A. H. Keys are interested in the company.

LOCO, OKLA.—The installation of an electric-lighting system in Loco is under consideration. C. A. Fletcher & Company of Loco and Ringling are reported interested in the project.

MIAMI, OKLA.—Bids, it is reported, are being received by the Portland Lead & Zinc Company of Miami for four 100-hp. steam boilers, one 200-hp. Corliss engine, 18-in. crushers, gas engine and other machinery. Edward Nix is manager.

OKLAHOMA CITY, OKLA.—The contract for electric wiring for the new factory of the Siefers Candy Company, 517 Grain Exchange Building, has been awarded to the Oklahoma Electrical Supply Company. The cost of the building is estimated at \$90,000.

AMARILLO, TEX.—The County Commissioners have decided to install an ornamental lighting system.

BEAUMONT, TEX.—The Beaumont Iron Works is contemplating the installation of additional machinery, including electric transformers at its plant.

COOKVILLE, TEX.—The installation of an electric-light and power plant in Cookville is under consideration. B. B. Stevens of Cookville is reported to be interested in the project.

JEFFERSON, TEX.—The Jefferson Ice

& Light Company is considering the installation of a new electric motor and other equipment in its plant.

LAMPASAS, TEX.—The installation of additional machinery and equipment is reported to be under consideration by the Lampasas Light & Power Company.

LUBBOCK, TEX.—The city will soon be ready to connect the street lamps with the city plant. A movement is under way to extend the ornamental lighting system in the near future.

SAN ANTONIO, TEX.—The City Ice & Fuel Company, recently incorporated with a capital stock of \$50,000, is contemplating the construction of an ice factory. J. P. Wilhelm is interested in the company.

Pacific and Mountain States

OLYMPIA, WASH.—Bids will be received by the Board of Control, Olympia, until Dec. 1 for the construction of a power and electric plant at the State School for Girls. The cost of the work is estimated at \$65,000.

PROSSER, WASH.—Final details of the plans for the proposed pumping station to be installed, at a cost of about \$200,000, near Prosser, for lifting water from the Sunnyside canal to irrigate 2000 acres, have been decided upon by the Prosser Irrigation District and R. K. Tiffany, representing the United States Reclamation Service. Site for the pumping station has been purchased and as soon as the Supreme Court passes upon the validity of the issue of the bonds, which the government will take, work will begin on construction of the pumping station and distribution system.

SEATTLE, WASH.—Bids will be received by the Board of Public Works until Nov. 23 for furnishing complete lighting system for the harbor patrol boat. Bids will also be received on the same date for the installation of a power plant in the harbor patrol boat to be built for the City Harbor Department.

SEATTLE, WASH.—Plans are being prepared by the Skinner & Eddy Shipbuilding Corporation for extensions to its plant, which will involve an expenditure of about \$1,000,000, and will include a foundry, 60 ft. by 150 ft., adjoining the third machine shop, now under construction, power house and punch shop equipped with six machines.

TACOMA, WASH.—H. F. Gronen, commissioner of the Light and Water Department, has requested the city attorney to frame an ordinance for immediate introduction in the City Council providing for an issue of \$4,000,000 in bonds for the purchase of a power site.

TACOMA, WASH.—The contract for the installation of a sewer, water and lighting system for the Amusement Midway to be built at the American Lake Cantonment, Camp Lewis, near Tacoma, at a cost of \$1,500,000, under the government supervision, has been awarded to Porter Brothers, general contractors of Spokane and Portland, Ore.

OROVILLE, CAL.—The construction of a large hydroelectric plant is reported to be under consideration by the owners of the Bloomer Quartz Mine.

SANTA ANA, CAL.—The Pacific Electric Railway Company, it is reported, is contemplating extending its railway from Santa Ana through Tustin to Irvine, and eventually to San Diego.

CATALDO, IDAHO.—The erection of an electric transmission line, 45 miles long, from Cataldo, via Fourth July Canyon to Coeur d'Alene is under consideration by the Washington Water Power Company of Spokane. The cost is estimated at \$200,000.

GLENWOOD, UTAH.—The Utah Power & Light Company of Salt Lake City has petitioned for a franchise through a portion of Glenwood.

BISBEE, ARIZ.—The City Council is considering calling an election to submit the proposal to issue \$375,000 in bonds, the proceeds to be used for the construction of a new electric-light plant, water-works system and a gas-generating plant.

SNOWFLAKE, ARIZ.—Steps have been taken by the residents of Snowflake, Taylor and Shumway to organize a company to construct and operate an electric-light and power plant to furnish electricity in the three towns. The company will be capitalized at \$50,000, and will be known as the Silver Creek Electric Light Company. Work will begin on the proposed plant at once.

YUMA, ARIZ.—The City Council has called an election to vote on the proposal

to issue \$300,000 in bonds for the purchase of the local water, electric-light and power and gas plants or the installation of new ones. The Council has asked T. E. Trask of Los Angeles, Cal., to obtain an option on the existing plants in Yuma as a basis for an action in the direction of municipal ownership of public utilities.

MISSOULA, MONT.—Plans have been decided upon for the installation of a lighting system for the State University campus, which provides for the erection of nine 400-cp. lamps on iron brackets on the driveway and similar lamps throughout the campus grounds.

CARSON CITY, NEV.—Arrangements are being made by the Truckee River General Electric Company for the installation of a new lighting system on Carson Street. It is proposed to replace the arc lamps now in use with 14 nitrogen-filled lamps.

ELY, NEV.—The Eastern Nevada Power Company has been granted permission to issue 1000 shares of capital stock at par (\$100 per share), the proceeds to be used for the development of the Ruby Mountain power project in Nevada. The cost of building the first unit, which will develop 4800 hp. delivered at Ely, 150 miles from the power house, will be about \$1,100,000. Frank B. Ench of Oakland, Cal., is interested in the company.

LOVELOCK, NEV.—The Liberty Gold Mines Company, recently incorporated by local men, is planning to extend and operate a mine on the easterly slope of Lime Mountain on Deep Creek, about 70 miles from Elko. Plans are under way for the construction of a 100-ton mill, which will be operated by electricity transmitted from the power plant located on Bull Run Creek, about 4 miles distant.

CLOVIS, N. M.—The Board of County Commissioners has granted the State Line Utilities Company a franchise to erect an electric high-tension transmission line from Texico to Clayton and Portales.

TEXICO, N. M.—C. A. Roberson of the Cannon Ball Motor Company of Texico, it is reported, is in the market for equipment, etc., for foundry, including electrical machinery, heating and ventilating apparatus, air-washing machinery, power house equipment and machinery for manufacturing automobiles, trucks and tractors.

Canada

DELTA, B. C.—A petition has been filed with the City Council by land owners in the East Delta District, asking for the installation of an electrically operated pumping station in that section, to cost about \$12,000.

ARMAGH, QUE.—Plans are being prepared by Gauvin & Beauchemin, civil engineers, Quebec, for a power development at Armagh on the River Fourche-du-Nord-Ouest. Tenders, it is understood, will be received by the engineers for water turbines, generators, sluiceways, penstock, wooden pipes, etc.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing agent, the Panama Canal, Washington, D. C., until Dec. 10 for refrigerating apparatus, electric freight elevators, track rollers, ice crusher, ice elevator, etc. Blanks and information may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; Audubon Building, New Orleans, La., and Fort Mason San Francisco, Cal.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Nov. 30 for furnishing steel, car wheels, steel pipe, boiler tubes, chain, bronze bars, copper tubing, gommets, refrigerating apparatus, refrigerator doors, gage lamps, steam whistles, grease cups, etc. Blanks and information relating to this circular (No. 1182) may be obtained from the above office or from the offices of the assistant purchasing agents, 24 State Street, New York City; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

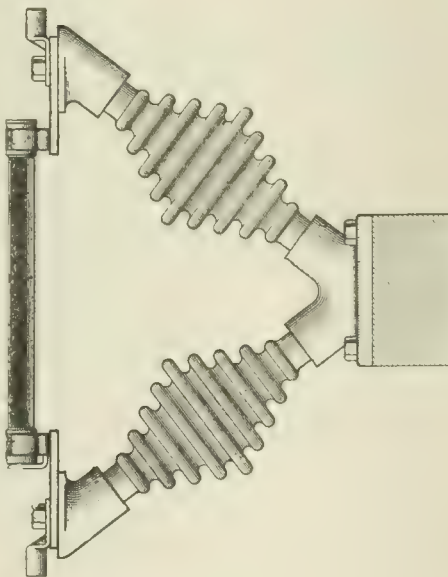
HONOLULU, H. T.—Contract has been placed with Catton, Neil & Company of Honolulu for equipping the Ewa plantation mill for electrical operation. The equipment will include a General Electric Curtis steam-turbine-driven generator, 750 kw., 480 volts, 60 cycles, switchboard and complete equipment for an electric generating plant.

Record of Electrical Patents

Notes on United States Patents
issued on November 6, 1917

- 1,245,151. MOUNTING FOR CIRCUIT BREAKERS; Nicholas J. Conrad, Chicago, Ill. App. filed Feb. 2, 1917. Particularly for high-tension fuses and switches.
- 1,245,187. INCLOSED ELECTRIC FUSE; Leonard B. Buchanan, Woburn, and Franklin N. Conant, Newburyport, Mass. App. filed Jan. 8, 1914. Improved form of renewable fusible element and of means for detachably connecting the same to the terminals.
- 1,245,194. MOTOR-CONTROL SYSTEM; George N. Crabbe, Cresskill, N. J. App. filed March 21, 1914. Is adapted, among other things, automatically to prevent a too sudden reversal of an electric motor.
- 1,245,259. MAIL APPLIANCE; William H. Milleville, Chicago, Ill. App. filed Aug. 14, 1915. For facilitating the delivery of mail.
- 1,245,282. DRAFT REGULATOR FOR FURNACES; Allen M. Smith, Fort William McKinley, Philippine Islands. App. filed Nov. 27, 1916. Improvements.
- 1,245,305. RECEPTACLE; Ernst G. K. Anderson, Chicago, Ill. App. filed Jan. 3, 1916. In which the contacts are electrically dead until an insertible member is introduced in the receptacle.
- 1,245,326. CANDELABRUM SOCKET; Edgar H. Freeman, Trenton, N. J. App. filed March 22, 1917. Improvements.
- 1,245,356. PROCESS OF INTERCONVERTING HIGH-POTENTIAL POLYPHASE AND DIRECT ELECTRIC CURRENTS AND TRANSMITTING POWER; Carl G. Koppitz, Youngstown, Ohio. App. filed Oct. 10, 1912. The invention involves the flow of polyphase currents to or from and through a fixed winding, and the flow of direct currents to or from the collector brushes, pulses of direct current jumping across the spaces between these brushes and fixed segments connected by spaced leads to different portions of a closed winding in inductive relation to or included in the polyphase circuits, the brushes rotating in synchronism with the cycles of alternating current, thereby remaining at a predetermined point on the emf. wave. The segments and brushes are preferably cooled and the arcs extinguished by blasts of pre-cooled non-oxidizing gas, caused to impinge upon them by fans carried by the brushes, the portions of gas heated by the several arcs being electrically insulated as they flow away from the segments and being delivered to a separate cooler.
- 1,245,368. SPARK-PLUG TESTER; Wilmer M. Near, Shelby, Mich. App. filed April 14, 1917. May be easily carried in one's pocket or occupy very little space in a tool box or kit.
- 1,245,428. COVER FOR STORAGE BATTERIES; William L. Bliss, Niagara Falls, N. Y. App. filed April 17, 1914. Will prevent the entrance of dust and dirt into the battery and the escape of fumes therefrom.
- 1,245,459. ELECTRIC HEATING DEVICE; John A. Heany, New York, N. Y. App. filed Nov. 12, 1914. Contemplates a heating unit in which the body portion is made of a metal having the capability of developing high hysteresis and eddy-current effects.
- 1,245,464. ENGINE-STARTING DEVICE; John J. Kane, Milwaukee, Wis. App. filed Dec. 22, 1913. Motor vehicle.
- 1,245,467. DISPLAY SIGNAL; Elmer J. Kingsbury, Chicago, Ill. App. filed Sept. 25, 1916. Particularly adapted to that character of sign in which a plurality of individual units is utilized to make up a complete sign.
- 1,245,505. ELECTRICAL CARD-TABULATING MACHINE; James Powers, New York, N. Y. App. filed Aug. 21, 1915. Relates to accounting machines co-operating with record cards.
- 1,245,518. ELECTRIC MUSICAL INSTRUMENT; Melvin L. Severy, Los Angeles, Cal., and George B. Sinclair, Georgetown, Me. App. filed Feb. 8, 1916. Improvements.
- 1,245,523. REGENERATIVE BRAKING SYSTEM FOR ELECTRIC MOTORS; Norman W. Storer, Pittsburgh, Pa. App. filed Sept. 7, 1916. The object is to increase materially the efficiency of an electric railway distributing system by effectively utilizing the energy, usually dissipated in the form of heat, which is released when railway vehicles are brought to rest from relatively high speed or are run down hill with the brakes set.
- 1,245,532. CONTROLLER FOR MOTOR-DRIVEN MACHINES; Frank P. Townsend, Milwaukee, Wis., and Wilmar F. Lent, New York, N. Y. App. filed Sept. 18, 1916. Provides means whereby the mill rolls will be disconnected from the driving motor during reversal thereof and thereafter automatically reconnected to said motor

- 1,245,551. MOTOR CONTROLLER; Thomas E. Barnum, Milwaukee, Wis. App. filed Sept. 18, 1915. Provides a controller which will automatically return to its initial position when released from either starting or running position.
- 1,245,570. PUSH BUTTON; William J. Cook, Charlotte, N. C. App. filed June 26, 1916. One object is to provide an improved construction in which sticking or jamming of the parts is impossible.
- 1,245,588. RECORDING DEVICE FOR METERS; Angus S. Hibbard, Chicago, Ill. App. filed July 23, 1915. By burning a permanent record of the meter indication onto a sheet of paper prepared for such record.
- 1,245,592. MULTIPLE RESETTING FUSE; Joseph W. Huebner, Milwaukee, Wis. App. filed Sept. 30, 1916. Provision of a device including a plurality of fuse elements adapted for selective inclusion in a circuit whereby should a fuse burn out a fresh fuse may be immediately substituted.



1,245,151—Mounting for Circuit Breakers

- 1,245,627. CIRCUIT CONTROLLER; Arthur Simon, Milwaukee, Wis. App. filed Oct. 30, 1914. In the control of electric motors it is common to provide overload protective means to be included in circuit for running and to be temporarily excluded from circuit in starting, and this invention has among its objects to provide improved means for controlling the connections of such protective means.
- 1,245,628. SPRING TERMINAL FOR BINDING POSTS; Charles H. Smith, Chicago, Ill. App. filed Dec. 26, 1912. Improvements.
- 1,245,654. MASTER CLOCK; Kikokichi Abe, Yamagata-Ken Japan. App. filed July 29, 1916. Provides a master clock which will generate the necessary electric current by means of a self-contained generator.
- 1,245,665. REGISTERING MECHANISM; William J. Bohan, St. Paul, Minn. App. filed May 4, 1914. Improvement.
- 1,245,673. ELECTRIC FITTING; Frank V. Burton, Bridgeport, Conn. App. filed March 21, 1917. Particularly adapted to fittings of the type designed to be secured at the end of a wire conduit.
- 1,245,699. ELECTRIC-LAMP SOCKET; Frederick P. Gates, Hartford, Conn. App. filed April 11, 1916. Improvement.
- 1,245,701. SHORT-CIRCUITING DEVICE FOR MOTORS; Michael I. Ginsburg, Baltimore,

Md. App. filed Aug. 24, 1916. Provision of an improved short-circuiting device which automatically comes into play when the armature attains a predetermined rotative speed, whereby the windings of the armature are short-circuited.

- 1,245,717. ELECTROMAGNETIC SEPARATOR; Clark T. Henderson, Milwaukee, Wis. App. filed June 20, 1914. Provides improved means for extracting free magnetic particles from flowing substances.
- 1,245,746. ELECTRICALLY HEATED BED-LASTING MACHINES; Edwin N. Lightfoot, New York, N. Y. App. filed March 19, 1917. Applies more particularly to means for heating the same electrically.
- 1,245,753. THERMOSTAT; Merle M. Mason, Cleveland, Ohio. App. filed June 11, 1914. A feature is that the main body of the mechanism, the electric contacts, etc., are so constructed that the thermostat may be utilized without bringing these delicate parts into contact with extreme temperatures. Another feature provides adjustment for a wide range of temperature.
- 1,245,762. ALTERNATING-CURRENT MOTOR; Alfons H. Neuland, New York, N. Y. App. filed Aug. 7, 1915. The invention has for a general object the production of a motor operable with alternating current, and particularly with single-phase alternating current, the speed and torque of which may be varied within wide limits by simple mechanism and easy manipulation.
- 1,245,817. FLASHLIGHT CARRIER; Haakon Suserud, Montreal, Quebec, Canada. App. filed March 2, 1917. Provides a convenient means for holding a flashlight in operative position for the user during the process of writing.
- 1,245,821. T-HEAD CONSTRUCTION; Wade B. Thompson, Detroit, Mich. App. filed July 5, 1916. This invention relates to a T-head construction and has for its primary object to provide a T-head having the inherent properties of attaching itself to surfaces of certain characteristics.
- 1,245,823. AUTOMATIC SPEED REGULATOR; Stonewall Tompkins, New York, N. Y. App. filed March 10, 1914. This invention relates to a means for changing the power output of a prime mover or motor which drives an electric generator so as to meet the conditions of demand upon the generator for electric energy.
- 1,245,860. ELECTRICALLY DRIVEN TOOL; Samuel D. Black and Alonzo G. Decker, Baltimore, Md. App. filed Dec. 4, 1914. Improvements.
- 1,245,863. ELECTRIC FUSE; Ralph C. Bronson, Chicago, Ill. App. filed Oct. 23, 1914. Provides an electric fuse particularly adapted for comparatively heavy currents and arranged so that when the fusible strip is blown out the hot metal will not be scattered about and so that the fusible strip can easily, quickly and cheaply be replaced.
- 1,245,940. INSULATOR; Richard H. Marvin, East Liverpool, Ohio. App. filed May 11, 1916. Particularly for insulators of the multi-unit type.
- 1,245,949. ELECTRIC-LAMP SOCKET; Arvid H. Nero, New Britain, Conn. App. filed July 8, 1916. Provides a device which may be applied to an ordinary lamp socket in order to form therewith an electric fitting of the candle type.
- 1,245,954. VALVE FOR JOLT RAMMING MACHINES; William C. Norcross, Terre Haute, Ind. App. filed Oct. 21, 1916. Has for its object the provision of an improved spring device or means co-operating with the valve and with the solid lower end of the piston in a novel manner whereby accidental or premature displacement of the valve is prevented and the valve remains where kicked until kicked back to its other position by the opposite reciprocation of the piston.
- 1,245,956. ELECTRICAL MEASURING APPARATUS; Edwin F. Northrup, Princeton, N. J. App. filed May 15, 1917. Particularly for determining the magnitude of an unknown emf., and when the source of the unknown emf. is a thermocouple the measuring apparatus may be used as an electric pyrometer.
- 1,245,980. INSULATING COMPOUND AND PROCESS OF MAKING THE SAME; Sadakichi Satow, Sendai, Japan. App. filed Dec. 30, 1916. The object of the invention is to utilize vegetable proteins in the manufacture of compounds for use as insulating material and to produce therefrom insulation for electricity in the desired form for use wherever such insulation is required.
- 1,245,993. CONTROLLING INDUCTION MOTORS; Richard Van R. Sill, New York, N. Y. App. filed Feb. 3, 1914. Invention embodies improvements



Manufacturer: Before you fix that price—
Dealer: Before you add that extra profit—
Workman: Before you strike— Ask yourself—

Is this MY boy?"

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN

Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, NOVEMBER 24, 1917

No. 21

Is This My Boy?

WE HAVE put our young men in arms and we have a large task to see that they get what they need. While they are in Europe they have a right to know that we at home are not slacking in the earnest, unflagging determination to see the war through. In this task all must co-operate. Those who are not at the front are as necessary a part of the supporting nation in arms as if they faced the life and death of the trenches. It is a safer part, to be sure, but it is nevertheless a part. Let us not forget that. No matter what our situation in life, we must all work together for victory, and victory cannot be secured without sacrifice. Moreover, this sacrifice is personal and cannot be passed on. The obligation rests on all alike and not on any particular class. To visualize the close tie between trench warfare and the industrial trials at home, the publishers of the ELECTRICAL WORLD send with this issue a supplement which tells its own story. It is a message to business and also to labor. Each should contemplate the lad in the trench and ask himself what his fate shall be. Shall he die game with an empty musket and an empty stomach while capital and labor squabble for advantage and fight for the last cent of profit or wages, or shall he be inspired and encouraged with the thought that here at home all are working harmoniously, industriously and unselfishly for the common cause?

The Suppression of Electric Signs

IT HAS been fairly evident for some little time past that general efforts directed toward the saving of fuel must end in the abandonment to a considerable extent of the flamboyant electric signs which are so conspicuous in the average city. The natural course of events would have been a gradual disappearance of these as a matter of personal conservation and economy on the part of those who use them. The general pressure should ordinarily be sufficient without specially directed efforts. Now, however, the Fuel Administrator has definitely restricted the use of electricity for signs by regulations going into effect on Nov. 15, as reported fully in our issue of last week. How great a saving of fuel can be thus accomplished remains to be seen, for electric signs do not demand energy at all commensurate with their conspicuousness; but in the aggregate the results may be considerable. The most important feature of the matter, however, is that manufacturing conditions are more than likely to demand all the energy which can be saved on the signs. We cannot look forward to an actual material diminution in the amount of

electricity used, but rather to a shifting of the demand from comparatively needless things to those which have definite public usefulness.

The present prohibition, too, is by no means absolute. It does not apply to public lighting of any kind nor to the maintenance even of signs within certain restricted hours, from 7.45 to 11 p. m. in the case of signs in general, and from half an hour after sunset to 11 p. m. in the case of simple announcement signs. The gross effect, therefore, of the restrictions on the actual demand for energy will be considerably lessened, but the sign business will be thrown considerably off the peak, thereby permitting a freer use of electric power without difficulties caused by lap load. From this standpoint the effect on generating companies will be rather salutary, since these are difficult days in which to obtain additional equipment. The companies therefore, while losing some revenue from signs, are very likely to recoup themselves handsomely in industrial lighting and power work.

In all these efforts at fuel conservation it must be borne in mind that the difficulty to be met lies not so much in the actual lack of the fundamental supply of coal as in the burdens that its transportation entails and in the necessity for using for the navy in particular large quantities of fuel of the very grades which have customarily been popular with electric supply companies. The chief difficulty is in the transportation, and therefore the necessity for limiting the fuel as closely as possible to necessary industrial purposes is sufficiently evident. From a practical standpoint we do not believe that the present restrictions are going to have any serious effect whatever on the supply companies other than the inconvenience due to a shift in the incidence of demand from one class of users to another. And, as the proportion of industrial power and lighting grows, by just so much more will the obligation rest on the Fuel Administrator to see to it that the coal supply is kept up.

Financing Abnormal Cost in Extensions

EXTENSIONS of central station service in these days mean a twofold problem. Part of the problem arises from inflated cost and abnormal scarcity of materials and labor; part of it is due to usurious rates for capital, which is almost as scarce as hens' teeth. If materials, labor and capital are to be had, they are to be had only under conditions gravely altered by the world upheaval. The present is enough to guide us; the future we cannot foretell, but from the immediate trend of events it is plain that we may soon be at the point

where for every effort of labor, for every pound of material, for every dollar of investment, we shall have to show a purpose connected with stern war.

These are not ordinary times and they call for extraordinary measures. The central station cannot make extensions without calculating cost. Labor and material cost is very high, and it may be double the normal figure. Neither can the company provide new facilities without cold cash to finance them. The cost of money runs away above the usual percentage. It is under these circumstances that the Cleveland Electric Illuminating Company has introduced the form of prepayment contract for commercial loads in excess of 5-kw. capacity which is published elsewhere in this issue. In effect, it leaves the responsibility of raising capital for a new extension to the customer. Necessarily in such a form of contract it is not feasible to cover all of the items of abnormal cost. Some extra cost will be experienced in feeders, subway and increase in plant capacity which the company will have to contend for in any future valuation. This part of the cost the company will meet. In general, however, the contract provides that the customer shall advance the capital for the construction which is specifically an extension to render service to him. It differentiates between the necessary outlay under present critical conditions and the estimated normal cost as of 1914. The customer advances the full outlay, but he receives a refund of what the work would have cost at 1914 prices. The central station company keeps the balance, representing abnormal cost, so as to protect its property values. The customer pays an abnormal cost to get a construction job done in abnormal times, and his expense in so doing is part of his manufacturing cost.

With the property investment thus restricted on its books to a figure which regulating commissions and courts can never question, the utility can base its rate for service on the new extension according to its rate for like service on the old lines. The utility can make rates based on pure operating cost if it continues static; it would be under an urgent incentive to make higher rates if it should enlarge capital account by the present full high cost of materials, labor and money. The Cleveland company protects its market for service on the new line constructed under the plan by returning the normal cost advanced by the customer so that he receives it in annual installments during a period of ten years. It furnishes service, but it holds out no bright prospect for a mushroom plant with an exigent war order to sign a power contract with a glad hand and skip the community without ceremony at some early day.

As an emergency measure, justified by the clear necessities of grim days, the solution which has been developed with care by the Cleveland company is reasonable and just. We believe that the public service commissions generally have a keen understanding of the emergency requirements of the times and that they will not let central stations be overburdened with service extensions calling for heavy financial outlays to unbalance their accounts. With the return of normal times the

issues will be on a different footing again, but in the meanwhile the problems loom large, they are vital to the maintenance of the properties on a sound financial foundation, and they have to be coped with by special methods as in this case.

Motor-Driven Tools

PROFESSOR CLEWELL'S discussion of motor drive for machine tools gives an admirable consecutive view of the present development of the art. By consolidating the views of ten representative toolmakers he has brought the situation clearly into the foreground, and it is surprisingly favorable to the general use of electricity. The use of motors has steadily increased with the improvement of their applications and the general availability of electric power until to-day the majority of new equipment of the heavier sort is fitted for motor drive. Its fundamental advantages of convenience, efficiency, flexibility and exact speed control are well known. The objections on the score of high first cost, the price of power and the conservatism that clings to old methods have been steadily fading from view. From now on, as new shops are equipped, the motor is surely coming into its own. Heretofore there have been the inconvenience of changing over machines for individual drive and the natural objection to scrapping equipment in good condition. Moreover, in an old shop fully organized for belt drive many of the characteristic advantages of motors cannot be fully realized. In starting afresh the whole layout of the shop can be planned for maximum efficiency without having to consider the necessities of arrangement from the viewpoint of the transmission of power by belts and shafts.

Speaking broadly, a machine in which the item of power consumption is a considerable one in the cost of product should be individually motor-driven merely on account of the increased efficiency. If, as very commonly happens, exact speed control exercises an important influence on its rate of output—that is, on the working efficiency of the operative—individual drive with its complete power of speed control is doubly necessary. Only with light machines steadily worked in groups at fairly uniform output can group driving be really advantageous. It is the working unit, whether of one or half a dozen machines, that must be considered. At the present moment the amount and character of overtime work is a peculiarly important item. With individual drive certain combinations of machine tools necessary to production can be made at will without reduction of efficiency from the power standpoint, while with belt and shaft drive as generally found full efficiency can be obtained only when the plant is in full operation. Most important of all, however, is the influence of individual motor drive on shop layout and working organization. When every machine has its own separate motor, not only can the plant be kept more clearly and better lighted, but it can be arranged for the highest efficiency of production irrespective of all considerations of power supply. Machines can be

grouped and placed so as to insure the minimum of backlash in that steady movement of materials, processes and finished work that is so necessary to high output at a minimum cost.

Mere saving of time due to speed and ease of control and to the placing of machines so as to call for the least human effort in handling the work is no small practical item of gain. Likewise, the abolition of shafting, belting and all overhead gear leaves the space clear for the cranes and travelers needed for the easy transference of heavy products without interference with the floor space and often with the workers as well. In fact, it is these operative advantages, quite aside from the saving of power, that constitute the strongest reason for going to individual motor drive in all new installations. Maximum output of machines, minimum waste of human power and time—these are the watchwords of American industry, doubly forceful in the stress of war production.

Conservation of Small Water Powers

IN THE present exigency every pound of coal that can be saved by whatever means is clear gain. The necessary industries of the country require so large a supply and the transportation facilities are so taxed that every effort ought to be made, and made at once, to utilize the country's water powers to the fullest extent. It is not that the general public is going to suffer from personal lack of fuel, nor that disaster is going to overwhelm any industries. There is coal enough and transportation enough to prevent any such unhappy results, provided that each is wisely utilized; but the difficulties of getting coal, to say nothing of its cost, are going to be serious enough to make transmitted power more than ever desirable as a relief to the fuel situation. The ordinary course of events in developing hydraulic privileges has been the organization of a utility company, the development of the privilege, and the building of a more or less extensive network of transmission lines to deliver the power to various customers. This in the last resort means that a bond issue must be floated to finance the proposition, and that the owners must go for help to the bankers as general custodians of the world's money.

In their turn the bankers, assuming the enterprise to be one sound enough to appeal to their business sagacity, are chiefly interested, not in the technical details of the work nor in its ultimate relation to the fuel supply, but merely in the prompt, successful and

profitable handling of that bond issue. The bigger the better from the banker's standpoint so long as there is clear and definite prospect that the interest will always be paid. Now, it is as much, if not more, trouble to float a small issue of bonds as a fairly big one, and the practical result of our methods of financing has been that the small water powers have gone begging and have remained to this day undeveloped. They are not propositions which can be easily financed, while if they fall into the hands of some one who can personally reach the capital with which to develop them they often turn out to be excellent properties. Small powers, too, are handicapped in another way, in that unless some local electric lighting company looks to them for service they cannot dispense their goods freely to the public and are likely to become mere appurtenances to some particular manufacturing concern. Just now the main consideration is that the small powers should be worked for all they are worth. A little stream that can find enough storage to assure even 100 hp. ten hours a day for manufacturing work is right then and there saving fuel at the rate of something like 700 tons a year and thereby doing sterling service to the cause of conservation.

The costs of operation in such cases are very small. The plant is practically a one-man affair and the chief expense is in the necessary capital charges. Under these circumstances it would seem wise for the commissions and other regulating bodies to take cognizance of the value of small plants and to realize that there is a public exigency which demands their encouragement even to the extent of allowing them to sell to all comers up to the limit of their capacity, a step which is not ordinarily considered good public policy, since existing plants are glad to pick up and utilize water powers, although sometimes the same regulating bodies are loath to permit the necessary increase in securities. Now, when fuel is scarce and many a station likely to be greatly inconvenienced in getting its coal supply, would seem to be a good time to loosen up restrictions all along the line and to use public authority so far as may be to encourage the utilization of every bit of water power which can be reached—by existing plants if practicable, but utilization in any case. We could mention a good many small privileges which have been employed to good advantage, and the example which they have set ought to be followed promptly. The task naturally falls to the lot of companies now operating, but the main thing is to see that it is accomplished as soon as feasible by whosoever will undertake it.

WHILE the advantages of individual motor drive for large machine tools are generally conceded, there are differences of opinion concerning the wisdom of such an investment for medium or small-sized machinery. In the next issue of the *ELECTRICAL WORLD* Prof. C. E. Clewell will discuss this subject, basing his conclusions on the merits of each case. He will point to other economies than energy saving due to elimination of line shafting and belting which should determine the policy to follow in any given

The Coming Issues

instance. In addition to this discussion, there will be an article on a hydroelectric plant in which all of the operations of starting, stopping and switching are performed automatically, an attendant visiting the plant only once every eight hours. There will also be discussed in the next issue questions of public relations and of inter-trade relations, besides the regular statistics of the central station industry, which, despite many handicaps, is enjoying unprecedented business.

Attitude of Machine-Tool Builders to Motor Drive

Collected Opinions of Ten Typical Manufacturers Are Uniformly Favorable
Toward Electric Drive—Nineteen Advantages of Individual Motor
Drive Compared with Line-Shaft Drive

BY C. E. CLEWELL

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SYNOPSIS.—This article summarizes in a broad general way some of the recent tendencies in machine-tool design which have been brought about, in part at least, by the growing use of motor drive, particularly in the larger types of machinery. The article is based on a number of individual opinions expressed by machine-tool manufacturers either favorable or unfavorable to the wide use of motor-driven appliances. In order to make these opinions definite and comparable, a number of typical questions were addressed to representative machine-tool firms and a digest of the answers has been included in the article. Special attention is directed to the list of advantages of motor-driven machinery over line shafting or group drive according to a representative of one of the leading machine-tool manufacturers. This list is particularly interesting because it presents the case from the standpoint of the machine-tool builder rather than that of the motor manufacturer, and the article as a whole is unique in the emphasis it places on the viewpoint of the former rather than the latter.

THERE are essentially three viewpoints to the motor application problem: (1) that of the motor manufacturer, who quite naturally views the whole situation in a way favorable to the widespread use of motors; (2) that of the machine-tool builder, who is more liable to be unbiased in his attitude toward motor and line-shaft driving and whose opinion is determined partly by the advantages in the use of the motor, partly by the demands of the trade, and partly, of course, by the experience of the machinery manufacturers in their own plants with motor-driven machine tools in comparison with line shafting and belting; (3) that of the user of machinery, whose choice and preference in turn are governed to a considerable extent by what types of machine-tool drives are available and also in some cases by the information received from the motor manufacturers.

Taken as a whole, therefore, it is reasonable to assume that the viewpoint of the second group—that is to say, the machine-tool manufacturers—if based on information from a sufficiently large number of firms, will probably form a better basis for conclusions as to the present status of motor-driven machinery than information from any other available channel. In this connection it is only fair to say that the various motor manufacturers because of their study in this field possess a remarkable accumulation of data on which to base accurate conclusions.

BASIS OF THE OPINIONS

In order to reduce the various opinions of representative machine-tool manufacturers to a comparable basis, and also partly for the purpose of securing tangible replies from these firms, definite questions were sent to a number of representative machine-tool manufacturers. The answers which were received and which are condensed and grouped in the following paragraphs form an interesting and instructive commentary on the present attitude of these firms to the motor problem. In a general manner they may be taken

as an indication of what may be expected in the way of developments in this field in the near future as far as a more uniform policy in the application of motors is concerned for the various classes of machinery employed for industrial purposes.

ATTITUDES OF DIFFERENT COMPANIES TOWARD MOTOR DRIVE

(1) *Lodge & Shipley.*—In general group drive is preferred to individual drive except in cases where a few machines are run on overtime or at night and for the reversing control of planers and where crane operation is facilitated by the elimination of overhead shafting.

(2) *Ingersoll Milling Machine Company.*—Individual motor drive is preferred.

(3) *Jones & Lamson.*—The tendency is strongly toward motor-driven machinery, motors being used practically always on heavy machinery and, where con-

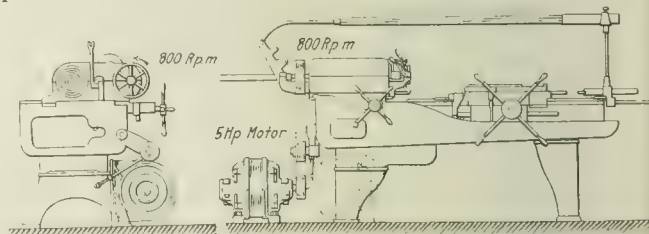


FIG. 1—FLAT-TURRET LATHE WITH TWO METHODS OF MOUNTING MOTOR (ON FLOOR AND ON LEG)

ditions permit, also on lighter lathes, drill presses and the like.

(4) *Cincinnati Bickford Tool Company.*—Not much choice is expressed between a speed box and a variable-speed motor for standard tools. For special schemes of mounting the motor (Fig. 9) motor drive is preferable.

(5) *International Machine Tool Company.*—Individual motor drive is preferred to any other method of drive.

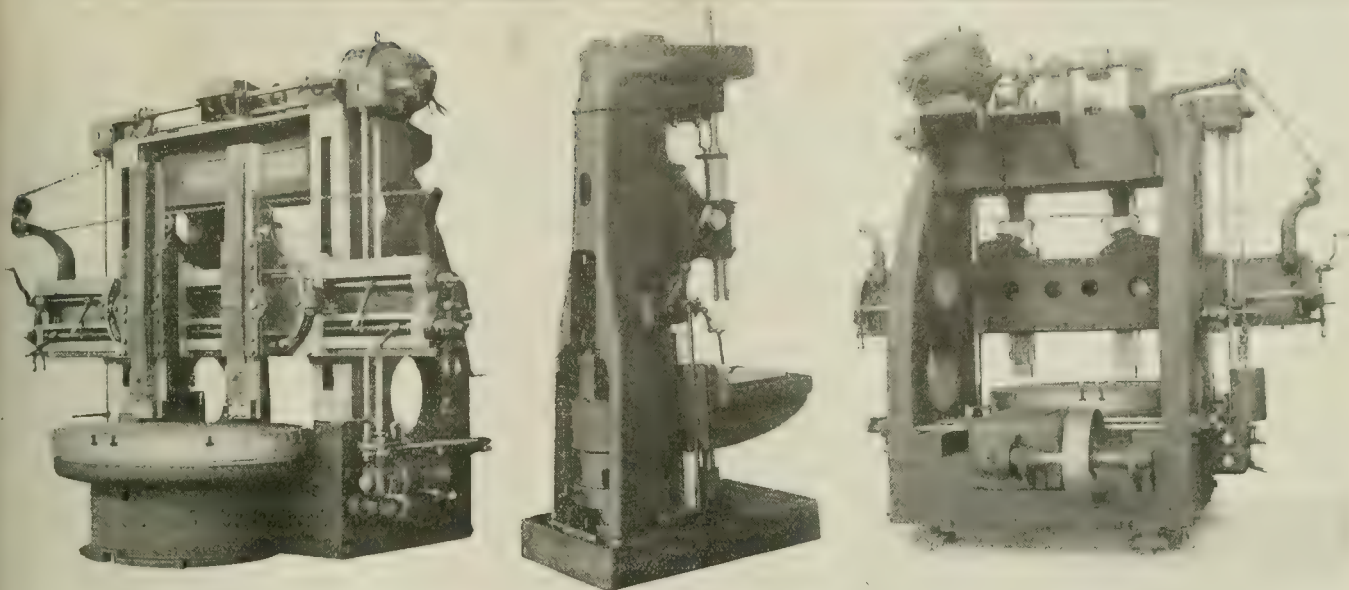
(6) *Bridgeford Machine Tool Works.*—Individual motor drive is preferred for machine tools requiring 20 hp. or more, group drive for machines which require not more than 5 hp. or 6 hp. All machines that are made by this company and have gear heads are heavy-duty, requiring 10 hp. to 15 hp. In 95 per cent of the cases involving these machines motor drive is specified. Very few geared-head machines are belt-driven.

(7) *Cincinnati Planer Company.*—Wherever possible, electrically driven tools are favored.

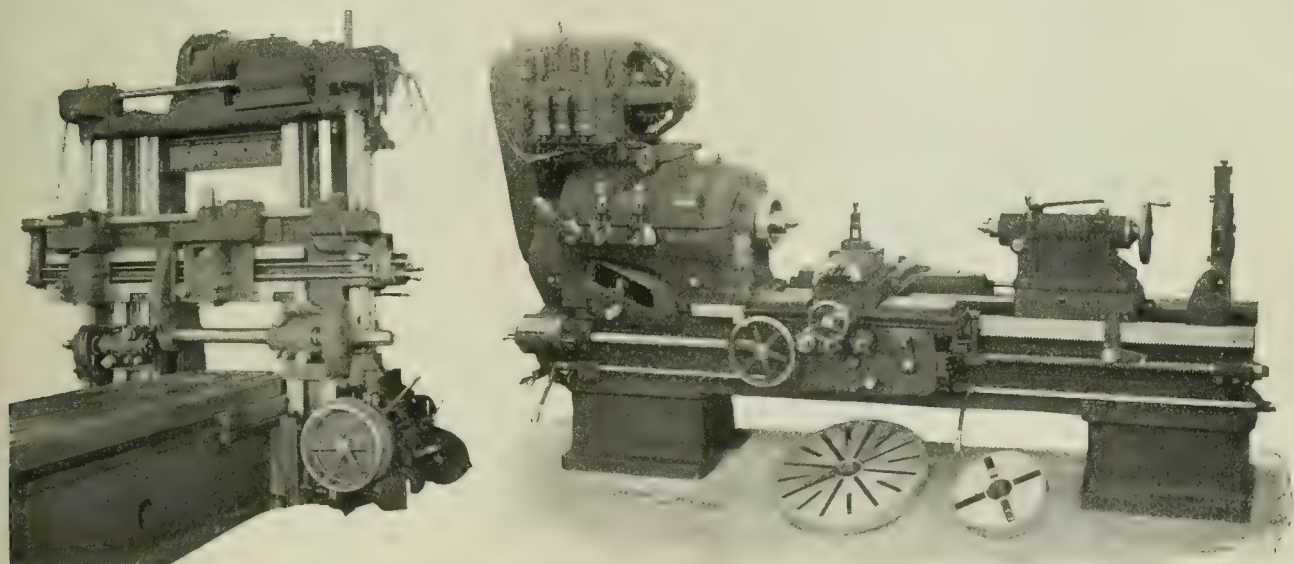
(8) *Bausch Machine Tool Company.*—Favorable to motor-driven machinery.

(9) *Foster Machine Company.*—About 80 per cent of the machine tools in this company's plants are individually motor-driven.

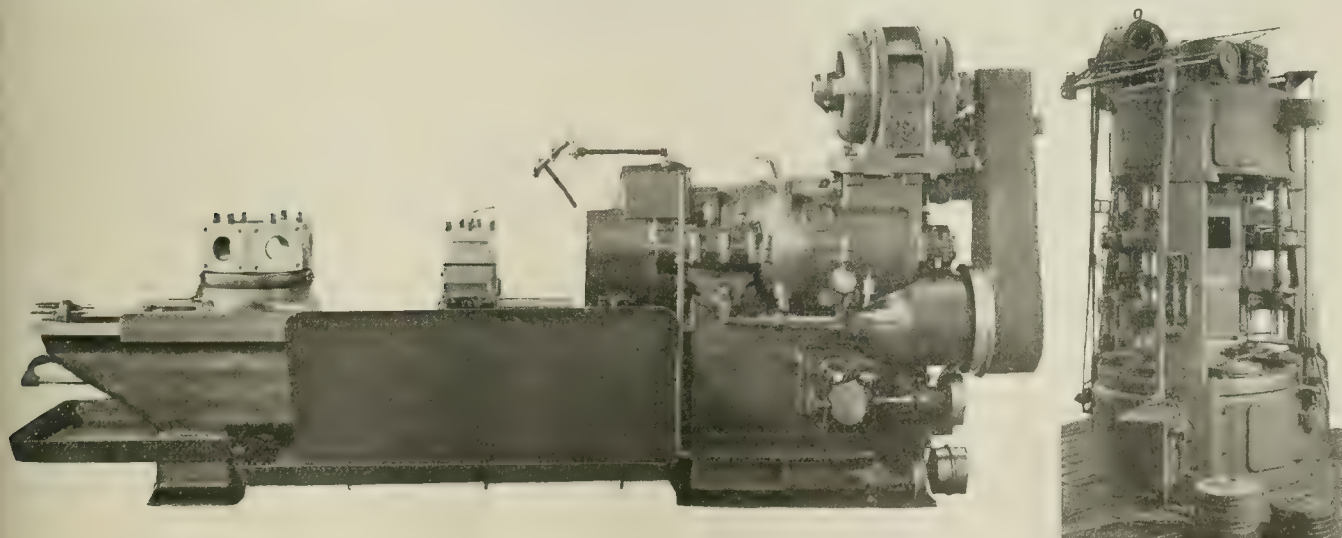
(10) *American Tool Works Company.*—The preference of this company for motor-driven or belt-driven



FIGS. 2, 3 AND 4—BORING MILL WITH MOTOR WHICH RAISES AND LOWERS CROSS RAIL AND DRIVES RAPID-POWER REVERSE; STATIONARY-HEAD DRILLING MACHINE WITH VERTICAL-SHAFT MOTOR; REAR VIEW OF MACHINE IN FIG. 2



FIGS. 5 AND 6—PLANER WITH MOTOR AWAY FROM DIRT AND POSSIBLE INJURY; LATHE ARRANGED FOR BELTED MOTOR DRIVE, AND PUSH-BUTTON CONTROL



FIGS. 7 AND 8—LATHE DRIVEN BY MOTOR THROUGH BELT; MOTOR-DRIVEN FLYWHEEL DRILLING MACHINE

machine tools is influenced entirely by the conditions under which these tools are to be operated. Both types of machines are handled and each has a legitimate field of operation.

The machine-tool manufacturers giving the preceding opinions have not been selected because of any known attitude (either favorable or unfavorable) to the problem of motor applications; their names have merely been taken at random from a large list of possible firms from which answers might have been solicited. On such a basis the trend of the opinions expressed may probably be taken to indicate fairly the average opinion of the majority.

It will be noted that these ten opinions point almost uniformly to an attitude favorable to electric power for machine-tool work. About three and a half years ago (in 1914) the writer addressed a somewhat similar query to leading manufacturers of machine tools, and there was a noticeable difference in the opinions expressed at that time from the trend of opinion as outlined above. This seems to show a growing tendency toward a more and more favorable attitude concerning motors for machinery drives, which in turn seems to indicate that the well-directed efforts of the motor manufacturers to this end are now beginning to find widespread acceptance in the machinery field.

SUPERIORITY* OF MOTOR-DRIVEN TOOLS TO LINE-SHAFT-DRIVEN APPARATUS

(1) See the list† of advantages for motor-driven machines as given at the end of this article.

(2) Individual motor drive best for machine tools of large size (10 hp. to 75 hp.); can be mounted on top of the machine as in Fig. 5, thus being out of the way and protected from dirt and other injury.

(3) Advantages: extreme flexibility of equipment, a lighter and cleaner shop, less trouble with upkeep. Disadvantages: slightly increased first cost, complicated mechanical attachments for direct driving when the design of the machine tool has not been adapted to motor drive, possibility of low power factor with alternating current if the motors used are larger than necessary.

(4) Number of working parts in the transmission reduced, speeds changed readily.

(5) Machine can be operated individually regardless of whether other machines or line shafts are running or not; the machine can be shut down and the power stopped independently of other machines; individual motor drive is more serviceable than other methods.

(6) For large machines individual motors are preferred, but no specific reasons are given.

(7) Eliminates the upkeep and cost of belting, line shaft and pulley and the time consumed in oiling; does away with the objectionable feature of obstructing the light by overhead construction, and a greater number of speeds is possible with less complication.

(8) Economy in energy, space and material.

(9) For such special cases as single-pulley drive with screw machines or turret lathes, heavy planers and boring mills the first cost of individual motor drive is less, but only for such tools as have been designed for either

method of driving. Greater flexibility is produced with individual motor drive, which may contribute to a higher total factory efficiency.

(10) Constancy of power input, no belt slipping, adaptability of the machine to overtime work, freedom from dependency on the rest of the shop, and in some cases greater convenience in control. The choice should be governed by the circumstances under which the machines are to be operated.

APPROXIMATE PERCENTAGES OF OUTPUT SUPPLIED FOR INDIVIDUAL MOTOR DRIVE, GROUP ELECTRIC DRIVE AND STRAIGHT LINE-SHAFT DRIVE

(1) Machinery for new shops in large majority of cases is for individual motor drive. About 36 per cent of total product is equipped for motor drive. No figures on group or straight line-shaft drive percentages.

(2) Very few machines furnished for belt drive. (See Fig. 5.)

(3) About 50 per cent at least for individual motor drive. Practically all the rest for group drive.

(4) Smaller machines, 10 to 15 per cent motor-driven; medium-sized machines, 30 to 40 per cent, and for the larger machines, 60 to 75 per cent. No percentages available for group and line-shaft drives.

(5) About 55 per cent, particularly in the larger sizes, are arranged for motor drive. No figures on group and line-shaft drive.

(6) Approximately 95 per cent motor-driven.

(7) About 60 per cent of planers are belt-driven either by line shaft or group drives and about 40 per cent are individually motor-driven. About 85 per cent of boring mills are for individual motor drive and about 15 per cent for belt drive.

(8) About 50 per cent for individual motor drive.

(9) About 5 per cent of the screw machines and turret lathes are supplied for individual motor drive.

(10) Majority of lathes above 30 in. (76.2 cm.) and of radial drills above 5 in. (12.7 cm.) are individually motor-driven. Practically all the very large tools of other manufacturers are individually motor-driven. For small lathes (14, 16 and 18 in.—35.4, 40.6 and 45.6 cm.) and small radial drills (2, 3 and 3½ in.—5.1, 7.6 and 8.9 cm.) belt drive is preferred, although some are arranged for individual motor drive.

RECENT CHANGES IN MACHINE TOOLS ADAPTING THEM SPECIFICALLY TO MOTOR DRIVE

(1) The selective head lathe (see Fig. 6) of this company has been developed during the period when the demand for the motor-driven machine tool has come, and hence it has been natural for the motor drive to be a consideration in its development.

(2) The tendency of this company's design is for electric drive and moreover for constant-speed work so as to accommodate alternating-current motors from stock.

(3) Four twelve years the flat-turret lathe made by this company has been so designed as to require no additional attachments for constant-speed motor drive. Two ways of mounting the motors are shown in Fig. 1, in the first case the motor being mounted on the floor and in the second case on a "motor leg."

(4) Some interesting cases of recent designs for electric drive by this company are shown in Figs. 3 and

*The opinions on this subject and the following ones are arranged in the same order as those for the first subject; that is to say, opinion (1) refers to Lodge & Shipley, opinion (2) to the Ingersoll Milling Machine Company, etc.
†This list was submitted by E. E. George, plant engineer, Lodge & Shipley, expressly for use in the present article.

10 and are described in the captions under the illustrations.

(5) No changes have been made in the motor-drive arrangements employed by this company, as the lathe was originally designed for individual motor drive and it has been very satisfactory. (See Fig. 7.)

(6) This company's output has always been a heavy-duty geared-head line of machines especially adapted to motor drive, and hence no radical changes have been made during the last ten years.

(7) The smaller planers are arranged so that motor brackets can be attached to the housings at any time and the larger planers can be changed to reversible motor drive at any time. All boring mills are arranged so that a motor can be attached at any time. An example of the latter is shown in Figs. 2 and 4.

(8) No recent changes in machine tools to adapt them specifically to motor drive. (See Fig. 8.)

(9) The machines made by this company in general lend themselves very readily to individual motor drive.

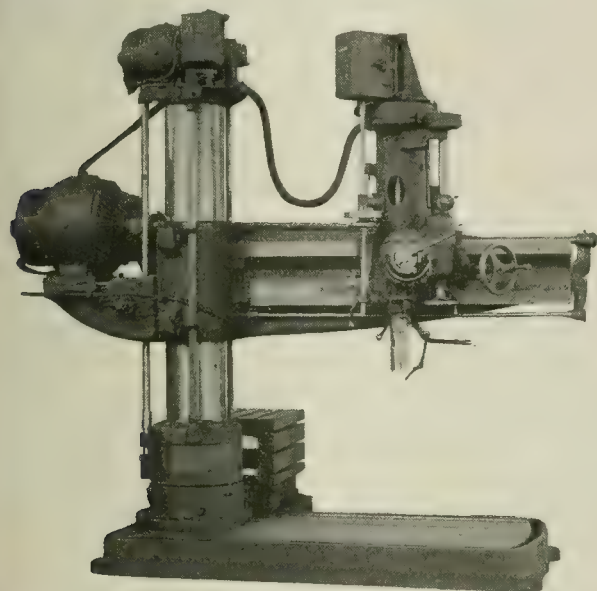


FIG. 9—RADIAL DRILL WITH SEPARATE MOTORS FOR DIFFERENT OPERATIONS

(10) The machines of this company when originally designed took motor drive into consideration. On the geared-head lathes there is a planed surface on top of head-stock on which the motor plate may be mounted.

LIST OF ADVANTAGES OF INDIVIDUAL MOTOR DRIVE

The following list of advantages of individual motor drive in comparison with line-shafting or group driving is presented from the standpoint of a representative machine-tool manufacturer as a supplement to the preceding opinions. On this basis the points favoring the individually motor-driven machine have a peculiar significance and become of unusual interest to the motor manufacturer, while they constitute an excellent statement of the problem as it is viewed at this time.

(1) The maintenance of motor equipment is much less than that of counter-shafting, line-shafting and belting for the same number of machines.

(2) The initial cost of motor equipment is less than that of equally satisfactory counter-shafting and line-shafting. The only type equipment that will give as good service as a motor drive is that with ball-bearing hangers, clutches and loose pulleys.

(3) The power losses in an individual motor drive are much less than in the average counter-shaft.

(4) A motor-drive machine can be set up and moved much more quickly.

(5) It can be moved around the shop from one location to another in about one-third of the time.

(6) It can be started and stopped much more quickly and safely, particularly if an automatic starter with dynamic braking is used.

(7) Much finer speed control can be secured with a rheostat than with a gear-changing device.

(8) Reversing with a motor controller is much simpler than by mechanical device.

(9) Special control is available as required for reversing planers, slotters, boring mills, etc.

(10) There is clearance overhead so that cranes and hoists can be used for loading and unloading machine. It is very difficult to arrange any sort of crane for a belt-driven machine.

(11) Better lighting is secured in the shop by the absence of belts and counter-shafts.

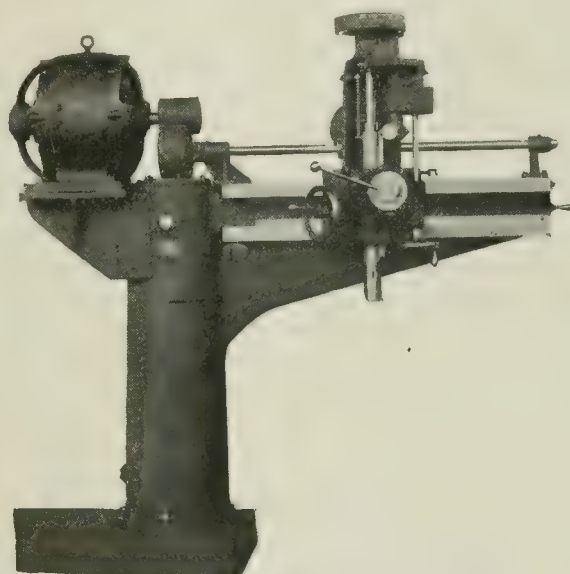


FIG. 10—RADIAL DRILL EQUIPPED WITH ONE VARIABLE-SPEED MOTOR PERFORMING ALL OPERATIONS

(12) Machine can be set at any angle to suit bar stock.

(13) The machine can be arranged to suit the space requirements of the machine and any counter-shaft.

(14) The machine can be much better balanced by an end-to-end coupling of the machine spindle to the motor than by using a belt with the consequent side pull and unbalance.

(15) Sliding contacts or flexible cable can be used instead of having belt move over a drum, as in designing grinding machinery.

(16) The machine can be designed for its best speed, regardless of all other machines. In laying out line-shaft and group drives it is difficult to secure a speed that will be applicable to the various makes and sizes of machines.

(17) Machine can be protected against overload by fuses or circuit breakers.

(18) It can be protected against shock due to a tool sticking or any other accident by the use of quick-action circuit breakers.

(19) Safety devices are very easily applied to a motor-drive machine.

Advantages of Electrified Rolling Mills

Considerations That It Is Necessary to Keep in Mind in Selecting Drive—
Comparative Costs and Performance of Different Types, and
Useful Information on Power Requirements

BY WILLIAM KNIGHT

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A TREMENDOUS volume of manufacturing production has been the outstanding feature of the last few years, and the steel mills in this country as well as in Europe have played no small part in contributing their share to the enormous amount of work done. The trend of evolution of power supply in iron and steel plants has been to electrify every machine up to and including the main rolls, owing to the greater flexibility of operation and control of the electrical machine as compared with the steam engine.

THE IMPORTANT FACTORS

Among other factors which must receive consideration in the electrification of the steel mills are the following: First of all is efficiency. There is no doubt that in an electrically driven rolling mill the cost of the power can be conveniently controlled by using the most suitable arrangement in the electrical plant. Furthermore, the elimination of the losses in the boiler room and all along a steam pipe line which is made possible by buying the power from an outside source will still further reduce the cost of operation per ton rolled. The output of an electrically driven rolling mill is also larger than it would be with steam drive, owing to the rapidity with which the mill can be controlled and handled and the uniform torque exerted by electrical motors equipped with flywheels to carry them over peak loads.

The economy of space that can be effected by buying electricity from an outside power station instead of installing a steam-power plant in the works, and the possibility of measuring very accurately the amount of power needed for rolling a given section (thus allowing a very close estimate of the manufacturing cost of any product), are the two points that, in these days of high cost of land and keen competition, speak strongly in favor of electric drive in rolling mills.

It need hardly be said that in a rolling mill the demand of power generally varies rapidly between wide limits. When the ingot enters the rolls a large demand of power occurs, and as soon as it leaves the rolls the power demand may suddenly be reduced to that required for overcoming the friction losses in the mill itself and in the motor only. This rapid fluctuation of power which occurs during the operation of a rolling mill, if not corrected somehow, will create a very unfavorable condition for rolling at the lowest price, since this price is contingent on the condition that the power demand should be, as much as possible, maintained steadily at the full capacity of the generating plant. To meet this requirement, however, in some cases may mean an increase in capital cost and a large increase in friction losses which may not be offset by the saving effected by obtaining the power at a lower price.

The operation of a rolling mill, like any other engineering problem, is a commercial proposition aiming

at the largest possible production obtained with the least expense, so that the best results are reached through a compromise between the advantages and the disadvantages arising from several general and local conditions, the maximum over-all economy being reached when the combined total capital charges and running expenses per ton rolled become a minimum.

For instance, it is generally agreed that the maintenance expense for an electrical installation is lower than that of a steam plant, but where gas can be obtained at a low price it is readily seen that electricity has a formidable rival. In Germany, for instance, the "uniflow" engine has in many places been used with good results for small direct rolling-mill drives in preference to electrical drives, doing away with the conversion of mechanical into electrical power in the central station and back again into mechanical at the mill.

STEAM VERSUS ELECTRIC DRIVE

Before deciding whether to adopt a steam engine or an electric drive for a rolling mill the following points must be considered: (1) capital outlay; (2) steady losses; (3) saving effected with electrical motors during reversal, in the case of reversing rolling mills; (4) power absorbed with partial load; (5) speed of mill as affecting production; (6) if the power is generated within the works, what investment or operating expense it involves, or if it is purchased from a public service corporation, under what conditions the purchase can be made.

In many steel plants the waste gas from the blast furnace may be used for generating the needed power. If the surplus of such waste gases is large enough, there is little doubt that it will be cheaper to generate the power inside of the works than to buy it from an outside generating plant. In plants which are purely rolling mills, where there are no blasting furnaces in operation, and in small plants which do not have a very large production, the local generation of the power would not be in the majority of cases a sound economical policy, as advantages are usually derived by means of purchasing the power from an outside source.

When figures on the paper show that local generation of power would be cheaper than purchased power, the fact should be taken into account that the only object of a public service corporation is to sell energy and that, in order to accomplish this purpose, the combined efforts of a staff of specialists are used in the production of a reliable source of power at the lowest price. In a steel plant, instead, the main object is to produce steel, and the production of power is only a side issue which, generally speaking, could not be handled as efficiently and economically as if the power were produced by a concern established for that purpose only.

The load factor of a central station supplying energy to a steel mill increases with the magnitude of the plant. With small plants, however, the load factor is larger than would be expected, owing to the fact that the rolling is generally done in multi-stand mills and a larger number of passes are taken to produce a desired

chant mill must be run at a high speed. The finishing rolls, on the contrary, must be able to run at different speeds, according to the size and the shape of the section being rolled.

With a direct-current power supply this is a comparatively simple matter, the speed variation being obtained by means of field regulation only. With alternating-current motors this requirement is not so easily met, and a serious loss is experienced, since the efficiency of alternating-current motors decreases practically in proportion to the decrease in speed when the regulation is attained by the introduction of resistances in the rotor circuit.

Assuming that the power is transmitted to the rolling mill by alternating current at high pressure, there is no question that induction motors should be used for driving the main rolls. There is, however, a difference of opinion as to whether the so-called auxiliaries should be driven by alternating-current or direct-current motors. This latter point was discussed by B. R. Shover and E. J. Cheney in the London *Electrician* of Oct. 18, 1912, where very careful estimates are published of the capital expenditure and working expenses under the two systems in a certain hypothetical case which is fairly representative of a large mill. The conditions under which the one system or the other is to be preferred and the advantages and disadvantages of both are fully stated. The authors conclude by stating that when the percentage of power required for auxiliary apparatus (exclusive of pumps) is 25 per cent or less of the total power delivered to the mill, and where the power factor of the entire mill, including main and auxiliary apparatus, is more than 70 per cent, the alternating-current system should be used throughout, a saving being thereby effected in working expenses and in the absence of complications.

TABLE I—DATA ON PLANTS USING ILGNER SYSTEM*

Type of Mill	Work Done	Mill Motor, Direct-Coupled		Flywheel Motor-Generator Set				Additional Information
		Normal Output, Hp.	Maximum Speed, R.p.m.	Maximum Torque, R.p.m.	Maximum Speed, R.p.m.	Motor Output, Hp.	Flywheel Weight, Tons	
34½-in. three-high mill with three stands of rolls	Rolling heavy beams	12,600	180	70	428	2,600	55	
29½-in. mill with three stands of rolls	Rolling beams and light rails	8,400	180	62	428	1,500	55	
29½-in. mill with five stands of rolls	Rolling beams and rails	7,300	180	52	428		75	Power supplied by a generator attached to an existing fly-wheel motor-generator set used for another mill.
32½-in. mill with three stands of rolls	Rolling beams, rails and sections	6,000	180	140	500	1,200	50	
22-in. three-high mill with three stands of rolls	Rolling rails, sections and rounds	2,400		120				Power supplied by a generator attached to an existing fly-wheel motor-generator set used for another mill.
20½-in. three-high roughing mill	Rolling billets	3,800	180	100				Power supplied by a generator attached to an existing fly-wheel motor-generator set used for another mill.
34-in. reversing blooming mill	Rolling ingots	3,000	70		500	1,800	50	At the Steel Company of Canada's works at Hamilton, Ont.
Reversing blooming mill	Rolling ingots	4,000	75		375	1,800	75	Algoma Steel Company of Sault Ste. Marie, Ont.

*Obtained from several papers presented before the A. I. E. E., the British I. E. E., and the Association of Iron and Steel Electrical Engineers.

section. Also, in many mills, several pieces are rolled at the same time, the result being a more uniform load with multi-stand mills than with the large single-stand mill. The load factor is an important item and affects a good deal the cost of the power.

HOW SELECTION OF EQUIPMENT DEPENDS ON ENERGY CONTRACT

When energy is charged for on maximum demand the introduction of a flywheel is necessary in order to minimize the load fluctuation and thus obtain the lowest possible rate. When a flat rate is offered there is no need of using an equalizer flywheel for reducing the cost at which the power is purchased. Instead, a motor large enough to take up the peak loads on the mill could be used, thus eliminating the bearing and windage losses of the flywheel. This, however, may be objectionable because of the large size of motor needed. A convenient compromise may be reached by using a comparatively small flywheel and a motor of a convenient size.

In the third case, when peak loads of a long duration only are objected to, a motor of varying speed may be used. In merchant mills it is an advantage, and practically a necessity, to be able to vary the speed of the mill motor. The roughing rolls of a mer-

TABLE II—COMPARISON OF FIRST COSTS OF STEAM AND ELECTRICALLY DRIVEN REVERSING MILLS (40-In. Blooming Mill Rolling 60,000 Tons of Steel a Month)

ELECTRIC DRIVE WITH PURCHASED POWER	
Complete cost of reversing motor, flywheel motor-generator set, exciters and control equipment.....	\$185,000
Foundations, wiring, etc.....	10,000
Total.....	\$195,000
ELECTRIC DRIVE WITH POWER GENERATED AT PLANT	
Complete cost of reversing motor, flywheel motor-generator set, exciters and control equipment.....	\$185,000
Foundations, wiring, etc.....	10,000
Proportion of power house cost, 2500 kw., at \$50 per kw.	125,000
Transmission and outside wiring.....	5,000
Total.....	\$325,000
STEAM DRIVE	
Compound reversing engine.....	\$125,000
Condenser, exhaust piping, including pumps.....	25,000
Foundations	10,000
Boilers, 2500 hp., including stokers and coal-and-ash-handling plant, at \$30 per hp.....	75,000
Steam piping with covering, valves, etc.....	15,000
Water tunnel for condenser, with discharge for 8500 gal. of water per minute.....	50,000
Total.....	\$300,000

If the power is generated within the works, it is always a good policy to install motors which, in case a breakdown should occur in the generating station, could be operated from the plant of a local public service company, thus avoiding serious losses due to interruption of output.

The action of rolling-mill motors may sometimes create a sensible fluctuation in the voltage, thus disturbing the performance of other machinery. To obviate this inconvenience a flywheel of a convenient size may be provided with a suitable arrangement for slip regulation which, by decreasing the speed of the motor, will allow the flywheel to give up enough of its stored energy to make up for the difference between the maximum peak load on the mill and the overload capacity of the motor.

In some cases a flywheel of prohibitive size may be needed for this purpose, and this means large windage and bearing losses that are a constant burden on the cost of production. By increasing the slip of the motor more stored energy can be given up by the flywheel, and a smaller one could be used for the purpose. For instance, with a 10 per cent fall in speed 20 per cent of the energy stored up in the flywheel can be utilized, and with 20 per cent fall in speed 36 per cent of that energy can be used. When 20 per cent speed variation is figured on between no load and double full load (which is about the maximum momentary overload that commercial machines can stand), it does not necessarily follow that this variation will be experienced under actual working conditions, because when the work at the mill is being carried on fairly steadily the power demand never drops to zero, neither does it reach double full-load value except under very exceptional conditions.

CONSIDERATIONS NECESSARY IN APPLYING MOTORS

In many cases, owing to the low speed of the mill and to the high cost of a low-speed motor with good electrical characteristics, a high-speed machine is used and connected to the rolling-mill shaft by means of gears or ropes. When a directly coupled machine is used it is always desirable to use a flexible coupling in order to render less severe the shocks on the motor during the operation of the mill. With either coupled or geared motors the design of the motor bearings must be particularly good if serious troubles are to be avoided. Ropes or gear drives will allow the use of a higher-speed machine, which is both more efficient and less expensive.

The most suitable place to mount the flywheel is on the highest speed shaft, but this arrangement imposes an extra strain on the gears or ropes. To avoid this the flywheel can be mounted on a separate shaft directly geared to the mill. As stated before, by using a larger slip a smaller flywheel can be used for supplying the required amount of energy during the peak loads. However, there is a serious objection against this practice—the increase in cost of production brought about by the reduction of the output of the mill and the drop in the efficiency of the motor, if an alternating-current motor is used.

The use of a separate motor-generator and flywheel set for supplying the power needed by the mill motor will obviate this objection. In this case a motor large enough to stand the peak loads on the mill will have to be used. The motor-generator set can run at a considerably higher speed, and by regulating the field current of the generator the voltage of this machine may be varied, causing the speed of the mill motor to increase rapidly or decrease correspondingly.

This arrangement is generally known as the Ilgner

system. With it, owing to the high speed of the motor generator and flywheel set, a comparatively small flywheel may be used, and, although the loss of power taking place in the electrical machines is increased, the speed of the mill can be varied at any moment by any desired amount. The increased output of the mill will more than compensate for the increase in losses and the considerable increase of capital cost of the electric plant. An additional advantage with the Ilgner system is that any mill can be used as a reversing mill.

Particulars* of several successful electrifications of steam-driven, non-reversing rolling mills, together with data on power consumption for rolling different classes of materials, follow:

Cold Rolling-Brass Merchant Mill.—This mill consists of one set of breaking-down rolls, one set of second breaking-down rolls and two sets of finishing

TABLE III—STATISTICS OF MOTOR-DRIVEN MILLS†

	Hamilton, Ont.	Bethlehem, Pa.	Massillon, Ohio
Size of ingot, in	15 x 17	19 x 23	18 x 20
Weight lb.	4,000	10,000	5,000
Size of finished material (in.)	4 x 4	4 x 4	4 x 4
Elongation	16	10-12	Up to 20
Number of passes	19	17-21	19-21
Capacity tons per hour	60	100	60
Roll diameter in	30	30	30
Pinion diameter (in.)	34	35	34
Speed, full motor field (r.p.m.)	70	40	50
Speed, weakened motor field (r.p.m.)	100	120	120
How driven from motor	Direct	Direct	Direct
Number of motors	2	2	1
Voltage across each armature	600	600	700
Maximum operating torque (ft.-lb.)	900,000	1,550,000	750,000
Maximum motor horsepower	10,000	12,000	8,000
Number of generators	2	2	1
Rated hp. of driving motor of set	1,800	2,000	1,500
Weight of flywheel (lb.)	100,000	100,000	60,000
Speed of flywheel motor-generator set (r.p.m.)	500	375	375

†From paper presented before June, 1916, meeting of A. I. E. E. by W. Sykes and D. Hall.

rolls. The breaking-down rolls are 20 in. (50 cm.) in diameter, 30 in. (76 cm.) long, and all are driven at 6 r.p.m. by a long train of gear wheels. Originally this mill was driven by a single-cylinder horizontal non-condensing engine 28 in. (71 cm.) in diameter, 48 in. (122-cm.) stroke, and run with a boiler pressure between 60 lb. and 80 lb. per square inch (4.2 kg. and 5.6 kg. per sq. cm.). The usual size of ingots dealt with in this mill is 3 in. by 1½ in. by 7 ft. (7.6 cm. by 3.8 cm. by 2.1 m.) rolled down to various gages.

The motor used now is a 200-hp., 240-r.p.m., three-phase slip-ring motor, direct-geared by means of cast-iron gear to the mill. The gear ratio is about 4.8 to 1. No flywheel is provided. This equipment has proved extremely satisfactory, and a considerable reduction in the cost of operation and increase in the output has been obtained.

Iron and Steel Merchant Mill.—The mill consists of five pairs of 12-in. (30.6-cm.) rolls running at a minimum speed of 80 r.p.m. and is driven through double helical steel gears (ratio 1 to 2.5) by a 200-hp. direct-current motor at from 200 to 450 r.p.m. Since the mill was electrified an increase of output of over 30 per cent and decrease in the power consumed of 60 per cent have been obtained.

*Obtained from a paper by W. F. Mylan read before the British Institution of Electrical Engineers and from another paper by Koettgen and Ablett before the Iron and Steel Institute.

Power Consumption for Rolling Different Classes of Materials.—Re-rolling 90-lb. (45 kg. per m.) rails to a section 16 lb. (8 kg. per m.) per yard, each piece 30 ft. (9.1 m.) long, required 56 units of energy per ton. Total output of mill, 4800 pieces per twelve hours. Small mining rails were rolled from billets 5 in. by 5¾ in. (12.7 cm. to 14.7 cm.), weighing a maximum of 900 lb. (408.2 kg.). In the case of 28 lb. per yard (14 kg. per m.) this comes to an average of 650 lb. (294.8 kg.); in the case of 18 lb. (9 kg. per m.) rails the requirement is as follows per ton rolled: 28 lb. (14 kg. per m.), 38 units; 24 lb. (12 kg. per m.), 42 units; 20 lb. (10 kg. per m.), 45 units; 18 lb. (9 kg. per m.), 48 units. Smaller rails of 12-lb. and 8-lb. (6 kg. and 4 kg. per m.) section required from 49 to 54 units per ton rolled.

Girders 11 in. by 6 in. (27.9 cm. by 15.2 cm.) can be rolled for about 50 units per ton. Channels averaging 1½ in. by ¾ in. by 2 in. (3.8 cm. by 1.9 cm. by 5.09 cm.) require 66 units. Angles 3½ in. by 3½ in. by ⅝ in.

(9.5 cm. by 9.5 cm. by 1.6 cm.) from 800-lb. (362.9-kg.) billets require 50 units. Sheet (iron) 8 ft. 3 in. by 33 in. by 0.064 in. (2.5 m. by 8.4 cm. by 0.16 cm.) require 95 units per ton; sheet (iron) 8 ft. by 48 in. by 0.08 in. (2.4 m. by 1.2 m. by 0.21 cm.), 70 units per ton; sheet (iron) 10 ft. by 48 in. by 0.067 in. (32.8 m. by 1.2 m. by 0.17 cm.), 80 units per ton; sheet (iron) 10 ft. by 48 in. by 0.125 in. (32.8 m. by 1.2 m. by 0.32 cm.), 60 units per ton; sheet (iron) 9.5 ft. by 42 in. by 0.09 in. (2.84 m. by 1.07 m. by 0.24 cm.), 84 units per ton, from billets of 7.9-in by 7.9-in. (20-cm. by 20-cm.) section, weigh 388 lb. (175.9 kg.).

In two articles published in the *ELECTRICAL WORLD* on Sept. 30 and Dec. 16, 1916, the writer suggested a simplified method for calculating the proper size of motor and flywheel to be used when the demand of power on the rolls at any moment is known. The graphical solutions given should be found very handy in avoiding long calculations.

Tests of Iron-Wire Transmission Line

Comparison of Losses in Similar Iron-Wire and Copper-Wire Lines, Made by the Engineers of a Middle West Company, Shows That Construction of the Former Type Is Not Advisable on Certain Classes of Lines

ON ACCOUNT of the increased cost of copper and aluminum the engineers of the Iowa Railway & Light Company of Cedar Rapids, Iowa, installed iron wire as an experiment on a three-phase, 13,200-volt circuit extending west from Marshalltown, Iowa, about 28 miles (45 km.). To offset the poor regulation of the iron-wire induction feeder, regulators (10 per cent buck or boost) were installed at different substations along the line. Later it was decided to ascertain the actual conditions existing on this circuit.

The general characteristics of the transmission line are shown by the data in Fig. 1, the portion tested being that section from Marshalltown to Zearing. Dur-

125 ft. (38.5 m.) or forty-two poles per mile (twenty-six poles per km.). Every three miles a complete transposition was made in the conductor positions.

Before testing the line an oscillograph record was taken of the no-load voltage wave of the turbo-generator energizing the line at Marshalltown, and this was found to be within the A. I. E. E. specification for the line wave of an alternating-current machine. The direct-current resistance of one wire loop was next measured with a Wheatstone bridge (in ohms):

Phase	Test I	Test II	Average
A-B.....	341.2	341.0	341.1
A-C.....	341.0	343.0	342.0
B-C.....	344.4	343.0	343.7
Average for test.....			342.3

From this table the resistance of one wire from Marshalltown to Zearing (124,000 ft. or 37,800 m.) would be approximately 171.65 ohms. The temperature was 80 deg. Fahr. (32.2 deg. C.) in the shade.

The waves on the high side and the low side of the transformers were next photographed, but owing to an incorrect adjustment of the oscillograph the desired results were not obtained. After short-circuiting the three-line conductors at Zearing an impedance test was run by varying the voltage on the 2300-volt side of the step-up transformers at Marshalltown. From measurements of the power input into the iron-wire circuit with varying current and impressed voltage it was possible to obtain the curves shown in Fig. 2.

A load test was made by using two of the three conductors and employing water-barrel rheostats on the low side of the single-phase substation at Zearing. The curves derived from this test are presented in Fig. 3.

After completion of the test at Marshalltown a test

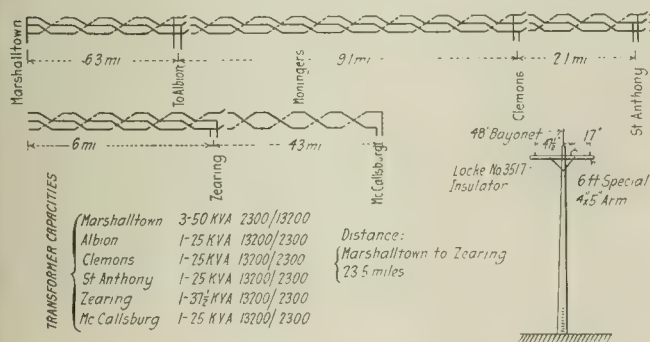


FIG. 1—PHYSICAL CHARACTERISTICS OF LINE TESTED

ing the test the substations other than Zearing were disconnected, and likewise the tap to Albion and Mc Callsburg. The material and specifications of the line are as follows: The wire from the Marshalltown plant to the substation at Clemons is No. 4 B.W.G. wire (E.B.B.) and from Clemons to Zearing No. 6 B.W.G. wire (E.B.B.), all being solid and spliced with tinned steel splicing sleeves. The pole spacing of the line was

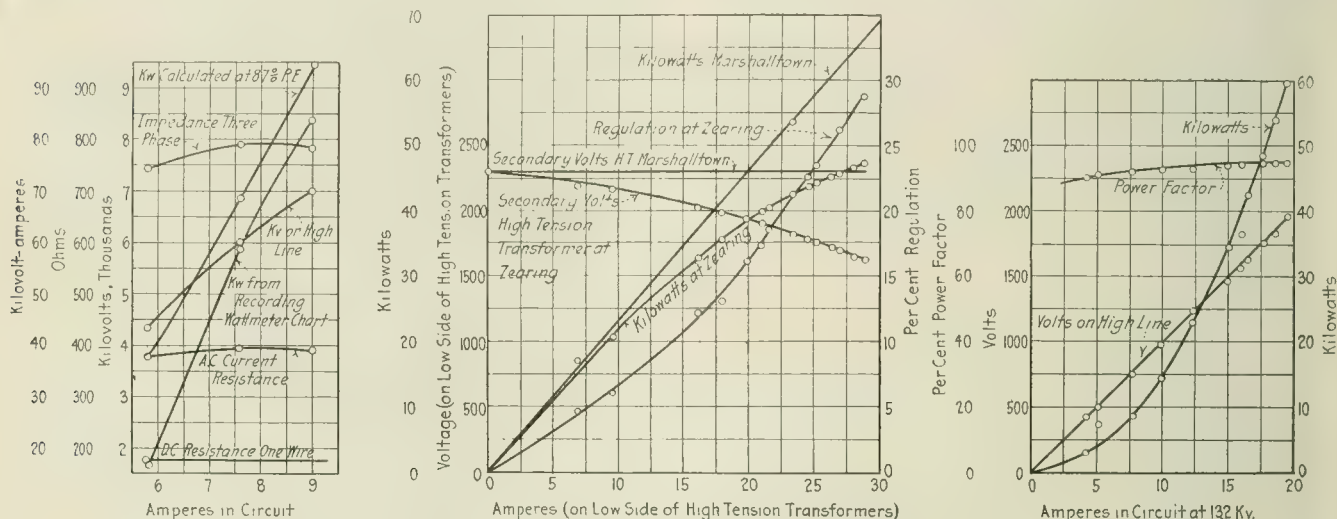
was run on a line equipped with No. 6 copper conductors, but otherwise the same as the iron line. The results of the test corresponded so closely with calculated values that they are not at all included here. The results of the impedance test are given, however, by the curves in Fig. 4.

WHAT THE TEST DATA SHOW

Basing calculations for direct-current resistance on 82,000 ft. (24,994 m.) of No. 4 E.B.B. iron and 42,100

be impressed between wires at Marshalltown, resulting in a load of 35 kw. This large loss is brought out more strongly in the load test. It should also be noted from Fig. 4 that full-load current was obtained with only 600 volts impressed on the copper circuit and an input of only 5 kw.

The load test results shown in Fig. 3 are based on current. This test was conducted single-phase but gives the existing conditions which have to be met. The large losses and poor regulation are clearly shown



FIGS. 2, 3 AND 4—RESULTS OF THREE-PHASE IMPEDANCE TEST ON IRON WIRE. SINGLE; SINGLE-PHASE LOAD TEST, AND THREE-PHASE IMPEDANCE TEST OF COPPER-WIRE CIRCUIT AT IOWA FALLS

ft. (12,802 m.) of No. 6, it was found that one-wire direct-current resistance should be 165 ohms, whereas the test showed 171.65 ohms. This indicates comparatively low resistance in the splices, etc., when corrected for a temperature of 40 deg. C., as the calculations were based on a temperature of 25 deg. C.

Investigation of the iron-wire circuits showed that there is a point of maximum impedance when considered with respect to the current carried by the cir-

by the curves in Fig. 5. At a load of 37.5 kva. (transformer capacity at Zearing) the voltage on the 2300-volt side of the high-tension transformer will be 1875 volts, or the regulation will be 18.75 per cent. This indicates what quality of service will be maintained even with the 10 per cent "buck or boost" regulator. The figures seem to indicate therefore that iron wire is not advisable on long lines of low voltage and comparatively high current densities.

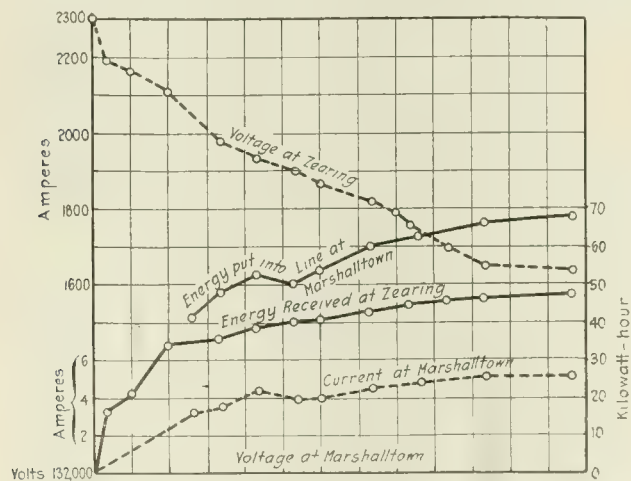


FIG. 5—REGULATION AND ENERGY LOSS IN IRON-WIRE LINE

cuit. The point of maximum impedance is 8.2 amp., and as the full-load current of the line (based on 150 kva. at 13.2 kv.) is 6.58 amp., it can be seen that the line will be operated near the worst point of current density.

It is interesting to note from Fig. 2 that to furnish the losses in the line at full-load current 5.1 kv. must

Uranium Calcium Arc Lamp

The highest candlepower in commercial arc lights has hitherto been obtained by the use of calcium fluoride as the main constituent, which produces a yellow flame. In certain cases, however, a pure white light is a desideratum, this being particularly true of photographic and photo-engraving work. For general street lighting also a white light is to be preferred. In order to obtain an intense light of snowy whiteness William R. Mott of Lakewood, Ohio, in patent No. 1,235,996, suggests the use of uranium as an ingredient together with calcium fluoride.

Uranium in the electric arc probably gives more lines in the spectrum than any other known element, and the arc is exceptionally rich in the blue and violet rays, while it also contains a considerable number of ultra-violet rays. Uranium has the unique distinction of giving 50 per cent more photographic power when used in the arc than rare-earth fluorides or titanium oxide. Moreover, when mixed with calcium fluoride in making up an arc lamp electrode it fully blends with the yellow rays of the latter to produce an intense snow-white light of extraordinary photographic power.

Analysis of 1000-Kw. Plant's Revenue and Expense

Detailed Figures Covering All Items Show Marked Effect Exercised by the Prevailing High Prices Even Under Conditions That Are Especially Favorable to Economical Operation

WIDESPREAD talk about increasing coal prices, announcements of rate increases by many companies and actual power shortages in some communities have forcefully conveyed the general impression that unusual things are happening inside the central station industry. The data here presented show, on analysis, in detail the reason why these unusual conditions prevail. These figures were obtained from the records of the Crawfordsville (Ind.) Electric Light & Power Company. This concern, serving a population of 13,700 in Crawfordsville, Linden, Wingate, Waynetown and New Richmond from its 1000-kw. station, has not experienced in a degree so marked as have many of its neighbor companies the difficulties that arise out of having to buy necessities at high prices. Its case is not by any means the worst that might be chosen in Indiana as an example of the effect of high prices on operation. It is perhaps nearly typical, as is indicated by the fact that the operating ratios over the last four fiscal years, ended in July, were: 1914, 49 per cent; 1915, 52 per cent; 1916, 55 per cent, and 1917, 63 per cent. It should also be observed in connection with these data that this increase in operating ratio took place at the same time the company was making a 14 per cent net gain in customers and was increasing its peak load from about 500 kw. to 1100 kw. on a 1000-kw. plant.

WHAT THE LOCAL CONDITIONS ARE

Before going into a detailed analysis of the increasing costs, however, it may be well to state a few general facts concerning the Crawfordsville concern. It operates a modern mechanically stoked steam-turbine jet-condensing station containing two 500-kw. machines. Its lighting rates range on a sliding scale from 7 cents down to 4 cents per kilowatt-hour. Its power rates range from 4 cents down to 1 cent. Ten per cent is allowed for prompt payment. The minimum monthly bill for light is 50 cents, and that for power is 50 cents per horsepower up to 10 hp. and 25 cents for each horsepower additional. A lighting contract with the city brings \$48 a year for 4.4-amp. arc lamps, \$21 a year for 100-cp. alley lamps, and \$30 a year for five-lamp ornamental standards equipped with four 60-watt lamps and one 100-watt lamp. Energy for lighting the small neighboring towns is sold for 3 cents per kilowatt-hour at the station switchboard and is sent out over lines owned by other concerns. Electrical merchandise sales are not pushed, and the company is gradually withdrawing from this business in favor of local contractor-dealers. The present plant peak is actually larger than the station rating, and about 900 hp. in power load is waiting to be taken on.

Turning to the revenue account for the last four years, in Table I, it will be observed that the income is divided into five general classes, namely, commercial lighting, municipal lighting, commercial power, sales to other utilities, and miscellaneous earnings. These

data are shown just as they are taken from the company's books, "cents" being omitted. The revenue from flat-rate commercial lighting is a heritage which is now gradually being worked over to a metered basis. In it there are some sign lighting and some employees' accounts. Fixed charges on power customers were eliminated in 1917 in favor of a minimum charge. The earnings for electricity sold in Crawfordsville show a return of \$7.45 per capita. The earnings from the four smaller towns to which energy is sold at wholesale and for which the Crawfordsville company is obliged to supply no transmission lines or distribution systems amount to \$1.85 per capita. In the records of metered commercial lighting revenues the effect of a rate reduction is clearly shown. The top step in the rate was

TABLE I—REVENUES OF THE CRAWFORDSVILLE ELECTRIC LIGHT & POWER COMPANY

	1917	1916	1915	1914
Commercial lighting earnings:				
Flat rate	\$1,339	\$1,460	\$968	\$451
Metered	44,733	40,584	35,957	44,915
Municipal contract lighting	13,672	13,296	13,678	14,737
Commercial power earnings:				
Fixed charges		535	3,227	1,061
Metered	24,519	22,404	14,974	8,243
Sale of energy to other utilities	4,438	4,150	3,506	154
Merchandising profits:				
Material	483	2,163	1,620	2,972
Labor		—2	45	9
Rent from land, buildings, etc.	—108*	98	101	719
Interest on deposits	1,845	865	293	72
Miscellaneous non-operating			4	25
Wiring and installation:				
Material		1	31	...
Labor		399	—7	67
Gross revenue	\$90,921	\$85,953	\$74,404	\$73,425

*Houses moved.

lowered from 10 cents to 7 cents in 1914, and, as the figures show, it took three entire years to get the gross lighting revenue back to where it was on the 10-cent rate.

Table III, which contains data on operation of the plant from 1914 to 1917 inclusive, shows that while the amount of coal burned had been doubled, the output of the plant increased nearly threefold. Apparently the losses in the plant's auxiliaries have increased from year to year, but the use of this increasing amount of energy in the station is attributable to the increasing load, which has made it necessary to run both machines sixteen hours a day, whereas formerly one machine carried all but the peak. This plan of operation, of course, increased the use of energy by auxiliaries. The losses in the distribution system, however, have decreased from 18 per cent in 1914 to 15.3 per cent in 1915 and 1916 and to 17 per cent in 1917. This reduction was made by relocating some transformers and by taking down some of the smaller units. The increase in 1917 over 1916 is believed to be caused by increasing power loads which overloaded some transformers and which dictated the installation of oversized transformers in some cases to take care of future growth. It is also noticeable that the coal per kilowatt-hour was higher in 1917 than in 1916. This is due to the fact that in 1916 it was possible to get

No. 5 Indiana screenings, while in 1917 the plant was glad to take No. 6 and No. 7 coal, which are of a lower grade. Furthermore, the operators dared not risk operating on only two boilers in 1917 on account of load conditions, and consequently it was not possible to keep all boilers so clean as they were in 1916. These

TABLE II—EXPENSES OF THE CRAWFORDSVILLE
ELECTRIC LIGHT & POWER COMPANY

	1917	1916	1915	1914
Steam power generation:				
Labor	\$6,375	\$5,950	\$5,414	\$5,928
Material	1,304	1,018	1,089	747
Fuel	16,614	11,270	9,848	8,953
Maintenance:				
Labor	492	364	422	294
Material	4,465	1,531	759	994
Transmission and transforma-				
tion:				
Labor			7	37
Material				205
Maintenance:				
Labor	187	558	127	311
Material	111	500	3	113
Distribution:				
Labor	382	185	365	161
Material	293	337	296	2,679
Maintenance:				
Labor	1,176	1,028	563	493
Material	381	226	930	2,219
Consumption:				
Labor	520	451	534	564
Material	12	50	607	280
Maintenance:				
Labor	283	694	296	486
Material	1,677	540	273	133
Commercial:				
Advertising			381	588
Supplies	69	246	14	19
Salaries	319	332	284	322
General expenses:				
Salaries	4,735	4,325	4,773	6,515
Rent	360	360	360	360
Supplies and expense	728	586	489	1,143
Undistributed:				
Injuries and damages	65	19	42	252
Insurance	89	45	26	141
Stationery and printing	313	252	476	140
Stores department	177	397	784	835
Utility equipment:				
Automobiles	899	462	530	463
Wagon	396	416	16	312
Depreciation	12,000	12,000	1,091	
Interest	3,036	3,036	4,307	
W. O. No. 1-A, labor			1,559	
W. O. No. 1-B, material			2,336	
Building, grounds and fixtures		74		
Total expense	\$57,458	\$47,252	\$37,442	\$35,687
Gross revenue	\$90,928	\$85,958	\$74,401	\$73,431
Total expense	57,471	47,272	39,068	35,698
Net revenue	33,456	38,686	35,392	37,732
Operating per cent	63	55	52	49
Construction and equipment	5,454	8,677	12,150	18,377
Cash on hand	51,480	33,650	17,290	10,753
Depreciation reserve	33,090	6,122	8,966	
Sinking fund	8,253	20,228	4,254	

conditions increased the unit coal consumption about 9 per cent. The costs per kilowatt-hour generated and per kilowatt-hour sold were obtained by taking the total cost of generation from Table III and dividing it by the kilowatt-hour records. The revenue per kilowatt-hour sold is based on the energy accounted for. The records of total customers show a saturation of about one meter to five inhabitants.

Table II, which shows in detail the expenses of the company, brings out some interesting facts regarding increases in material and labor costs during the last four years. The expenditure for material during the four years was: 1914, \$7,202; 1915, \$3,957; 1916, \$4,202; 1917, \$8,243. Of course, the entire increase of over \$4,000 in 1917 was not due to higher prices. The item of \$4,465 under "generation" includes three Detrich arches installed to replace old arches which had seen five years' service. The item \$1,177 under "consumption" includes some new alley-lamp fixtures, new arc-lamp chain and painting lamp posts. Nevertheless, there was a substantial increase due to higher prices, as may be observed from the fact that the material for operating the plant itself increased from \$1,018 to \$1,304, or about 30 per cent. The 1914 figures can

hardly be used as a basis of comparison, because in that year a great deal of construction was still in progress, as may be seen by the construction and equipment account, amounting to \$18,377.

The company has spent for labor in the last four years the following amounts: 1914, \$8,236; 1915, \$7,728; 1916, \$9,230; 1917, \$9,415—showing that the labor cost has increased steadily since the retrenchment in 1915, and this in spite of the fact that the company has consistently employed less labor. This increase would surely have been more marked had not the plant been equipped with efficient coal-handling facilities which enable coal and ash to be handled for 0.08 cent a ton.

In its fuel costs, which with other plants have been very burdensome, the company has been particularly fortunate. Its coal consumption has about doubled since 1914, and its coal cost has also about doubled. That so favorable a condition prevails is attributable to the fact that the company did not have to buy coal in the open market. For the coming year there will no doubt be an increase because the contract price has increased.

The data at the bottom of Table II accurately summarize the foregoing details. They show that gross revenue has increased from \$73,431 in 1914 to \$90,928 in 1917. Expense in the same period increased from \$35,698 to \$57,471, and the operating ratio increased from 49 per cent to 63 per cent. The year 1916 was the best in the period, as is shown by the net revenue account. In that year the company reaped a reward which it earned by close attention to every detail that would make for economical operation, which even high prices would not then offset. It should be noted in connection with this summary that taxes have not been taken into account. The reason is that the plant does not pay taxes. For purposes of complete comparison, however, the following data are given as the taxes which would have been levied had the property been taxable: 1914, \$3,570; 1915, \$3,704; 1916, \$4,069; 1917, \$4,179—an increase in hypothetical taxation of about 14 per cent for the period.

Taken as a whole, these figures show quite conclusively that even under very favorable circumstances

TABLE III—OPERATION OF THE CRAWFORDSVILLE
ELECTRIC LIGHT & POWER COMPANY

	1917	1916	1915	1914
Tons of coal on hand	421	241	15	500
Tons of coal received	11,022	9,138	7,413	4,820
Tons of coal burned	10,699	8,957	7,098	4,305
Tons of coal sold			90	
Tons of coal left	744	422	240	15
Kilowatt-hours generated	3,417,700	3,114,400	2,081,178	1,719,314
Kilowatt-hours used in plant	72,750	71,900	49,400	22,920
Kilowatt-hours output	3,344,950	3,000,500	2,031,778	1,696,394
Kilowatt-hours accounted for	2,769,184	2,643,159	1,804,675	1,396,476
Kilowatt-hours loss	575,766	399,321	276,503	322,838
Per cent loss	17	15.3	15.3	18.
Pounds of coal per kw.-hr.	6.2	5.7	6.7	6.2
Cost per kw.-hr. generated	0.016	0.014	0.019	0.0202
Cost per kw.-hr. sold	0.019	0.016	0.025	0.0259
Revenue per kw.-hr. sold	0.032	0.033	0.035	0.0526
Peak load	1,100	1,050	750	500
Maximum daily output	12,450	11,350	8,600	7,324
Minimum daily output	3,100	3,000	2,135	2,080
Total consumers	2,073	1,945	1,802	1,703

the company has been seriously troubled by increasing costs. The data also constitute another bit of evidence that the requests for increased rates by many Middle Western companies will find justification. During the period covered by this analysis the Crawfordsville company has been operated under the direction of F. H. Miller, manager.

OBSERVATIONS REGARDING
BREAKDOWN OF CABLE TAPE

Effect of Temperature of Impregnating Compound,
and Relative Advantages of Abutting
and Half-Lap Windings

BY L. F. PUTNAM

While in charge of the research and experimental work of one of the large public service corporations, the writer's attention was called to the change in composition of the compound used for filling pot-heads and

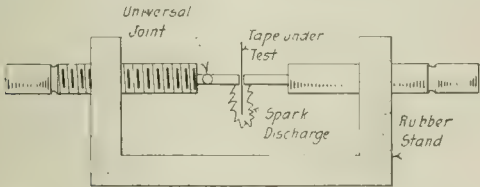


FIG. 1—METHOD OF IMPRESSING POTENTIAL ACROSS TAPE, THE AVERAGE BEING 8600 VOLTS

sleeves of high-tension cables. Inability on the part of manufacturers to import materials had occasioned a change in the formula of the compound which resulted in a higher melting point. It was also noticed that the "chill point" practically coincided with the melting point, so that in cold weather the compound had to be heated to an extremely high temperature in order to be used. The question then arose as to the possible damage done to "Linotape" insulation by pouring in the hot compound.

Consequently samples of tape 1 in. (25.4 mm.) wide were taken and heated in an electric oven, one sample being removed for each 20 deg. rise of temperature. The last samples removed were heated well above the highest temperature used in melting the compound. Other samples were heated in the compound to different temperatures and removed.

These samples were then subjected to a high-voltage breakdown test (Fig. 1), in which it was found that all the samples apparently broke down at the same voltage. More careful examination showed, however, that none of the samples had been ruptured, but that a flash-over had occurred in each case. That is, the tape was so narrow, 1 in. (25.4 mm.), that a high-voltage discharge would pass around it rather than puncture.

As soon as it became certain that the testing apparatus would not rupture the tape it was decided to find some method of wrapping or combining several layers and puncture the sample so made. Six brass rods 0.5 in. (12.7 mm.) in diameter were wrapped, each with a

TABLE I—RESULTS OF BREAKDOWN TESTS WITH BUTT-WRAPPED TAPE

Number of Layers	Maximum Voltage at Breakdown	Voltage Difference Due to One Extra Layer
2.....	4,600	.....
3.....	9,000	4,400
4.....	14,000	5,000
5.....	18,500	4,500
6.....	23,300	4,800
7.....	27,800	4,500

different number of layers of tape. In order to insure a smooth specimen, the tape was wrapped spirally, with butting instead of lapped edges, each layer being wrapped in the same direction (Fig. 2). A ring of brass was slipped over the whole specimen, and the

terminals of the testing transformer were connected to the rod and ring.

Table I gives the data resulting from this test. The values in the last column being less than the flash-over voltage obtained with the apparatus of Fig. 1, it was evident that no puncture occurred in any case recorded.

TABLE II—RESULTS OF BREAKDOWN TESTS WITH TAPE WOUND IN HALF LAP

Number of Wrappings	Number of Actual Layers	Breakdown Voltage	Extra Voltage Due to One Wrapping or Two Layers
1.....	2	4,700	.....
2.....	4	9,200	4,500
3.....	6	14,000	4,800

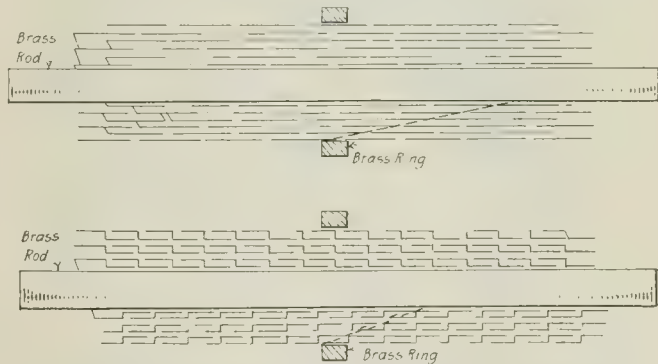
In other words, the breakdown occurred by flashing over between layers as shown by the dotted line in Fig. 2.

It was thought that this flash-over between layers might have been occasioned by the method of wrapping. Other samples were therefore prepared in which the tape was wound in the usual half lap as shown in Fig. 3. Table II gives the data obtained in this series of tests. No punctures were obtained.

It must be remembered that one wrapping of half lap requires twice as much tape as one layer of butt lap, as twice as many turns are made in the same length. It may be seen, however, by comparing Tables I and II that each additional wrapping of half lap gives only the same additional insulation value as one layer of butt lap. That is, to get insulating value with the usual method of winding tape (half lap) twice as much tape is required as is needed with the butt-lap method.

The above is true, of course, only when tape is so strong electrically, or else so narrow, that breakdown occurs by flash-over rather than by puncture. Practically all of the tapes of the "Linotape" class will break down in this manner.

The companies manufacturing cable for high-tension work evidently know the value of the butt lap, as it is nearly always used. After the above tests were completed and the diagrams Figs. 2 and 3 drawn, the reason of the advantage of the butt lap became apparent, the breakdown voltage being proportional to the length of the breakdown path. It is certain, however, that



FIGS. 2 AND 3—TEST ROD WRAPPED SPIRALLY WITH TAPE SO THE EDGES BUTT, AND HALF-LAPPED TAPE WRAPPED ON ROD FOR TEST

most users of the class of tape referred to are unaware of the waste of material occasioned by the use of the half-lap method. It should be noted that to gain the advantage of the butt-lap method of winding each layer must be wound in the direction of the preceding one.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

CORNER CONSTRUCTION FOR RURAL-SERVICE LINE

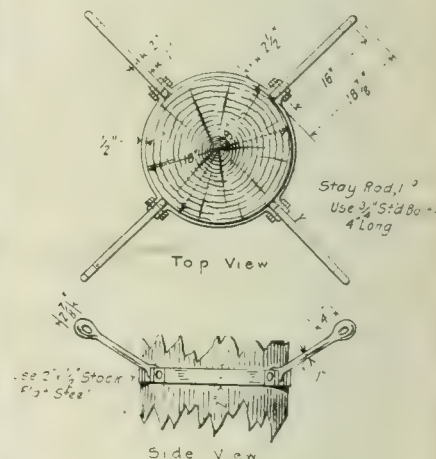
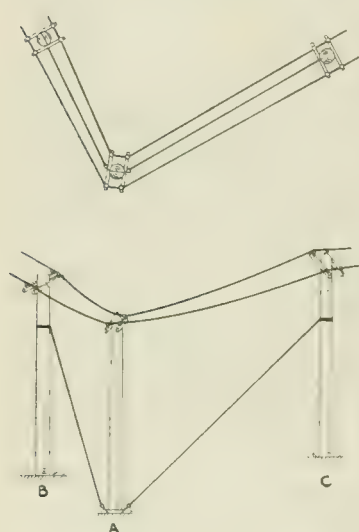
Description of a Method of Guying Poles That Eliminates the Necessity of Using Anchors on 90-Deg. Corners

BY M. H. WAGNER

Engineer Dayton (Ohio) Power & Light Company

An unusual method of guying poles at sharp turns in the line has been adopted by the Dayton (Ohio) Power & Light Company. Three poles are employed at the corner, the pole at the apex of the angle being used as an anchor pole to hold the line in both directions.

The line on which this construction is employed consists of 40-ft. (10.2-m.) class A Idaho cedar poles, fitted with bow-arrow cross-arms giving a 72-in. (1.8-m.) triangular wire spacing. The wires are No. 4 B. & S. hard-drawn, stranded bare copper. The sky wire is carried on an angle-iron bayonet. The guys each consist of two $\frac{3}{8}$ -in. (9.5-mm.) Siemens-Martin galvanized strand. The line is built on private right-of-way which, as a rule, follows the fence line. Therefore two-pole corners with the short span cutting the corner could not be used because this construction would have necessitated securing a special aerial right. In that case it would also have been difficult to maintain the uniform wire



FIGS. 1, 2 AND 3—ARRANGEMENT OF POLES AND CONDUCTORS IN A THREE-POLE CORNER; CORNER POLE WITH CONCRETE COLLAR HOLDING GUY RODS; DETAILS OF POLE CLAMP

This construction has been used with special success on 90-deg. corners, which, from the guying standpoint, are most difficult to build.

The method of installing such a corner is illustrated in the accompanying drawings. All the poles at the corner are double-armed, and B and C are head-guyed to the base of pole A. In effect this arrangement has the same results as dead-ending the line at C and B, and allows loose spans to be strung over the 50-ft. (12.6-m.) spaces CA and AB. The proper spacing between conductors in these spans is maintained by lengthening the arms on pole A to allow for the shorter effective distance that would come between pins if standard arms were set at an angle on pole A.

Around the ground line of pole A is a clamp like that shown in Fig. 3. It is made in four parts and is arranged so that short steel guy rods, made from 1-in. (2.5-cm.) round stock, can be attached to the bolts. After the guys are drawn up taut a 6-in. (15.2-cm.) collar of concrete is molded around the pole so it extends 18 in. (45.6 cm.) below the ground line and 12 in. (30.4 cm.) above it.

spacing which the three-pole corner permits. The three-pole construction has the further advantage that it meets with the approval of the farmers and that the pole under strain is protected by concrete from grass-fire risks, which occur frequently in country districts.

Use of Bonus System in the Boiler Room

BY C. T. BAKER

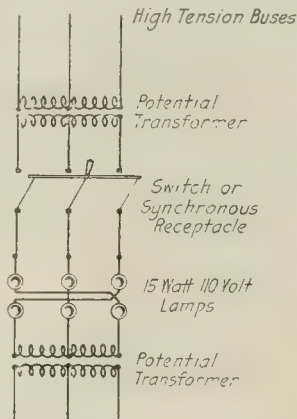
In reference to the article on this subject appearing on page 765 of the Oct. 20 issue of the ELECTRICAL WORLD, the writer believes that while some apparently good reasons were given why the bonus system might not work satisfactorily in the boiler room, there are many plants where the system is entirely satisfactory and where the over-all boiler-room efficiency has been considerably increased since its introduction. There are boiler-room employees who will attempt to take advantage of a given condition, and in some plants they will succeed. However, there are ways of handling such situations which are purely operating details and can be made successful by proper organization.

SIMPLE SYNCHRONIZING SCHEME

Lamps Connected to All Phases to Facilitate Determining Exact Point of Synchronism

BY DAVID R. SKEARER

Illustrated herewith is a synchronizing arrangement which has proved of considerable value in many small plants and even in much larger stations where the switchboard expense must be kept to a minimum. Lamps are placed in all three phases, as it is found to be a great deal easier to determine the exact point of synchronism if bright guide lamps are used in connection with the dark lamps. Speed under and above synchronism is also easily determined by the flashing motion of the six lamps. The advantage of having the phases crossed between the lamps rather than above or below them is that the two lamps on differing phases are placed very close together. Furthermore, it is comparatively easy to determine when the center lamps are dark and the outside lamps are at equal brightness, which is the condition which should exist when synchronizing. Several plants have been using this arrangement for some time, and in many cases the operators prefer it to a synchroscope.



CONNECTIONS THAT MAKE SYNCHRONIZING EASIER

CROSS-ARM EXTENSION BRACKET

Obviates Large Expenditure Where Circuits Must Be Added to Already Filled Cross-Arms

Occasionally it is found necessary to add a wire to a circuit carried on a cross-arm having all line positions already filled. If the existing cross-arm is changed to



FIG. 1—LINE USING CROSS-ARM EXTENSION BRACKET

one having more positions, or a second arm is added, running the additional wire then becomes very expensive.

A makeshift which will often be found useful in such cases is the cross-arm extension bracket illustrated

herewith. It is made of pipe and fittings which can be readily obtained from any hardware dealer, and consequently will be found especially desirable in these days of delayed factory shipments.

The bracket should have two coats of paint, prefer-

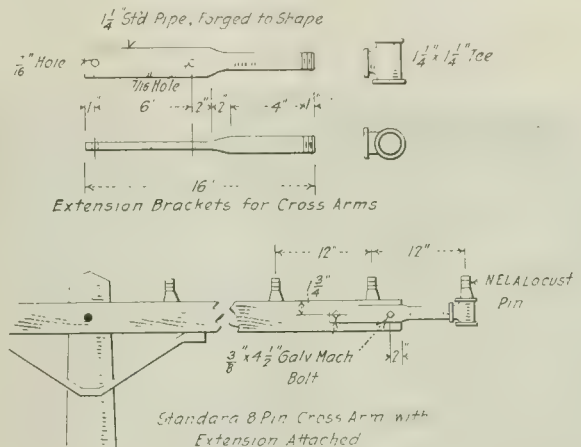


FIG. 2—DETAILS OF EXTENSION BRACKET

ably of the same color as the cross-arm, as a protection against corrosion. It will be found that the T can be screwed on tightly enough so that there will be no tendency to untwist. A standard N. E. L. A. 9-in. (22.9-cm.) locust pin will fit snugly into the T.

ATTACHMENT USED TO REEL WIRE

Reels Clamped to Rear Wheel of Automobile Have Been Found to Provide a Convenient Method

The United States Forest Service standards call for heavy wire for telephone lines, and with the hand reels ordinarily used in rough country work the process of winding up the line is slow and laborious. To speed up the work on lines that are accessible by automobile,



REELING WIRE WITH DRUM ATTACHED TO AUTOMOBILE WHEEL

a reel is clamped to the rear wheel of the automobile, the axle is raised by jacks, and the line is reeled up as rapidly as may be desired. The accompanying view shows the attachment being used in the Colville National Forest, Washington.

VENTILATING STORED COAL

Discarded Boiler Tubes Used to Admit Air and Thus Liberate Heat Caused by Oxidation

The Galesburg (Ill.) Railway, Lighting & Power Company, in storing coal on a narrow strip of property between its coal tracks and a fence, places large lumps of coal along the tracks to "wall up" the finer coal,



BOILER TUBES PROTRUDING FROM PILE OF STORED COAL WHICH THEY VENTILATE

which is placed in the center of the pile. To reduce the danger of spontaneous combustion in the pile old boiler tubes are laid in the coal as the pile is made. By this plan it is hoped sufficient ventilation will be provided so that temperatures necessary for spontaneous combustion cannot be developed.

RUBBING OF ROTOR WILL CAUSE FREQUENT TROUBLE

Method by Which This Condition Can Be Detected Before It Is Too Late—Result of Neglect in Actual Case

BY E. C. PARHAM

Ordinarily rubbing of the stator of an induction motor by the rotor is announced by the fuses blowing, the frequency gradually becoming greater as the arc of the rubbing contact increases. In course of time, if the condition is not detected, the extra load imposed by the mechanical friction and the local heating due to the friction will result in damage that can be repaired only at great expense. The most common method of testing for bearing wear of small motors is to lift the working end of the rotor shaft up and down by hand to note if there is any knock. In doing this the stress should be exerted sideways as well as upward, because the greatest amount of wear does not always take place on the bottom of the bearing lining. In any event, if there is any knock at all the rotor should be removed and stator pole surfaces inspected for rubbed areas.

In one case which came to the attention of the writer a 20-hp., 220-volt, three-phase induction motor was giving trouble due apparently to a hot bearing on the

pulley end. The whole end of the motor would get too hot to touch, and it became impossible to keep oil in the bearing on that end. The owner hesitated about stopping the motor because its continuous operation was so important. Instead he tried to cool the bearing with a block of ice. Finally the fuses in the pole transformer that supplied the motor gave way.

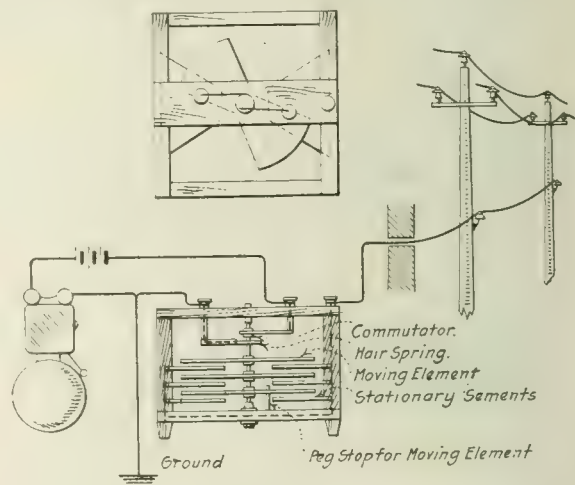
The first abnormal condition noted was that the motor was not protected by means of fuses. Furthermore, the transformer fuses were large enough for ten such motors. Inspection disclosed that rubbing had worn some of the stator laminations almost through to the winding. Judging from the wear of the bearing on the other end of the motor, the excessive heating must have been due, not to a hot bearing but to the rubbing of the stator by the rotor. Fortunately, the stator winding was not injured, and after renewing the bearings on both ends of the motor normal operation was permitted again. The owner of the motor also hastened to order a fuse panel for his second-hand compensator.

DEVICE FOR INDICATING DEAD INCOMING LINES

Trouble-Saving Arrangement Used at Important Junction of Lines in Cases Where Telephones Become Inoperative

So much trouble was experienced with the telephone communication at an important but isolated junction of several long power lines in Tennessee that the apparatus illustrated herewith was devised to ring a bell whenever one or more of the sections are de-energized. This was necessary because the telephone system which had been used paralleled the transmission lines and was seriously affected during line disturbances, lightning, etc., and because the nearest long-distance telephone was 15 miles (24.1 km.) distant.

The apparatus which was developed consists of an electrostatic voltage indicator constructed chiefly of old



ELECTROSTATIC VOLTAGE INDICATOR CONNECTED TO WARN OF INTERRUPTION OF SERVICE

watt-hour-meter parts. One span of wire is strung parallel to the power line and connected to the stationary segments of the voltage indicator. Two years' use of the apparatus has demonstrated its value when the telephone is out of service and one or more of the transmission lines are in trouble.

CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

RAPID GROWTH CHARACTERIZES DOMESTIC APPLIANCE LOAD

**Larger Holiday Trade than Ever Anticipated All
Over the Country—Price Concessions Less
Necessary than in Former Periods**

Almost without exception electric light and power companies engaged in retailing domestic appliances are meeting with an unprecedented demand from their customers. Sales are not only larger, but they involve much less expense than formerly. It has been found that expensive campaigns are not so necessary. Larger results are being obtained from smaller advertising expenditures. The reason, of course, is apparent; the supply of domestic labor is inadequate, and, besides, many customers are now for the first time in a position financially to purchase electrical appliances.

One large company in the East sold more vacuum cleaners recently in a few weeks than it used to sell in six months. A Southern property in the first month of its sale of electric-driven sewing machines disposed of forty-seven motors and fourteen complete sewing machines. Another company in one month sold at regular prices fifty-six washing machines in addition to other laundry appliances.

Many other instances could be cited, all of which would show that domestic labor-saving devices for the home are selling faster than ever before. In this connection, however, it has been noticed that some, not all, companies are still prone to offer exceptional price inducements to customers. In some instances, of course, these prices do represent a profit on the prices that were in effect as late as 1915, and it is not unlikely that in many of these instances the goods now sold were purchased at the lower prices. This is not true, however, in all cases.

DOMESTIC LOAD GOOD FOR ALL TIME

One thing is certain. This domestic load now being taken on is not one to fall off markedly when dull times come along. It is a fairly steady load. Moreover, except for electric cooking, this load is served at the maximum lighting rates, and thus has in most instances a high earning value to the utility.

Furthermore, this load represents not a single penny of outlay for line extension. The present installation is sufficient to accommodate the household devices.

Reports to the ELECTRICAL WORLD from every section of the country are to the effect that electrical labor-saving devices will have a far greater demand this coming Christmas season than ever before. For some years now the industry has been educating the public to give electrical presents. This year the Society for Electrical Development is back of a movement to stimulate holiday buying of electrical goods. The outlook from the demand viewpoint is encouraging.

The question that arises, therefore, at this time is

that of supply. Are the retail distributors sufficiently well stocked to supply the demand? It is doubtful if at this time an order of any size can be filled in time to meet the demand. Local jobbers in some instances have fair supplies of some products.

With the more or less limited supply on hand and with buying anywhere near as large as is anticipated, it becomes very evident that special inducements in price will not be as necessary as they may have been in the past. In fact, it will probably be found that customers will come prepared to pay the price asked. The public generally does not know the price of electrical goods, and consequently present prices bring up no unfavorable comparisons, but are accepted as they are. In fact, it has been found right along that the heavy demand has not come in the least expensive lines.

Furthermore, with expenses outdistancing those of the past, the profit on labor-saving devices will go a long way toward meeting the commercial department costs. While a good many companies are to-day putting into practice economies wherever it is felt they will produce results, it is equally justifiable to consider more ways of making a profit. It is a well-recognized fact that expense curtailment can only go just so far, beyond which it defeats its purpose.

UNIT COSTS FOR ACCIDENTS TO STREET-LIGHTING EQUIPMENT

**Plan for Rendering Bills Promptly Proves of
Assistance in Collecting Damages from
Careless Automobile Drivers**

The electrical department of Lincoln Park, Chicago, which operates and maintains about 8 miles (12.87 km.) of ornamental street lighting, has worked out a plan which enables it always to submit a bill for damage done to posts on its system within twenty-four hours after the accident occurs. This plan has enabled the commissioners to reduce considerably the number of uncollectible accounts arising out of accidents in which automobile drivers collide with lighting standards on the curbs and on the "isles of safety" that mark important street intersections.

The importance of such a system is apparent from the fact that last year it was necessary to write off about \$4,500 for damages of this sort on which the park could not collect. The insurance limit expiring in thirty days was responsible for a large part of this. It is also interesting to note that on the 8 miles of street lighted in the park as many as forty accidents to posts sometimes occur in the course of a single month.

The scheme was worked out as follows: From a large number of accident repair jobs in which automobiles had caused the damage averages of repair costs were

worked out. This gave the department a fair set of unit prices on which to base estimates of the cost of repairing any sort of damage to posts on its system. These unit costs are filed in the department's office, so that as soon as a complete report of the extent of damage from any accident is received an estimated bill for repairs can be mailed to the owner of the offending car. Collec-

PRICES OF STREET-LIGHTING EQUIPMENT, LINCOLN PARK

UNIT COST ISLE MATERIAL	
Isle post.....	\$16.60
Red globe.....	7.15
No. 14 duplex wire...	0.03
Rubber connectors...	0.35
Eight-light clusters...	3.00
Isle-light sign.....	3.60
Rubber tape.....	0.44
Handhole cover...	0.60
Friction tape.....	0.17
16-cp. lamp.....	0.20
32-cp. lamp.....	0.22
Isle base.....	18.35

UNIT COST LAMP-POST MATERIAL	
20-in. Alba globe.....	\$8.53
18-in. Alba globe.....	2.75
W. E. 400-cp. lamp.....	3.00
Protector for globe.....	0.88
Cement, per bag.....	0.65
Concrete post.....	22.60
Compensator.....	4.04
Triple-braided cable.....	0.075
Isle transformer.....	8.80
No. 1 duplex L. & R. cable.....	0.185
Cap and grill.....	15.00
Mogul socket and plate.....	1.50
2-in. galvanized pipe, per foot.....	0.18
2-in. elbow.....	0.45

	Labor	Sta. Exp.	Transp.	Material
Setting concrete post.....	\$19.75	\$8.00	\$6.12	\$51.20
Rebuilding manhole.....	27.22	5.52	2.75	27.25
Splicing in transformer.....	5.50	1.60	0.75	9.50
Lamp and globe broken, concrete post.....	0.85	1.00	1.00	*
Island light damaged without base.....	8.26	6.48	1.75	*
Island light base replaced....	16.60	5.50	3.75	21.60
Island globe and lamps damaged.....	0.90	1.75	0.75	*

*See list for material

tion is made on the basis of this estimated bill. As prices change the prices must, of course, be revised. The accompanying table shows the unit prices as approved and placed in effect in September, 1917, by Claude H. Shepherd, electrical engineer for the Lincoln Park Commissioners.

STRICT MEASURES FOR REDUCING DELINQUENCIES

Municipal Property When Account Runs for More than Two Months Denies Service Until Settlement of Bill Is Made

A municipal electric lighting system in one of the small Eastern towns has recently decided on a very strict measure for reducing delinquent accounts, and the plan is meeting with success. Instead of allowing customers to accumulate large unpaid accounts, the lighting plant's officials have decided that as soon as an account becomes two months old the customer will be considered a delinquent and further service denied until it is paid in full. It is not expected that this measure will result in the loss of more than half a

dozen customers, and already it has proved of benefit in reducing delinquent accounts.

Because of commission regulation it would, of course, not be possible for some companies to adopt such a measure. It is, nevertheless, true that a good many properties, especially smaller ones, could make much more stringent rules for delinquent accounts than they now have. At the present time not only must economies be effected in every possible way, but also it is equally important that all money owing the company shall be paid as promptly as possible. Electricity has reached such a position in civilized life and in present-day homes that it will probably not be found that strict measures will reduce the number of customers to any appreciable degree. On the contrary, they may materially increase the company's earnings by reducing the loss from unpaid accounts both in principal and interest.

MEETING THE COST OF WAR-TIME EXTENSION

Cleveland Electric Illuminating Company Introduces New Form of Contract Whereby Customer Finances Cost of Extensions

The Cleveland Electric Illuminating Company has established as part of its regular rate schedules a form of contract where new construction is required before service can be furnished. Under this contract, printed in full on the opposite page, a customer advances the cost of construction; the normal cost of such construction—that is to say, the cost as of July 1, 1914—is returned to the customer in periodical payments.

SUGAR MILL ELECTRIFICATION RESULTS IN ECONOMIES

Cane-Mill Engineer Points Out that Increased Production as Well as Decreased Costs Accompanied Electric Drive

At the sugar mill engineers' convention held last month at Honolulu, H. I., Robert E. Hughes presented a brief paper recommending the use of electricity in place of steam for drive in all new installations. He was very much in favor of electrification of sugar mills, and while no comparative figures as contrasted with steam drive were presented, he unqualifiedly stated that electricity was the more efficient. Mr. Hughes' remarks on this subject were in part as follows:

With the extension of the use of electricity for motive power in sugar factories, we have sufficient proof that its many advantages are very generally recognized. The application of electricity to all forms of power application has long since passed the experimental stage. The larger the scale on which electric power is generated the greater the economy.

Cane-sugar factory operation and general mill practice have been improved as the result of the application of the electric motor drive to the many pumps and line shafts in the factories, and almost without exception have been attended by the following results: Increased production, decreased operating expenses, decreased maintenance charges, greater ease of operation and increased reliability.

There are now some twenty or more sugar mills in the world completely electrified, and in every one the change to electric drive resulted immediately in better steam economy, lower maintenance and labor cost and greater reliability of service.

THE ILLUMINATING COMPANY

CONSUMER'S CHARGE APPLICATION FOR COMMERCIAL LOADS IN EXCESS OF 5-KW. CAPACITY

Applies in any instance where the company is required to make an expenditure for the installation or construction of the following:

SWITCHING APPARATUS:

For additional or specific switch gear, meters, instruments, panels, frames, control, cables and buses, connections and transformers, in switch houses or substations.

SUBWAY:

For additional or specific subway from generating plant to substation, from substation to consumer's premises, from generating plant to consumer's premises, or from substation to substation, or from substation to point of feeding overhead line, or from existing distribution system to consumer's premises.

CABLE:

For additional or specific transmission or distribution cable from generating plant to substation, from substation to consumer's premises, from generating plant to consumer's premises, or from substation to substation, or from substation to point of feeding overhead line, or from existing distribution system to consumer's premises.

OVERHEAD LINES—LINE EXTENSIONS:

For additional or specific overhead lines, including poles or towers, with necessary and usual equipment, wire, lightning arresters, line switches, ground wires or connections, or for any work on existing poles or towers, with all the attendant equipment as aforesaid, for increasing the existing distribution system or transmitting direct to consumer's premises.

TRANSFORMERS:

For any step-up or step-down transformers located in switch houses, substations, line houses or other structures, not otherwise specified.

SERVICE ON CONSUMER'S PREMISES:

For the installation of poles, towers, lines, ducts, cables and vaults; also, where the transformer capacity to be installed exceeds 50 kw., for the transformers and switches required; and for special transformers of 50 kw. capacity or less.

Name..... Date.....191.....

Premises.....
The undersigned hereby makes application to The Cleveland Electric Illuminating Company to install or construct, at the expense of the applicant, the following described work:

The above work is to supply.....kw. line capacity to the above premises, which capacity the company agrees to hold and reserve to the use of the applicant for ten years from the commencement of supply, subject to federal, state, county, township or municipal regulation.

1. The applicant deposits herewith the sum of.....dollars (\$.....), which is the estimated cost of the above work, upon the understanding that the work constructed shall at all times be and remain the property of the Illuminating Company.
2. Refund to the amount of.....dollars (\$.....), which is the estimated cost of the above described work as of July 1, 1914, and hereinafter called the normal cost, will be made to the applicant, subject to the terms and conditions hereinafter specified:
 - (a) on the current taken and used by the applicant from the work constructed under this application; and
 - (b) in addition, on the current taken and used by other consumers connected to the line or lines constructed under this application, except where the work constructed consists of feeders or an addition to the network in the general distribution system of the company, in which event refund to the applicant will be made only on the current used by those consumers who are connected to that part of the work specifically constructed for the applicant which extends beyond the network in the general distribution system of the company; provided, however, that in no case shall the amount refunded to the applicant on the current used by any such consumer exceed the normal cost of that portion of the work constructed which is useful in serving such consumer.
3. The amount to be refunded to the applicant shall be based upon the current taken and used within ten years after commencement of supply, but the total amount of the refund shall not exceed the normal cost of the work herein applied for.
4. The refund will be computed at a rate per unit as determined by the following formula:

dollars

$$\text{Refund rate per kilowatt hour} = \frac{\text{36000} \times \text{contracted kilowatt demand}}{\text{.....}}$$

The sum of money in the above formula is the normal cost of the above-described work. The refund will be paid by the company to the applicant annually, subject to the conditions herein stated.

The kilowatt demand in the above formula is the capacity contracted for herein and reserved to the use of the applicant by the company.

5. No refund or interest shall be paid unless the applicant's bills for current have been paid in full; nor shall any annual refund payment exceed fifty per cent (50%) of the sum of the bills for the current taken and used within the refund period from the work constructed under this application as herein provided.
6. The company reserves the right to refund at any time all or any part of the unrefunded portion of the normal cost of the specified work.
7. No refund nor interest whatsoever will be allowed on the excess cost of the specified work, which excess is the difference between the normal cost and the amount deposited.
8. Interest, not exceeding six per cent (6%) per annum, will be paid by the company to the applicant annually, upon the balance of the normal cost held at that time and subject to be refunded as herein provided. The annual rate of interest will be computed by the formula:

$$\text{Rate} = 6/10 \text{ of } 1\% \times \text{average hours use per day of the contracted kilowatt demand.}$$

The hours' use per day of the kilowatt demand in the above formula shall be determined by dividing the monthly average of the kilowatt-hours upon which refund is allowed by thirty (30) times the demand contracted for herein.

9. The interest and refund periods will be considered as terminating on the first day of February of each year, and payments shall be made to the applicant, as above provided for, upon the tenth day of the same month.

Canvassed..... Signed.....

Deposit Receipt No.....

All quotations made under this application are subject to change without notice.
All work to be performed is subject to delays due to receipt of material, strikes or labor shortage.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

DETERIORATION IN HEAT VALUE OF STORED COAL

Experiments Made by the Bureau of Mines Show that the Decrease in Calorific Qualities Has Been Overestimated

A REPORT on the loss in heating value in various coals due to storage, prepared by Horace C. Porter and F. K. Ovitz, has been issued by the Bureau of Mines. These carefully compiled data refer to New River (West Va.), Pittsburgh, Pocahontas and Sheridan (Wyo.) sub-bituminous coals. In brief it may be said that the tests show that the amount of deterioration of coal in heating value during storage has commonly been overestimated. Except for sub-bituminous Wyoming coal no loss was observed in outdoor weathering greater than 1.2 per cent in the first year or 2.1 per cent in two years. The Wyoming coal suffered somewhat more loss, 2 to 3 per cent in the first year and as much as 5.5 per cent in three years. Under severe conditions of outdoor exposure the New River coal deteriorates in heating value approximately 1 per cent in the first year, 2 per cent in two years and not more than 3 per cent in five years. The storage under water prevents practically all deterioration during one year, and no more than 0.5 per cent has been found in any test for two years or less. Salt water possesses no advantage over fresh water in preventing deterioration. Intermitent exposure and partial drying of the submerged coal probably cause deterioration in some degree, although very small.

The submerged storage of New River coal is not to be recommended for the sake of preventing deterioration in heat value. Its advantage lies only in insuring against spontaneous combustion. With Pittsburgh gas coal the deterioration in one year with open-air storage was practically negligible, even in the upper 6 in. (15.2 cm.) of the exposed coal. During the second, third, fourth and fifth years the deterioration proceeded very slowly and did not reach an amount greater than 1.1 per cent in five years. The submerged portions may be said to have suffered practically no loss measurable by the degree of accuracy used. During one year's outdoor exposure the Pocahontas coal deteriorated very slightly (less than 0.4 per cent) in heating value, and the deterioration took place almost entirely during the first six months. There was a further deterioration of 0.4 per cent during the second year. Evidently Sheridan coal (a variety of black lignite) loses 3 to 5.5 per cent of its heating value in about three years' storage, the greater part (70 to 80 per cent) of this loss being in the first nine months. During the period of two and three-quarter years the deep bins suffered the greatest loss, probably because their sides offered greater surface access of air than those of the small bins. The latter became covered with a 12-in. (30.5-cm.)

layer of fine slack that helped to protect the layers beneath from oxidation. In the deep bins the lumps became badly cracked but retained their form sufficiently to give more ready access of air and thus permit greater oxidation. When storing this grade of coal for more than three months, covering the bins is not so advantageous as the use of air-tight bottoms and sides and the accumulation of a protecting layer of fine slack on the surface. In this manner the deterioration can probably be kept below 3 per cent in one year and will probably not increase to more than 4 per cent in two or three years if the coal remains undisturbed.

Physical deterioration (slacking), the report goes on to assert, is also very largely prevented in the upper portions by the formation of a closely packed layer of slack, at least 12 in. (30.5 cm.) thick. Although no indications of spontaneous heating were noted in the tests, it is dangerous to store Sheridan coal in piles greater than about 10 ft. (3 m.) in depth or width. In large masses of coal radiation of spontaneously developed heat is restricted to a dangerous degree. Submergence under water would probably prove particularly advantageous as a means of safely storing sub-bituminous coal of the Sheridan type.

Generators, Motors and Transformers

Series and Parallel-Connected Windings in Continuous-Current Machines with Auxiliary Poles.—J. VORONOFF.—The author maintains that the choice between series winding and parallel winding in designing continuous-current machines should be made after a detailed study of the respective advantages and disadvantages of each method and for each machine separately. With the aid of the formulas of Professor Arnold he studies the different cases in which one or the other of the two methods will be the more satisfactory from the point of view of commutation. In addition he directs attention upon the means of improving the commutation by diminishing the permeance of the slot and the air gap, as well as upon the different manner in which the current acts with each kind of winding.—*Revue Gén. de l'Elec.*, Oct. 6, 1917.

Lamps and Lighting

Code of Lighting School Buildings.—This code has been prepared by committees of the Illuminating Engineering Society in order to make available authoritative information for legislative bodies, school boards and others interested in enactments, rules and regulations for better lighting. While the code is intended primarily as an aid in formulating legislation relating to the lighting of school buildings, it is also intended as a guide to school authorities in individual efforts to improve lighting conditions.—*Illuminating Engineering Society*.

Generation, Transmission and Distribution

Water Power in Sweden.—Because of the scarcity of coal in Scandinavia and the increased demand in Sweden for products which heretofore have been imported from Germany, England and to a small degree from the United States, hydroelectric power production showed enormous gains during 1916. Exact figures for the entire country are, of course, not yet available, as no industrial general census has been taken in Sweden recently, but an inkling of the extraordinary spread of hydroelectric installations is given in the report of the Royal Swedish Waterfalls Commission, which gives a clear financial and technical résumé of what has been accomplished in the state-owned and state-controlled waterworks during 1916. In a purely financial way the waterworks proved very profitable for the state treasury, turning into it a net profit of 1,143,499 kroner. The gross income was 1,580,598 kroner, and the operating expenses (including all the salaries, rents and new equipment) 438,904 kroner. The waterworks under the control of this commission comprise four primary stations, ten secondary stations and sixteen tertiary stations, with high-tension lines stretching for a distance of 781.7 km. (485.6 miles). Of this total distance, 267.9 km. (166.5 miles) operate at 70,000 volts, 90 km. (55.9 miles) at 40,000 volts, and 401 km. (249.2 miles) at 20,000 volts. During the year 1916 no less than forty-six industrial plants, municipal establishments and electric lighting and power companies contracted for energy from these stations, and large additions will have to be built in all the power houses to meet the constantly increasing demand for electricity. The energy developed in the power stations amounted to 121,753,370 kw.-hr. Of this amount the 70,000-volt lines carried 75,688,100 kw.-hr., the 40,000-volt lines 5,973,410 kw.-hr. and the 20,000-volt lines 31,576,960 kw.-hr. Losses in the transformers and for use as lighting and heating current in the power stations and along the lines amounted to 21,150,837 kw.-hr.—*Report of the Swedish Royal Waterfalls Commission, No. 15, May 31, 1917.*

War's Influence on Electric Power in France.—The scarcity of coal in France has caused an extraordinary development of electric generating companies, especially in the Alpine and Pyrenees sections. From a total of 1173 establishments, of which only seven developed more than 10,000 hp., the industry jumped during 1915 and 1916 to more than 5,000,000 hp., with several establishments producing more than 40,000 hp. and one even reaching 250,000 hp. One of the dams in the Pyrenees will gather about 500,000,000 cu. m. (about 654,000,000 cu. yd.) of water for use in the production of electricity. High-tension lines are to distribute the current over nearly all of France.—*Teknisk Uteblad, September, 1917.*

Traction

Barcelona Traction, Light & Power Company.—A. HUGUENIN.—A short history and description of the system of the Barcelona Traction, Light & Power Company. The object of the company is to supply electric energy at cheap rates to the whole of the Barcelona district, and its program includes the conversion of the existing steam-power station at Barcelona into a standby station and turning to account the water power available in the rivers Noguera, Pallaresa, Segre and

Ebro, from the township of Pobla down to the Mediterranean.—*London Engineering, Sept. 21, 1917.*

Fuel and Electrification in Switzerland.—M. EMANUEL KUHNE.—The scarcity of coal in Switzerland has led to the resumption of mining where it had been abandoned because of insufficient return. There are layers of lignite in several of the cantons, and anthracite is to be found in Valais, where a reserve of 15,000,000 tons is estimated to exist. These somewhat meager sources, however, will by no means take the place of the imported coal used before the war, which in the year 1913 amounted to 107,000,000 francs (about \$20,200,000) in value. Consequently a great impetus has been given to the electrification of railroads, which is proceeding rapidly. For the present the government has enforced a reduced schedule on its lines, which has interfered with inter-city relations and even with the mails. Users of gas also have had their supply cut down to three-quarters of what it was, all in excess of this being charged for at a quadruple rate.—*Revue Gén. de l'Elec., Sept. 29, 1917 (reprinted from L'Economiste Français).*

Energy Saving on Street Railways.—A. M. BUCK.—The author discusses the influence of some variables on the energy consumption of street cars. If by slight changes in operating methods it is possible to reduce the input to the cars by 25 to 50 per cent, as may in many instances be the case, the results will be even more than the mere saving in cost of energy represented. The generators will be able to drive more cars, the transmission lines and feeders will likewise have greater apparent capacity, pressure regulation will be improved, and minor savings made all along the line. It is also a fact that the smaller amount of energy passing through the motors will cause less loss in them with reduced heating, so that they can either be used on larger cars or replaced by smaller motors on the old equipment. The savings thus work out into an almost endless chain. These statements, the author says, are not merely theories, but facts proved on many roads in different countries. When it is considered that these benefits are applicable to any road and that but few are availing themselves of them, it seems well worth the while of every manager to see what can be done to induce proper manipulation of his car equipment.—*Sibley Journal of Engineering, October, 1917.*

Installations, Systems and Appliances

Electric Drives for Warships.—A short article discussing some of the most important advantages of electric drive for warships. The article brings out in particular four features of electric drive, namely, interchangeability, backing power, efficiency of transmission and cruising economy.—*London Engineer, Sept. 14, 1917.*

Boiler-House Design.—HERBERT E. BIRCH.—In the first part of this article the author points out the lack of care in boiler-house design as shown by many different arrangements of apparatus and structural details. The article then follows with a statement of the essential requirements and a careful discussion of the advantages and disadvantages of several arrangements. Various methods of storing and charging coal are shown. A page illustration gives cross-sections of several poorly laid-out boiler houses. The second installment of this article takes up the problem of getting the

coal into the boiler-house bunker and deals with elevating and conveying machinery. The general advantages and disadvantages of several types of feeders, coal crushers, elevators and horizontal conveyors are pointed out, with numerous practical comments in regard to their installation and operation.—*Industrial Management*, September and October, 1917.

Electrophysics and Magnetism

Penetrating Powers of the X-Radiation from a Coolidge Tube.—E. RUTHERFORD.—This paper contains an account of some experiments made to determine the maximum penetrating power of the X-ray excited by high voltages in a Coolidge tube using lead as the absorbing material. The absorption has been examined over a very much wider range of intensity and of thickness of absorber than in any original experiment of Rutherford, Barnes and Richardson. According to the tests made, there was not much change in the value of the absorption coefficient μ for the end radiations between 79,000 volts and 144,000 volts and no observable change in μ between 105,000 volts and 144,000 volts. In the latter range the radiation is absorbed nearly exponentially with the value of μ equal to 22. Above 144,000 volts the absorption is no longer exponential, but the value of μ decreases progressively with increase of thickness of absorber. This is best shown by the results for 183,000 volts, where the value of μ decreases from 26 to 12 as the thickness of the absorber is increased from 0.7 mm. to 7 mm. The absorption of the end rays by aluminum was found unchanged between 142,000 volts and 175,000 volts after the rays had passed through 2.49 mm. of lead as absorber. Under these conditions the issuing radiation consisted mainly of the characteristic radiation of lead with the value of μ equal to 22, and no observable change in the absorption of aluminum is to be expected under the experimental conditions. A few isolated and approximate measurements were made of the absorption of the rays by aluminum under different conditions. The observations on the absorbing rays in aluminum and lead throw important light on the probable wave lengths of the penetrating gamma rays from radioactive substances. From the results obtained the author concludes that the wave lengths of the main gamma rays are much shorter than was previously supposed. The gamma rays from radium C consist mainly of waves of about one-hundredth the wave length of the soft gamma rays from radium B and are of considerably shorter wave length than any so far observed in an X-ray tube with the highest voltages obtainable. It appears probable, says the author, that the observed groups of beta rays are due to the conversion of energy into electronic form and that consequently the energy of the beta ray groups may be utilized to determine the wave lengths of the penetrating gamma rays. The result as a whole suggests that the groups of beta rays are due to the transformation of the gamma into single and not multiple quanta.—*London Philosophical Mag. and Journal of Science*, September, 1917.

Emission of Electrons by a Metal Bombarded by Positive Ions in a Vacuum.—W. L. CHENEY.—This paper compares the magnitude of the thermionic current in a vacuum corresponding to various potential differences with the thermionic current corresponding to a potential difference of 15 volts. The ratio of the

number of electrons leaving the cathode to the number of positive ions striking it has been found with positive ions of different velocities and for different metals, namely, aluminum and platinum. This ratio has been found to depend on the velocity of the positive ions. It appears that the effect is at least partly due to gas in the metal.—*Physical Review*, October, 1917.

Electrochemistry and Batteries

Steel Making in the Electric Furnace.—This article is descriptive of the first Australian installation for the production of high-grade steel castings and ingots of special steel. It is pointed out that the plant described has been in operation for only six months, but in spite of initial difficulties with local materials and the lack of skilled labor, a standard of regular practice has been reached which compares very favorably with longer-established European plants.—*Commonwealth Engineer*, Sept. 1, 1917.

Lead Plates in Storage Batteries.—L. JUMAU.—Second part of a continued article on the actual state of the storage-battery industry. In this installment the author develops some considerations upon the conditions of manufacture and use of lead plates, directing especial attention to the molecular state of the active materials and their solubility in the electrolyte. The author says that these are new questions that have an important bearing upon the technical qualities of the electrodes and which will well repay further study.—*Revue Gén. de l'Elec.*, Oct. 6, 1917.

Miscellaneous

Coking of Illinois Coals.—F. K. OVITZ.—The data in this paper have been presented by the Bureau of Mines in co-operation with the Illinois State Geological Survey and the University of Illinois to promote a more efficient use of coal. Some of the subjects discussed in this report are the following: Character of coking process; present conditions regarding coking of Illinois coals and future prospects; general results of use of mixtures of Illinois and other coals for making coke; effects of various factors on coking; Illinois coals available for coke making; character of coals; historical review of coking of coals, and detailed results of coking tests.—*Bureau of Mines Bulletin No. 138*.

Some Unusual Features in the Microstructure of Wrought Iron.—HENRY S. RAWDON.—Wrought iron is usually described as being of a very simple structure as revealed by the microscope compared with many of the alloys in commercial use. A study of the microstructure of a series of commercial wrought irons carried out at the Bureau of Standards, however, has shown the occurrence of some very peculiar and unusual variations in structure in such material. Many of the ferrite crystals, when properly prepared and etched for microscopic examination, show a decidedly banded structure instead of the homogeneous appearance usually described. This unusual structure is to be attributed to a relatively high phosphorus content in such portions and to a non-uniform distribution of this element. Although most specimens showing these unusual features of structure are of a rather poor grade, they are not characteristic of low-grade iron in general. The probable relation between such microstructural features and "fatigue" failure of such material is suggested.—*Technologic Paper No. 97*, Bureau of Standards.

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

USE OF CENTRAL STATION

URGED IN MASSACHUSETTS

Fuel Administrator Commends Use of Central Station Service to Save Coal Badly Needed in New England States

A timely suggestion to isolated-plant owners is being sent out by James J. Storrow of Boston, Fuel Administrator for New England, regarding the economies of central station service under present conditions. Each central station in Massachusetts received a letter recently from Philip Wrenn of the department of power economy at the Fuel Administrator's office, State House, Boston, asking for a list of isolated plants in its territory which in the company's opinion might save fuel by adopting central station service. This letter in a typical case read as follows:

I am writing to you at the request of J. J. Storrow, New England Fuel Administrator.

Because of the serious shortage of coal threatening New England this winter, we wish wherever possible to eliminate such waste as may exist through the maintenance of isolated or independent plants whose power could be furnished by the nearest central station with a materially reduced consumption of coal. Will you be good enough to inform us of the situation in the territory surrounding your station? If there are plants whose type of apparatus would permit them to change to your service without abnormal expense to them or to you, please send us the names of the plants and of the men in control.

Are there any concessions in the form of contract or in price of service which you are willing to make for the period of the war?

Central stations receiving these letters have in general recognized the opportunity afforded to press home the economic value of their service. Lists have been forwarded to the Fuel Administrator as requested, and the following typical letter has been sent by Mr. Storrow's office to the power users considered as "prospects" by the central stations:

Because of the very serious shortage of coal throughout New England we have asked the central stations throughout the State to send us lists of isolated plants which in their opinion could with very little or no expense save an appreciable amount of coal by taking power from the central station. The Worcester Electric Light Company (e.g.) has named your plant as one coming under this head. May we ask you to give this matter your urgent consideration?

In the case of the Worcester company the names of seventy-one isolated plants with a total prospective additional power load estimated at about 10,000 kw. were sent to Mr. Wrenn. These plants were classified under two lists, one showing the installations either on the company's lines partly or which easily could put their whole load on these lines, or plants that could be changed over at little expense, the other plants requiring a complete change-over from engine to electric motor drive. It was pointed out that the principal difficulty in making this addition to the local system's load would be in securing motors and transformers for the

OUR NEW ADDRESS

Beginning on Nov. 26, the publication and general offices of the ELECTRICAL WORLD will be at Tenth Avenue and Thirty-sixth Street, New York. The building at that location will be the headquarters in New York for the various publications of the McGraw-Hill Publishing Company, Inc.

Our friends will be welcomed most cordially at the new offices.

required large increase in service. At Worcester there are forty-one plants of the class requiring complete change-over, with an estimated load of about 5500 hp.

At a recent meeting of the fuel committee of the Boston Chamber of Commerce W. H. Atkins, general superintendent Edison Electric Illuminating Company of Boston, stated that if all the isolated plants now in the Boston territory could be taken over into Edison service there would be a saving estimated at 300,000 tons of coal per year. Twenty-one plants recently investigated consume 139,000 tons, and if all these were operated on the Edison system there would result a saving of about 57,000 tons, representing 1900 30-ton carloads. The isolated plant is coming over to the company's service with full appreciation of the savings effected, and in some cases the problem is solved by operating the isolated plant on the peak, carrying the rest of the load of the twenty-four hours on the Edison company. In this way the December load can be carried without extra investment by the company other than the ordinary service equipment.

MEETING OF GOVERNORS OF ASSOCIATED MANUFACTURERS

D. C. Durland Resigns as Member of Board and Dana Bullen Named as Successor—R. K. Sheppard and J. R. McKee on War Service Committee

At a meeting of the board of governors of the Associated Manufacturers of Electrical Supplies, held at the general offices, New York, on Nov. 21 D. C. Durland resigned as a member. Mr. Durland withdraws from the board because of his resignation from the General Electric Company to become president of the Mitchell Motor Car Company. Dana Bullen, General Electric Company, was elected to succeed Mr. Durland as a member of the board of governors.

R. K. Sheppard, Simplex Wire & Cable Company, Boston, and J. R. McKee, General Electric Company, New York, were named by the board of governors to serve as representatives of the Associated Manufacturers of Electrical Supplies on the war service committee of the Electrical Manufacturers' Council.

ADMINISTERING SIGN ORDER IN THE CHICAGO DISTRICT

Commonwealth Edison Company Sends Garfield
Regulation to 12,000 Sign Users—Spirit of
the Requirement Obeyed

As the first step in assisting electric sign owners to obey the regulation of the United States Fuel Administration, the Commonwealth Edison Company of Chicago mailed a copy of the order to each of 12,000 electric sign users in Chicago. The company secured a complete list of electric sign users from Victor H. Towsley, chief electrical inspector, City Hall. Notices were sent to this number in spite of the fact that only about 10,000 of the signs are on the Commonwealth company service. As there was some delay in getting the order in Chicago, it has not yet been determined what the effect in coal saving will be. Judging from figures which were prepared showing that only 0.75 per cent of the coal used would be saved in case the entire electric sign load were discontinued, it has been observed that the effect will be very small. Patrolmen charged with the duty of reporting sign owners who violate the order say that the spirit of the order is being lived up to pretty generally.

REPORTS TO WASHINGTON ON SIGN-LIGHTING ORDER

National Fuel Administration Receives Advices of
Some Violations, Which Are Being Investigated
—Studying Effect of Conservation

Some violations of the sign-lighting order issued recently by the Fuel Administration are reported in advices from the Washington representative of the ELECTRICAL WORLD. Field agents of the Fuel Administration have been ordered to investigate the alleged violations, with a prospect that offenders will be prosecuted immediately.

It is stated at the office of the Fuel Administration in Washington that it is not known yet whether the alleged violations have been the result of accident or design, but that the Fuel Administration is keeping a close watch on those who are expected to obey the order and on the effect of the order. It is stated that not sufficient time has elapsed to show how much coal will be conserved as a result of the regulation, but that the Fuel Administration hopes to have a table ready within two weeks showing a certain amount of conservation. This table, it is stated, will be based on the amounts of coal power and lighting companies have been receiving during weeks before the order was issued and the amounts received since then.

Notwithstanding that the order is in force, arguments are still heard against it, based on what is happening. It is stated that in many cities noted heretofore for brightly lighted thoroughfares, which were the resort of promenaders in the evening, fewer persons are seen on the streets at night, with the necessary attending result that more lights are used in the interiors of homes and places of resort, which, it is stated, causes the use of as much if not more fuel than would be consumed in sign lighting under the old system.

In the city of Washington there are very few large electric signs of an advertising character. The Potomac

Electric Power Company states that the cutting off of the signs and curtailment made necessary by the order means a loss of about \$2,000 annually.

COMPLIANCE IN NEW YORK WITH SIGN-LIGHTING ORDER

Some Questions of Details Have Arisen in Enforcement of the Restriction, but They Are
Being Worked Out

In New York City, where the volume of sign lighting due to the Broadway "white way" makes the order of Fuel Administrator Garfield of special interest, the new restrictions are generally complied with fairly. A number of detail questions have arisen as to the application of the order to moving-picture theaters, etc., but these are being worked out gradually.

ELECTRIC SIGN CURTAILMENT IN THE NEW ENGLAND STATES

Careful Inquiry Fails to Disclose Any Saving in
Fuel So Far Which Can Be Identified
as Due to Order

Central stations throughout New England complied promptly and patriotically with the order of Fuel Administrator Garfield relative to curtailment of electric sign service. In some cities and towns the public has not acted upon this order to the extent anticipated in the near future, but this condition is merely temporary. It has been found already that reduction of electric advertising display is increasing expenditures for newspaper publicity by merchants and other interests. Central stations have accepted the Garfield order in the spirit of full co-operation. A silver lining to the cloud of lost revenue from sign business is found in the increased amount of isolated-plant service now being taken over by central stations, on the basis, as one prominent utility executive puts it, of 5.5 lb. of coal per kilowatt-hour versus 2 lb. (the central station index of efficiency).

A careful inquiry by a representative of the ELECTRICAL WORLD fails as yet to disclose any saving in fuel due to sign curtailment which can be identified as such. The log sheets and daily load curves of several representative plants compiled before and after the institution of sign curtailment show nothing in the way of coal economy which can be attributed to the government's restrictive policy. On the Narragansett Electric Lighting Company system, Providence, R. I., the peak load fell at 6 p. m. from a maximum of 32,000 kw. to 26,000 kw. on two representative days prior to and subsequent to the order. The shape of the curves was practically identical. In this particular city a large number of small signs are in use which do not fall within the strict 7.45 p. m. to 11 p. m. burning period, and there are not so many spectacular signs apart from entrances and interiors of establishments as in some other places.

A comparison of station records at the Worcester (Mass.) Electric Light Company generating plant, for two "before" and "after" days, is given below. It will be seen that other conditions led to an actual increase of output and of total fuel consumption on the day

when sign curtailment was in force. As in Providence, it was impossible to detect on the station load curve any effect due to reduction in sign operation:

	Before Wed., Nov. 14	After Fri., Nov. 16
Three-phase energy generated, kw.-hr..	175,000	179,500
Peak load in kw. (5 p. m.).....	14,600	15,400
Hours of service of generator units:		
No. 1. 4500-kw.	24	24
No. 2. 2000-kw.	11 h. 15 m.	11 h. 5 m.
No. 3. 2000-kw.	0	0
No. 4. 2000-kw.	1 h. 15 m.	1 h. 35 m.
No. 5. 4500-kw.	15 h. 50 m.	15 h. 50 m.
Kw.-hr. output of each unit as above:		
No. 1.....	88,300	90,000
No. 2.....	18,200	18,600
No. 3.....	0	0
No. 4.....	2,300	2,700
No. 5.....	66,200	68,200
Coal consumed, lb.....	526,400	489,300
Coal per kw.-hr., lb.....	3.01	2.73
Station load factor in per cent.....	42	48
Pounds water per kw.-hr.....	20.4	20.4
Weather	Fair	Fair
Duration of peak in hours.....	1	1
Comparative loads (kw.):		
7.00 p. m.....	7,700	7,600
7.30 p. m.....	7,800	8,000
8.00 p. m.....	7,400	8,100
9.00 p. m.....	6,500	7,100
10.00 p. m.....	5,400	5,100
11.00 p. m.....	4,400	4,400
12.00 p. m.....	3,100	3,100

On the day after the curtailment went into effect the actual total loads on the station just before, during and after the permitted hours of burning were greater than when the signs were in use *ad libitum*. The company advertised the order of Dr. Garfield in the local press and has cut off the service of its own large signs. It estimates a loss of sign revenues of about \$3,500 per year.

On the Boston Edison system the effect of the curtailment cannot as yet be identified on station output curves. So far the variations of the weather have more influence upon the station output and coal consumption than the curtailment. It is estimated that the total annual income from electric signs on this system is about \$150,000, and that the absolute shut-down of all signs would save about 3500 tons of coal yearly. The Fuel Administrator of Massachusetts, J. J. Storrow, has recommended that window lighting be curtailed from Nov. 19, as shown in the following bulletin:

TO ALL MERCHANTS:

At the instigation of the Mercantile Bureau of the Worcester Chamber of Commerce the retail stores in Worcester are putting into effect the following recommendations, commencing Monday, Nov. 19, 1917:

1. Turn off the lights in the show windows at 8 p. m. It is understood that if a store keeps open for business after 8 p. m. it will turn off its show-window lights at the time the store closes.
2. Discontinue all electrical advertising signs as directed by the government.
3. Make a general effort to reduce the amount of heat, light and power used in retail stores.
4. Do not turn on the lights in showcases until 10 a. m.
5. Discontinue all window lights on Sunday night.
6. Display the "Help Save Coal" posters issued by the Massachusetts Fuel Administration so as to inform the public of what the merchants themselves are doing, in the hope that the public will be sufficiently impressed with the necessity of coal conservation.

We strongly indorse these recommendations and ask the merchants of Worcester to co-operate with us by putting them into effect.

It is too early to discuss the effect of this recommendation.

CALIFORNIA NOT AFFECTED BY SIGN-LIGHTING ORDER

Federal Restriction Construed on Pacific Coast to Be Measure of Relief in Railroad and Coal Industries

The Garfield order restricting electric sign lighting has not affected California, reports the San Francisco correspondent of the ELECTRICAL WORLD, because the order is construed there to be a coal-conservation and freight-car-relief measure. In this territory all stand-by stations which carry peak load burn oil delivered from the oil fields by long pipe lines. Thus until there are further orders from Washington there will be no restrictions on the use of electricity for any purpose in the Northwest. In some of the Rocky Mountain States coal fuel is used, but even there the effect of the order will be very slight. The Puget Sound Traction Company, for example, estimates that out of 250,000,000 kw.-hr. only 30,000 kw.-hr. is used for display lighting, and most of this is during the hours permitted.

ACQUIESCENCE IN KENTUCKY IN SIGN-REGULATION ORDER

Curtailment Expected to Result, However, in Only Negligible Saving in Coal—Economy in "White Way" Systems

In Louisville as well as all over Kentucky there has been general acquiescence in the Fuel Administration's suggestion that electric signs be limited. On the other hand, the observation is noted that this curtailment will result in a negligible saving of coal. Donald McDonald, vice-president and general manager of the Louisville Gas & Electric Company, is quoted as saying that curtailment of service in Louisville will amount to little more than reduction in consumption of one ton of coal a day, if, indeed, that much, and the company operates its own mines. Several isolated plants have curtailed similarly, and there is a general disposition to heed the suggestion whether or no. Some smaller Kentucky cities are reducing consumption by turning off two or more lights in cluster standards of "white-way" systems.

WAR SURCHARGE FOR BYLLESBY COMPANIES

Minneapolis General Electric Company to Add 10 per Cent for Power Bills and 5 per Cent for Lighting Bills—Iowa Company Acts

The Minneapolis General Electric Company, one of the larger operating units of the Northern States Power Company, has announced an increase in service rates effective on Jan. 1, 1918. After that date a temporary war-condition surcharge of 10 per cent will be added to power bills and 5 per cent to lighting bills. The executive committee of the Minneapolis Wholesalers and Retailers' Association has approved this action by unanimous vote.

The Ottumwa (Iowa) Railway & Light Company has announced that a war-condition surcharge will be added to the rates charged for electric light and power and steam heat.

ANXIOUS TO KNOW WHAT ARE "LESS ESSENTIAL" INDUSTRIES

Forthcoming Priority Order in Transportation to Be Means of Controlling Supplies of Coal and Other Material

Washington is being deluged by anxious inquirers who desire to know, in behalf of industry generally throughout the country, just what the so-called "less essential" industries will prove to be, in the view of the government officials and the industrial leaders who are assisting them, when the forthcoming priority order in transportation is issued.

The understanding in Washington is, according to the Washington correspondent of the *ELECTRICAL WORLD*, that the forthcoming order will undertake to tabulate, or that there will be issued at the same time as the forthcoming order a tabulation of, all the industries of the country in what is believed to be their relative order of importance so far as prosecution of the war is concerned. It is believed to be certain that there will be a number of industries toward the end of the list which will be obliged to shut up shop, and that their labor and coal and in some cases material will be turned over, if possible or wherever adaptable, to industries essential in the prosecution of the war.

"EXCESS PROFITS ADVISERS" MEET DAILY IN WASHINGTON

Many Attacks on Excess Profits Provision of the War Revenue Law Reaching the National Capitol—Congress May Act

The "excess profits advisers" of the Commissioner of Internal Revenue are holding daily sessions in Washington in an endeavor to gather and tabulate information which will aid the Commissioner and the Secretary of the Treasury in administering the law. The Commissioner recently sent out more than 2000 letters to various trade and technical organizations of the country, among them the Associated Manufacturers of Electrical Supplies, asking for information which will assist in administering the law. This information is now being considered by the "excess profits advisers." It is being held confidential.

The board of advisers includes Representative Cordell Hull, member of the House ways and means committee, chairman; T. S. Adams, economist, Yale University; Wallace D. Simmons, president Simmons Hardware Company, St. Louis; J. E. Sterrett of Price, Waterhouse & Co., accountants, New York; S. R. Bertron of Bertron, Griscom & Co., bankers, New York; E. T. Meredith, editor *Successful Farming*, Des Moines, Iowa; T. W. McCullough, editor *Omaha Bee*; Stewart W. Cramer, National Council of Cotton Manufacturers, Charlotte, N. C., and Henry Walters, chairman Atlantic Coast Line and the Louisville & Nashville railways.

Vigorous attacks on the excess profits provision of the law are reaching Washington in every mail and are beginning to appear in important newspapers of the country, as lawyers, actuaries and others complete their analysis in the endeavor to advise clients how to pay their excess profits taxes. Commissioner of Internal Revenue Roper frankly admitted to the Washington correspondent of the *ELECTRICAL WORLD* that the Treasury

Department expects considerable difficulty in administering the law, owing to what has been termed by some persons the ambiguity of its language. It is now expected in Washington that Congress will be obliged to straighten out some of the apparent inconsistencies by special enactment at the coming session.

TRANSPORTATION FOR THE NON-ESSENTIAL INDUSTRIES

Chairman Lovett Gives Assurance that No Industry Will Be Eliminated Without an Op- portunity to Be Heard

Robert S. Lovett, chairman of the Priority Board, states regarding transportation of "non-essentials":

While the situation may change, yet I am not at this time contemplating any further action with respect to transportation of non-essentials. Priority Order No. 2, with regard to open-top cars, went as far as it seemed wise to go in dealing with that problem by restricting the transportation of non-essentials.

Conditions, however, will be constantly observed. Whether the coal shortage requires restriction of the coal supply of non-essential industries is a question for the Fuel Administrator, Dr. Garfield, to determine.

As to the War Industries Board, apart from my action under the priority act with respect to transportation, I may say that the industries of the country would seem to be justified in assuming from the action of the board in the matter of copper and steel prices, and its record generally to date, that it is the desire and policy of the board carefully and liberally to conserve the interest and welfare of industries.

I feel safe in saying that the board will take no action designed to eliminate any non-essential industry without reasonable notice and an opportunity to be heard.

LIMITATION OF COAL FOR NON-WAR PRODUCTS

Dr. Garfield Determined that Sufficient Coal for the War, for Public Utilities and for Domestic Consumers Shall Be Provided

This statement by United States Fuel Administrator Garfield was issued on Nov. 17:

If voluntary economy on the part of industrial and domestic consumers, added to the increased coal production of 1917, which will reach a total of over 50,000,000 tons, does not provide fuel enough for the war and to keep our people warm, there will come a time when some limitation will have to be imposed upon manufacturers of non-war products. In such an event the business world may feel sure that all the bearings of such limitations will be given thorough consideration and that the necessary coal will be obtained with the least possible interference with industry.

Arbitrary limitation is a last resort and to be avoided if possible. In many cases industrial concerns have already begun a voluntary curtailment of their use of coal. Such efforts will receive the fullest support and encouragement of the Fuel Administration, including technical advice on the use of fuel. The important point for every one to remember is that if coal is now consumed in the old "peace-time" way the supply will fall 50,000,000 tons short of necessary requirements in spite of the large increase in production. As I have stated before, the Fuel Administration is determined that sufficient coal for the war, for public utilities and for domestic consumers shall be provided.

The way to prevent those losses incident upon limitation of industry is for every consumer of coal to cut off waste and unnecessary consumption with an iron hand and to start on this intensive course of conservation without a moment's delay.

CAMPAIGN TO HELP THE ELECTRICAL CHRISTMAS

Society for Electrical Development Is Pushing Its
Campaign to Draw the Attention of People
to Practical Gifts

This year's campaign of the Society for Electrical Development, New York, in furtherance of "America's Electrical Christmas" is progressing. A book just published by the society, which is being sent gratis to members and non-members upon request, designed for central stations and dealers, is filled with practical suggestions for stores of all sizes in large or small cities.

WESTINGHOUSE AGENT-JOBBERS DISCUSS TRADE RELATIONS

At Hot Springs Convention This Week Association
Members Expressed Belief That Now Is the
Time to Develop Merchants

A three-day annual meeting of the Westinghouse Agent-Jobbers' Association was held at Hot Springs, Va., beginning on Monday, Nov. 19. Reports and papers were presented by members and guests of the association, taking up particularly questions having to do with the agent-jobber's relations to his customer, the development of better merchandising relations in the industry and the definite relation of the Westinghouse Agent-Jobbers' Association to the better merchandising movement. Members of the association expressed the belief that now was the time to help to develop merchants in the industry, and a committee was appointed to devise ways and means to carry out a constructive program.

A complete plan of reorganization of the work of the association was outlined by the executive committee and adopted by the convention. The work of the association is to be carried on by an advisory board, of which Samuel A. Chase, Westinghouse Electric & Manufacturing Company, is chairman. The work of the board is divided into six subjects—advertising, supply, motors, sales methods, demand and production. Each of these subjects will be handled by two directors, one a representative of the Westinghouse company and one an agent-jobber. Associated with these directors under each subject is an agent-jobber as an adviser on a specific line of apparatus.

The lines of apparatus are as follows: Switches and protective apparatus, meters, transformers, insulation, railway accessories and line material, lighting apparatus and rectifiers, fans, heating appliances and motors. By this method there will be under each subject a committee of two directors seeking special information from an appointed group of advisers in the association.

Emphasis on the merchandising problems was given by a paper on "The Coming Merchant," by F. M. Feiker, editorial director *ELECTRICAL WORLD*, and in addresses and discussion by members of the association under the subject of advertising and sales methods.

"War and Its Obligations" was the subject of an address by Harry Dwight Smith, president of the Fuller & Smith Advertising Agency. An address was made by John J. Jackson, general attorney of the Westinghouse

Electric & Manufacturing Company, entitled "Your Duty."

Attendance fines, as well as the entrance fees to the golf tournament, were contributed by vote of the association to the Red Cross and Young Men's Christian Association funds.

The officers for the coming year are as follows: President, J. C. Schmidtbauer, vice-president of Julius Andrae & Sons Company; vice-president, S. L. Nicholson, Westinghouse Electric & Manufacturing Company; secretary, A. J. Cole, vice-president McGraw Company; assistant secretary, P. T. Pritchard, Westinghouse Electric & Manufacturing Company; treasurer, J. E. McLeron, president Northwestern Electrical Equipment Company; counsel, John J. Jackson, Westinghouse Electric & Manufacturing Company.

NEW YORK CONTRACTORS HOLD LARGE MEETING

Attendance of 1500 Gathers to Hear Plans for Better
Organization and to Listen to Exposition
of Goodwin Plan

In order to learn how the industry might be strengthened and placed on a better business basis, more than 1500 electrical contractors and dealers of New York City and their guests gathered in the Madison Square Garden Theater on Tuesday evening of this week under the auspices of the local supply jobbers and the different local contractors' associations.

L. K. Comstock was chairman, and in opening the meeting laid emphasis on the need for co-operation in order to effect results. James R. Strong explained the new national constitution of the contractors' association and was followed by George L. Patterson, president of Stanley & Patterson, jobbers, who spoke on the topic "Ideal Relations Between Jobbers and Contractors."

A code of ethics, or what might be called a code of practice, was read by Fred W. Lord of the Lord Electric Company. Some reasons why a contractor should affiliate himself with a representative association were given by J. C. Forsythe of the New York Board of Fire Underwriters. G. E. Bruen of the Suburban Exchange of Fire Underwriters told briefly some plans for changing the method of inspections in favor of the contractor. A brief address bespeaking the desire of jobbers to co-operate in furthering any movement to better the industry was made by Charles P. Scott of the Royal Eastern Electrical Supply Company. The extent to which electrical associations have benefited and can benefit the electrical contractor was the theme of an address by Louis Kalischer, chairman of the advisory board of the Electrical Contractors' Associations of Greater New York.

In closing the program for the evening, William L. Goodwin presented the Goodwin plan for harmonizing the industry from the standpoint of organization. Mr. Goodwin went to great pains to impress upon his audience that private ownership of utilities was absolutely essential if there is to be progress. He called attention to the need for a stabilizing influence in the industry, pointing out the way in which this could be brought about by making a profit on all sales and by preferential discounts in accordance with the service performed.

KANSAS CITY INDUSTRIES RELIEVE POWER SHORTAGE

By Co-operation with the Central Station Company
They Help to Tide Over Situation Resulting
from Coal Shortage

Patrons of the Kansas City (Mo.) Light & Power Company, both power and light, with great good nature and a fine spirit of co-operation, have made personal sacrifices to help the company over a critical situation in its supply. While the company had supplies of coal to keep its plants operating, the Kansas City Railways Company, which furnishes the bulk of the energy sold by the light company, was seriously handicapped.

Late in October the situation became grave, with a supply on hand for less than a week and expected shipments delayed. It became necessary to curtail street car service and to cut down on power and light users radically to carry the service over until coal could be obtained. In this situation about twenty large power users suspended operations entirely over Saturday, Nov. 3. For months these and other power users had been adjusting their loads to the exigencies of service, working more at night, and for several days they had suspended work from 3.30 to 7.30 p. m. daily. On Nov. 5 these plants resumed operations on the shortened schedules, some of the needed coal for the railways company having arrived.

The critical time was from Friday, Nov. 2, to Monday, Nov. 5. The railways and the light companies planned to give a maximum of service to all patrons consistent with conservation of the coal supply. Electric railway cars were kept in operation with a reduction of about 10 per cent in service during rush hours and a reduction of about 40 per cent in the middle of the day. For a week the light company had been cutting out certain sections of the city for short periods in the evening, and on Friday, Saturday and Sunday several sections were cut out for half an hour or more during the evening peak load. The endeavor was made to distribute the inconvenience over the entire city at different times. There was very little complaint, the public having been fully informed of conditions making the procedure necessary by advertisements.

Merchants also co-operated in large degree. The local association adopted resolutions urging members to darken electric signs and windows between 5 and 7.30 o'clock and to reduce lights in stores as much as possible in those hours. Many merchants complied with this recommendation. The inconvenience has been relieved by warm weather and better gas pressure so that householders can use gas for cooking and lighting.

The heavy drain upon the supply of energy in Kansas City caused by additional demand in cooking, heating and industrial uses was considerably relieved on Monday, Nov. 12, when a new 3500-kw. steam turbine was put into use in the central station of the Kansas City Light & Power Company. Owing to coal shortage, the company was compelled to shut off energy from industrial plants and even residence districts during the rush hours of the Kansas City Railways Company, which furnished much of the light company's energy. With the new equipment this will be unnecessary, light company officials believe.

Four new 500-hp. boilers have been installed. These boilers had been promised last July, but stress of gov-

ernment business forced Kansas City to wait. Four new 750-hp. boilers are being installed now in the same plant to feed a new 9000-kw. turbine that will be put into place by Jan. 1, when the light company will relieve the railway company from a heavy load of energy which can then be used for electric railway service during rush hours.

In another twelve months the light company's new plant on the Missouri River in East Kansas City will be in operation, and the company then will generate energy for its entire demand for industrial and home consumption in Kansas City, Mo.

The agreement between miners and coal operators of the Southwest last week has had a quieting effect upon the consumers of electricity in Kansas City.

With continuation of moderate weather the light company officials feel that there will be a small reserve supply of coal. The company, therefore, is inclined to be more lenient with consumers. Many industries are now running up to capacity in use of energy, although there is still conservation in electric signs and during the rush hours of each workday in big industries.

LIGHTING AND COAL ON THE NEW JERSEY COAST

President Hazelrigg of the Atlantic Coast Electric
Light Company Shows Why He Discourages
"White Way" Lighting

Reports were published recently in newspapers of Asbury Park, N. J., that the Atlantic Coast Electric Light Company might have to discontinue operation because of coal shortage. It appears that the reports grew out of the unwillingness of the company to meet the desire of the city commission for special illumination of streets already lighted. The attitude of the company was based on the cost and scarcity of labor and materials and the importance of conservation of energy.

In view of the keen anxiety about coal conditions the ELECTRICAL WORLD asked the company what the facts are. S. F. Hazelrigg, the president, writes:

The rumor emanated from the fact that we had declined to take on a large number of additional street lights, the city insisting that we make a price per month, per year each.

A year ago we made the city a proposition for this lighting. The option on this proposition terminates with December this year. The city wished a price as above stated on the lamps for 1918. Since the proposition was made we are paying twice what we were for coal. Labor has advanced, so that as matters stand we could not consistently make anything but a safe proposition, which would be prohibitive, and in view of the difficulty in securing copper and other material we are not making any connections except those immediately on our lines; in other words, making no extensions.

When my letter was read before the commission the newspapers immediately wanted to know the reason, and in the talk which I had with their representatives I was quite frank about the coal situation, as we have been having trouble for a year in securing coal, not only in quantity but in quality. I repeated some testimony which I had heard personally given by the chief engineer of the Erie Railroad to the effect that that road was liable to shut down during the winter for the lack of coal. The interpretation which was placed on this statement was to the effect that we might shut down for the lack of fuel. From what I have recently noted in the papers and been advised by other concerns this is possibly true, but we are in no more danger of a shutdown than any one else.

HEAVY DEMAND FOR POWER IN NEW ENGLAND STATES

Coal Situation Makes Hydroelectric Energy of Great Importance, and Systems Are Besieged with Requests for Supply

The supply of power cannot keep pace with the demand for electrical energy in New England under present conditions, according to a recent survey of the field by the ELECTRICAL WORLD.

Some of the larger utilities have had to decline to accept power contracts which under normal conditions would have been taken over without difficulty and this applies to hydroelectric organizations as well as to steam plants. To add to the troubles of the central station manager, the coal supply is still on a hand-to-mouth basis for many of the smaller companies. The protracted period of fair weather is not helping to fill the large reservoirs at the headwaters of the electrified streams at a rate at all commensurate with the needs of the situation. One large hydroelectric company reports that its load at present exceeds the estimated output for this time by 15 per cent. Demands for secondary power flood the offices of the company after every rainfall, but of late there has been little precipitation.

CONSTRUCTION OF THE NATIONAL ARMY CAMPS

Major Junkersfeld Addresses Chicago Section, A. S. M. E., on Huge Job of Quartermaster's Department in Constructing Cantonments

At a meeting of the American Society of Mechanical Engineers, Chicago Section, on Nov. 16, Major Peter Junkersfeld told of his work in assisting construction of the original sixteen National Army cantonments and indicated something of the present task of constructing embarkation camps, warehouses, centers of assembly for material and hospitals to back up the National Army. The subject of electrical construction at the camps was dismissed with: "The camps are all electrically lighted and all pumping except at one camp is done by electricity." While troublesome experiences were recounted in connection with practically every other branch of construction, there was no intimation of difficulty in securing electrical supplies or in bringing the electrical part of the jobs to successful completion on time.

Major Junkersfeld stated that the average cost of a complete cantonment was about \$8,000,000. This figures about \$200 per man. The profit to contractors is a matter on which erroneous figures have crept out. Contracts were let on the cost plus profit basis—cost plus 10 per cent on the first \$100,000, cost plus 8 per cent on the second \$100,000, cost plus 6 per cent on the third \$100,000, and a limit on the total profit of \$250,000. As the contracts extended into enormous totals, the average contractor's profit was only 3 per cent. The average ratio of labor to material was as \$1 is to \$1. The lowest ratio was 70 cents to \$1, and the highest was \$1.40 to \$1. The efficiency of labor was a great factor in determining the ratio.

Major Junkersfeld praised the National Council of Defense, the American Railway Association and the National Committee on Gas and Electric Service for

assistance rendered the Quartermaster's Department. He showed a number of lantern slides of the work and a motion-picture film to illustrate how one 200-man barrack was erected in two hours and fifty-five minutes.

HOW UTAH BENEFITS FROM ITS HYDROELECTRIC ENERGY

Utah Power & Light Company Shows that Its Water Power Means Saving of Coal, Transportation and Labor

The Utah Power & Light Company is advertising in the Salt Lake City newspapers to show how its hydroelectric energy saves coal.

The company shows further that the saving extends

**500,000,000 Kilowatt-Hours of Electricity
Saves Utah 1,000,000 Tons of Coal This Year**

The Figures Tell the Story—

Total kilowatt hours of hydro electric power generated by Utah Power & Light Company during 1917	500,000,000 Kilowatt Hours
Number of additional tons of coal that would be required to do the work performed by this amount of electric power	1,000,000 TONS
Railroad cars necessary to haul this coal	25,000 CARS
Coal saved each month	83,333 Tons, or 2,083 CARLOADS
Coal saved each day	2,740 Tons, or 69 CARLOADS

UTAH POWER & LIGHT CO.

to the man power necessary to production, the use of the additional transportation facilities and men and of other workers used in distributing coal.

COAL OPERATORS AND ROADS PLAN CO-OPERATION IN OHIO

Pooling of Coal, Elimination of Waste in Transportation and Creation of Distribution Centers the Cardinal Features

At a meeting of coal producers and representatives of coal-carrying railroads in Cleveland on Nov. 14 plans for handling coal in Ohio were formulated which will probably increase the supply 25 to 30 per cent.

In the first place operators on railroads in Ohio and West Virginia will supply the points of consumption nearest them, instead of shipping coal all over a large territory and having their cars crisscross the States.

The second phase is pooling coal in important distribution centers. Coal of different kinds will be placed on separate sidings at these points and the first cars on each track will be delivered to consumers in consecutive order. Each consumer who has a certain number of cars on the track will receive that total, although it may be not from the mine ordered or the exact amount expected.

Pooling points decided upon so far are Cleveland, Toledo, Columbus, Cincinnati, Canton, Akron and Detroit. Others will probably be established.

A committee of Cleveland operators worked out a detailed plan of operation for that city, upon which others will be modeled. This plan was to have been presented to the Fuel Administrators of Ohio, Indiana, Michigan, Pennsylvania and West Virginia in Cleveland on Nov. 21.

CHANGES IN PERSONNEL OF ENGINEERING FACULTIES

Further Listing of Resignations, Leaves of Absence, Promotions and Appointments in the Electrical Teaching Body of the United States

Following is the second installment of the record of resignations, leaves of absence, promotions and appointments in the electrical engineering faculties of the various colleges and universities of the United States. The first installment appeared on page 878 of the *ELECTRICAL WORLD* for Nov. 3.

California Polytechnic School, San Luis Obispo, Cal.—C. A. Binns, former head of the department of engineering, resigned last August to accept a position with the General Electric Company in its San Francisco office. He was succeeded by A. R. Redman, who is a graduate E. E. of Armour Institute of Technology and who was for five years instructor in physics and electricity in the Los Angeles Polytechnic. He then went into commercial work as superintendent of the Arizona Power Company, Prescott, Ariz., later leaving to take a place as superintendent of the Santa Barbara (Cal.) Gas & Electric Company.

Colorado College, Colorado Springs, Col.—Prof. George B. Thomas is on a year's leave of absence, during which time he will work with the Western Electric Company along lines of interest to the military authorities. His work at the university is being carried on by G. B. McNair of the faculty of Kansas State University. N. R. Love has resigned from the faculty, where he had charge of the shop and some electrical courses, and is engaged in time-study work for the Denver Tramways Company.

Mississippi Agricultural and Mechanical College, Agricultural College, Miss.—G. W. Thaxton, who was an instructor last year, has accepted a government position in New York, and his place is filled by W. N. Scales of last year's graduating class.

Oregon Agricultural College, Corvallis, Ore.—W. D. Peasler, instructor in electrical engineering, has been commissioned a captain in the Officers' Reserve Corps and is now at Camp Lewis, Wash. He has been succeeded by J. A. Hooper, a 1917 graduate of the university.

Purdue University, Lafayette, Ind.—Prof. L. D. Rowell has been commissioned a captain in the Engineer Officers' Reserve Corps and is now in active duty as the recorder of the Board of Engineer Troops, Washington, D. C. J. B. Sheadel and H. E. Phelps, instructors in electrical engineering, have resigned, the former entering the service of the Union Traction Company of Indiana and the latter that of the American Telephone & Telegraph Company of New York. Emerson Pugh, Purdue 1916, has been obtained from the testing department of the General Electric Company as assistant in the laboratory. Prof. R. V. Achatz will take the place vacated by Prof. L. D. Rowell, in charge of all electrical laboratory work in the school.

Sibley College of Cornell University, Ithaca, N. Y.—Prof. W. S. Ford, who had charge of the senior electrical laboratory work, has left to accept a position as superintendent of power with the Vacuum Oil Company, Paulsboro, N. J. G. D. Floyd, instructor, left to join the Canadian Aviation Corps. A. R. Cota, instructor, left to accept a position under the Mexican government as inspector of manufacturing and generating light, heat and power plants. F. G. Tappan, instructor, left to accept a place as associate professor of electrical engineering at the University of Oklahoma. William Deans, Jr., instructor, left to accept a position with the Thomas Edison Company, East Orange, N. J. A. C. Stevens, instructor, left to accept a position with the General Electric Company at Pittsfield, Mass. These positions have been filled by the following instructors: J. B. Joyce and R. D. Elliott, who were graduated in electrical engineering from the Agricultural and Mechanical College of Texas, College Station, Tex., last June, and D. H. Banks, who is a senior in Sibley College and a graduate of Clemson College. W. C. Ballard of the department of electrical engineering has been promoted to the position of assistant professor of electrical engineering.

IDENTIFYING COVERING IS ADVOCATED FOR CONDUCTORS

Revision Voted by Electrical Committee of National Fire Protection Association—Action of Associated Manufacturers

At a recent meeting of the electrical committee of the National Fire Protection Association, it was voted that in the next edition of the National Electrical Safety Code Rule 26-A should be changed as follows:

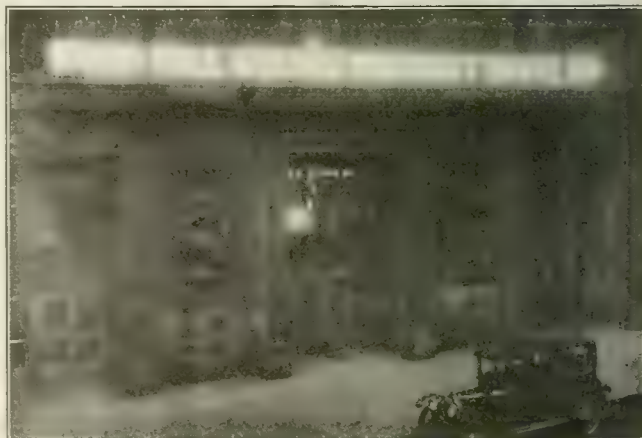
The neutral conductor of all three-wire circuits and one conductor on all two-wire circuits must have an identifying insulating covering readily distinguishing it from other wires. This wire must be run without transposition throughout the entire installation and properly connected at all fittings to properly identified terminals in order to preserve its continuity. When one of the circuit wires is to be grounded, the ground connection must be made to this identified wire and as prescribed in Rule 15 and 15-A.

This rule will appear in the new edition of the code, to be known as the 1918 edition, and does not become effective until Jan. 1, 1919. As all fittings having wire terminals, such as sockets, receptacles, cut-out bases, attachment plugs, etc., must have some identifying mark to enable them to be connected easily with the proper terminal, the Associated Manufacturers of Electrical Supplies has submitted the matter to members of all sections covering the devices affected, asking that proper committees be appointed to consider the matter and report results at as early a date as possible, in order that they may be fully prepared for the new order of rules when in effect on Jan. 1, 1919.

ELECTRIC SIGNS HELP CONSERVATION OF FOOD

Commonwealth Edison Company Installs and Maintains on County Building, Chicago, Sign to Help to Win the War

Two large electric signs are being installed, one inside and one outside the Chicago city hall, at a cost of \$5,000 to boost food conservation. These signs will flash in amber, scarlet and orange flames "Food Will



FOOD CONSERVATION SIGN ON COOK COUNTY BUILDING

Win the War." In addition daytime signs are being mounted on the outer walls.

The Commonwealth Edison Company has installed over the county building a large electric running sign carrying the words "Food Will Win the War." This sign it has installed and maintained at its own expense.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Sign Lighting Order in New York.—The New York Public Service Commission, First District, has issued an order permitting electric companies to conform to the order issued by Dr. Garfield, Fuel Administrator, with respect to street electric signs. The order of the commission allowed the companies to file supplements to tariff schedules, and thus placed them in a position to obey the order of the Fuel Administrator. In order that the contemplated saving of coal might begin forthwith, the commission waived the usual thirty-day notice required for any change in tariff schedules and allowed the companies to act at once.

Advise Consumers of Most Advantageous Schedules.—A decision of the Colorado Public Utilities Commission in the case of the town of Manitou vs. Colorado Springs Light, Heat & Power Company holds that electrical energy for lamps installed by a private corporation around and on its property in the central portion of a town the charges for which the town has agreed to pay should be billed on the basis of the company's commercial lighting schedule, rather than on its street-lighting schedule, since the character of the service furnished by the utility, and not necessarily the nature of the installation of the consumer, should determine the schedule to which the consumer is properly entitled. Any and all schedules of a public utility should be available to any of its consumers who will comply with the terms and conditions of such schedules and pay the charges provided therein. On the other hand, it is the duty of the utility to advise its consumers under what schedule or schedules they may be most advantageously served. Had the record in this case shown that the town of Manitou selected the street-lighting schedule after being advised to the contrary by the lighting company, the case would have been dismissed.

Value for Sale Purposes and Value for Rate Making.—The Illinois Public Utilities Commission in an order authorizing the sale by the Stark County Power Company of its electrical property in Wyoming, Ill., to the Public Service Company of Northern Illinois, takes a definite stand as to the relation of valuation for sale purposes to that for rate making. The principal difference pointed out by the order between valuation for these two purposes is that capitalized earnings may be considered in sale cases but not in rate cases. The commission says in part: "In the fixing of a value for rate-making purposes the public is directly and vitally concerned that this value shall

rest upon the firm basis of property values, although such property values should properly and reasonably give consideration to the intangible elements of value as well as to the more tangible elements. For rate-making proceedings the value under discussion is that upon which the utility is to be allowed its return, and it must be an equitable value as between the public and the utility. However, in a case of purchase and sale the public is not so vitally interested except to make certain that the property is not so crippled by indebtedness and fixed charges that its operation is precarious. The parties who are principally concerned are the purchaser and seller. . . . The seller in his determination of the value must take into consideration the revenues which he has received from the property and what he believes to be the possibilities for future revenues were he to retain the property under his control. The purchaser is governed by the revenues receivable from the property and by his opinion as to the possibility of developing these revenues in the future. . . . Under the laws existing at present, both parties must be largely influenced by the value of the physical property transferred, since the law clearly contemplates that the commission in fixing rates for utility service shall give primary consideration to the value of the physical property involved. . . . However, conditions may exist whereby the purchaser may feel warranted in the payment of an amount in excess of the physical valuation of the property, for the reason that the previous operation of the property may have been uneconomical and inefficient." The commission, however, though it permits the consideration of capitalized earnings in sale cases, specifically guards against their inclusion in future rate proceedings. "The commission cannot be bound in future rate-making proceedings by values permitted for purchase and sale purposes nor by amounts authorized for capitalization, since the value for rate-making purposes may differ in amount from the values previously determined for purchase and sale. However, the commission cannot in justice authorize the capitalization and the building up of a property account of a certain amount and at a later date decide that for rate-making purposes the value of the property should be diminished below this amount by large percentages, since by such action the commission would be creating an instability in utility property values and would be protecting neither the public nor the security holders." The commission authorized the purchase and sale of the property in question at the amount suggested, which was in excess of the physical value of the properties, but declined to permit the inclusion of the entire sale price in the property accounts and in the capitalization of the purchasing utility. The order required that the purchasing company amortize the difference between the fair value for purchase and sale purpose and the amount of the authorized purchase over a period of years.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Contributory Negligence.—In an action to recover damages for the death of plaintiff's husband caused by coming in contact with high-tension electric wires maintained by defendant in one of its waiting rooms, held it was not an error to refuse to set aside the verdict in favor of defendant because of a finding that at the time the deceased came in contact with the wires he was not in full control of his powers of locomotion, it was held by the Supreme Court of Kansas (167 P. 1041). The lower court charged that if the deceased "failed on his part to exercise ordinary care, or in other words was guilty of contributory negligence in the premises and thereby contributed to his own death, then the plaintiff cannot recover," but the Supreme Court held that it was not error to fail to qualify the instruction by stating that the deceased was guilty of contributory negligence if he voluntarily or of his own free will failed to exercise ordinary care. It was for the jury to determine under all the circumstances shown in the evidence whether or not the deceased was in the exercise of ordinary care at the time of the accident.

Reasonable Valuation.—What a telephone company is entitled to demand in order that it may have just compensation is a fair return upon the reasonable value of its property as a going concern, as distinguished from its physical value as a mere naked plant. This value is not obtained by adding up a number of separate items, but by taking a comprehensive view of each and all of the elements of property, tangible and intangible, including property rights, and considering them all, not as separate things, but as inseparable parts of one harmonious entity, and exercising the judgment as to the value of that entity, the Supreme Court of Oklahoma held (167 P. 995). Where, in a rate case against a telephone company whose lines extend throughout the States, it is charged that the exchange rates of a single municipality are unreasonable, the corporation commission in finding a basis for the adjustment of such rate should, as far as practicable, separate the valuation of the toll plant from the value of the exchange plant and equitably apportion between them the value of the property used in common in giving both classes of service. Where the evidence shows and the commission finds that the plant is kept in a high state of efficiency, and charges are made in rates for the purpose of counteracting or preventing depreciation by replacement, no necessity exists for building up a fund to be used for the purpose of counteracting purely theoretical depreciation.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Reorganization Plan Declared Operative.—The reorganization committee of the Northern Idaho & Montana Power Company has declared the reorganization plan operative.

No Cantonment Planned in Cuba.—Reports have been current that a cantonment would be built in Cuba. The Washington representative of the ELECTRICAL WORLD reports that there is no intention of building a cantonment in Cuba. This is also true of Porto Rico and other outlying islands.

Princeton Electrical Engineering Students in the War.—No students are enrolled this year for the electrical engineering course at Princeton University. Prof. Malcolm McLaren, professor of electrical engineering, writes in answer to an inquiry from the ELECTRICAL WORLD that all of the students have entered the national service to do their part in the war.

Competition in Electric Service Threatened at Toledo.—A resolution has been introduced in the Toledo (Ohio) City Council calling upon the Director of Public Service to have maps of the city light system prepared. Councilman Miller, who introduced the resolution, said that other companies will bid for the city light business if this information can be furnished.

Better Homes Exposition.—More than 150 manufacturers and dealers of the allied home furnishing and building trades will open on Nov. 28, lasting until Dec. 8, in the Klingman Furniture Exhibition Building in Grand Rapids, Mich., an exposition of furniture, house furnishing, house decorations, household appliances and utilities, household labor-saving devices, building material and a display intended to carry out the work of better home planning.

Liberty Bond Coupons to Pay Customers' Bills in Baltimore.—Announcement is made that the Consolidated Gas, Electric Light & Power Company of Baltimore will accept Liberty bond coupons in payment of customers' bills. The figures indicate that more than 90,000 Baltimoreans bought the second issue of Liberty bonds. This is one person in seven, and it is apparent that the day is fast approaching when there will be a Liberty bond in practically every Baltimore home. Each month almost every family living in Baltimore has a transaction with the Gas & Electric company. The first coupons will be payable on Dec. 15 for holders of the first Liberty bonds. In announcing the decision of the Baltimore company to take this action, John L. Bailey, treasurer, said that the company is doing everything possible to popularize Liberty bonds.

Prize Winners of Commonwealth Edison Section, N. E. L. A.—At the annual meeting of the Commonwealth Edison Section, N. E. L. A., at Chicago on Oct. 25, Samuel Insull awarded prizes for the best papers written by section members in competition during the past year, as follows: K. A. Auty, the Insull medal and first prize, \$40, for paper on "Advertising Our Kilowatt-Hours"; second prize, G. B. Springer, for paper on "Underground Conduit Construction"; third prize, \$20, Karl Horine, for paper on "Electrolytic Chlorine"; fourth prize, \$10, R. L. Frisby, for paper on "Generation, Protection and Control." Prizes for the most meritorious suggestions made by employees were announced as follows: First prize, \$50, J. P. Walsh, for recommending that when a meter is connected lights be tested and all burned-out lamps be replaced by new lamps; second prize, \$40, to N. H. Johann, for suggesting that the company erect a pole on each station and donate a flag for each pole; third prize, \$30, to H. E. Paaren, for recommending a new system of cutting off meters which are read and disconnected—that as men remove the house wire from its binding post they connect it to the neutral binding post, causing the house or flat to have two neutrals; fourth prize, \$20, to F. E. Aurand, for recommending that a relief valve be placed in the exhaust end of the steam exciter at the various stations; fifth prize, \$10, to L. M. Anderson, for the greatest number of accepted suggestions, eight of his suggestions having been accepted.

Battalion of Engineers for Gas and Flame Service.—The first battalion of American soldiers to meet offensively the gas and fire which the enemy introduced in warfare is being organized as the Thirtieth Engineers, Gas and Flame, with headquarters at Camp American University, Washington, D. C. The battalion is being recruited from the ranks of such civil professions and trades as chemical and mechanical engineering, explosive and gas manufacture, plumbing and carpentry and similar trades, and an exceptionally high grade of talent is volunteering. Major E. J. Atkisson, Corps of Engineers, a graduate of West Point and of Cornell, is in charge of organization. He has specialized in mechanical and electrical engineering, was formerly director of electrical and mechanical engineering, United States Army School, and was superintendent of locks, Panama Canal. It is announced that there is opportunity for a limited number of enlistments for the following classes of men: Chemists, gas engineers, plumbers, electrical experts, pipe fitters, interpreters, mechanics, chauffeurs, explosive experts, cooks, gas experts, blacksmiths, carpenters, clerks, and muscular, quick-thinking, resolute men, between the ages of eighteen and forty years, for pioneer soldier service of high character. Major Atkisson has announced that any man possessing the necessary qualifications may volunteer at any recruiting station of the country by asking to join the Thirtieth Battalion, Gas and Flame, forming at Washington.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Los Angeles Synchronous Club.—The second lecture of the Synchronous Club's electrical course on "Electricity and Magnetism" was given by Prof. J. C. Montgomery on Nov. 8 at the University of Southern California.

Electric Club of Toronto.—At its weekly luncheon on Nov. 9 the Electric Club of Toronto heard an interesting talk by Arthur Hawkes on "Relations Between Ontario and Quebec." On Nov. 16 Joseph E. Atkinson, president of the Star Publishing Company, addressed the members, his subject being "After the War—Industrial Changes."

General Glenn Speaks Under Auspices of Cleveland Electrical League.—On the evening of Nov. 16 General Edwin F. Glenn, commander of Camp Sherman, Chillicothe, Ohio, addressed a mass meeting at the Hippodrome, under the auspices of the Cleveland Electrical League. The address was for the purpose of increasing interest in the Y. M. C. A. campaign. General Glenn said he should not be surprised if France should have to withdraw from the conflict, to some extent at least, next summer, and that the weight of the war then may fall largely upon Great Britain and the United States. The league furnished many "four-minute" men, who addressed audiences in the motion-picture shows and at other places throughout the city during the week.

Railway Commissioners Meet.—At a meeting held at the Interstate Commerce Commission, Washington, D. C., the National Association of Railway and Utilities Commissioners elected the following officers for 1917-18: President, Edward C. Niles, New Hampshire; first vice-president, Charles E. Elmquist, Minnesota; second vice-president, C. M. Candler, Georgia; secretary, James B. Walker, secretary of the Public Service Commission, First District, New York; assistant secretary, Leroy S. Boyd, librarian Interstate Commerce Commission. Executive committee: C. M. Candler, Georgia, chairman; S. C. McChord, of the Interstate Commerce Commission; James C. Carr, New York; Alonzo R. Weed, Massachusetts; P. W. Dougherty, South Dakota; Edward C. Niles (ex officio), New Hampshire, and James B. Walker (ex officio), New York. President Niles announced the appointment of the special war committee created by the convention as follows: Max Thelen, California, chairman; Frank H. Funk, Illinois; Travis H. Whitney, New York; Joseph B. Eastman, Massachusetts; Ralph W. E. Donges, New Jersey, and Edward C. Niles (ex officio), New Hampshire. The association voted to hold its next meeting in Washington on Nov. 12, 1918.

David E. Howey has succeeded G. E. Tigner as superintendent of the St. Charles (Mich.) electric light and water works.

F. W. Bettys, who resigned as superintendent of the municipal electric light plant, Perry, Kan., last May, has been reappointed to that position.

Royal E. Frickey, for the last seven years electrical engineer of the Northern California Power Company at Redding, Cal., has resigned and has been succeeded by L. H. Kistler.

B. O. Millman has resigned as superintendent of the municipal light and power plant of Charter Oak, Iowa, to become connected with the Nebraska Gas & Electric Company at Genoa, Neb.

A. W. West, formerly engineer of design in the transmission division of the engineering department of the Georgia Railway & Power Company, has been promoted to be field engineer in the transmission department.

Herbert Berry, of the Gamewell Fire Alarm Telegraph Company, has been appointed superintendent of the Springfield (Mass.) fire-alarm signal system. He succeeds Samuel L. Wheeler, who recently retired after thirty-five years' service.

W. J. Swarting, who has been an engineer in the construction and operating department of the People's Power Company, Rock Island, Iowa, has been promoted to become superintendent of the People's Gas & Electric Company of Mason City, Iowa.

Sherman Creamer, Knowlton, N. J., has severed his relations with the Lehigh & New England Railroad to become connected with the Eastern Pennsylvania Power Company, Paulins Kill, near Warrington, Pa., as night superintendent at the power plant.

Prof. J. F. Wilson, who during the past year was professor of electrical engineering at Queen's University, Kingston, Ontario, was recently appointed assistant professor of electrical engineering at the University of Southern California, Los Angeles. Prior to going to California Professor Wilson was for five years a member of the engineering faculty at the University of Michigan. He is the author of a widely used dynamo laboratory manual, and a year or so ago he published an elementary text book on electrical engineering.

William S. Cone has resigned as manager of the United States Reclamation Service's Salt River project at Phoenix, Ariz., to form a consulting engineering partnership with Irving C. Harris, with offices in the Hollingsworth Building, Los Angeles, Cal. Mr. Cone was closely identified with the design and construction of several of the early hydroelectric installations of the West, including those of the Southern California Edison Company. Later he was associated with the late H. H. Sinclair in the Great Western Power Company's developments and subsequently was manager of the Sacramento district, later joining the Reclamation Service.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

Matt B. Jones, general counsel of the New England Telephone & Telegraph Company, has been elected a director and vice-president of the company, with membership on the executive committee. He will take general charge of the company's affairs during the absence of President Philip L. Spalding, who was recently appointed a lieutenant-colonel in the signal and aviation branches of the government service.

H. P. Wood, head of the department of electrical engineering at the Georgia School of Technology, Atlanta, Ga., has been appointed president of the Academic Board of the United States Army School of Military Aeronautics, which has been established at the Georgia School of Technology. Professor Wood became assistant professor of electrical engineering at the Pennsylvania State College in 1901 and later was appointed to a similar post at the University of Illinois. In 1907 he was made professor of electrical engineering at the latter university. He was at one time engaged in electric railway construction at Washington, D. C., and was also with the New York Edison Company. Later he was superintendent of the East Side Electric Lighting Company in Detroit, Mich. Professor Wood has had experience with the Westinghouse works and has also done some installation work. Professor Wood is a fellow in the American Institute of Electrical Engineers.

E. Burt Fenton, formerly publicity manager of W. S. Barstow & Company, has been appointed publicity agent of the Northern Ohio Traction & Light Company, with headquarters at Akron, Ohio. Mr. Fenton "graduated" into the utilities field from the editorial desk of a daily newspaper, after serving eighteen years in that field. His first connection in the utility field was with the Sandusky Gas & Electric Company, for which he did the publicity work through two "municipal ownership" campaigns, the latter of which was followed by a very productive campaign of "good-will" advertising. In 1915 he was appointed publicity manager of W. S. Bartow & Company, in charge of the publicity work of the utility properties controlled by that company. He became temporarily associated with the Northern Ohio Traction & Light Company in August, 1917, and on Nov. 1 was appointed to his present position. Mr. Fenton is the author of "Snuggling Up to John Smith" and "The Missing Link," papers which have attracted wide attention in the utility field.

Obituary

E. L. Clyne, superintendent of construction of the Denver (Col.) Gas & Electric Company, died recently at his home in Denver at the age of fifty-five years.

Frederick W. Cole, for many years consulting engineer of the Gamewell Fire Alarm Telegraph Company, Boston, and inventor of many of the devices used in the company's system, died at Newton Highlands, Mass., Nov. 11. He was sixty years of age and had been in the employ of the company for the past forty years.

John Richmond, a native of London, England, and for a number of years past in the electrical business in this country, died at Great Barrington, Mass., on Oct. 22 after a prolonged illness. He was at one time manager of the Allis-Watson Company in New York City and later acted as electrical engineer for the American Laundry Machinery Company, with headquarters at Rochester. More recently he was employed by the Cutler-Hammer Company at its Bronxville factory as industrial heating engineer.

William Timothy Call, secretary and treasurer of the Gage Publishing Company, publisher of the *Electrical Record*, died last week in his home at 669 East Thirty-second Street, Brooklyn, N. Y., in his sixty-second year. Mr. Call was born in Bangor, Me. After leaving Bowdoin College in 1878 he came to New York and entered newspaper work. For a time he was a reporter on the *Sun*, and later he became editor of the *Boot and Shoe Weekly*. Twenty-five years ago, with U. W. Gage, he established the Gage Publishing Company.

John Gilmartin, superintendent of the meter department for the Detroit Edison Company, died at his home in that city on Nov. 12. He had been suffering with typhoid fever for three weeks. Mr. Gilmartin was a pioneer in electric meter work and at the time of his death was a member of the meter committee of the National Electric Light Association, chairman of the meter committee of the Michigan Section, N. E. L. A., and associate member of the A. I. E. E. Early experience was gained in Toledo, and from there he was called to Detroit, where he was put in charge of the meter department.

Henry R. Ford, vice-president of McCarthy Brothers & Ford, electrical equipment contractors, and one of the foremost electrical authorities in western New York, is dead. Mr. Ford was born in Lawrenceville, Pa., forty-six years ago and went to Buffalo in 1893. He became associated with Edmond D. McCarthy and organized the firm of which he was vice-president. Mr. Ford was a member of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the Buffalo Engineering Society and many local clubs and organizations. He was also a veteran of the Seventy-fourth Infantry, N. Y. N. G., and an officer in the engineers' division of the Naval Militia of New York State.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

CREDIT SITUATION IS NOW UNDERGOING MARKED CHANGE

Conditions in Middle West as Seen by Delegates to Annual Meeting of Electrical Credit Association of Chicago

Representatives from Kansas City, Minneapolis, Indianapolis, Chicago, Milwaukee and other centers, speaking at the Electrical Credit Men's meeting at Chicago Nov. 15-16, all pointed out that the situation in the credit field is undergoing a marked change. At present there is practically no small building, but there are many large factories in process of construction. This takes from the electrical man's books the many small accounts he used to carry and supplants the many small accounts by a few large ones. It was urged that this situation should be watched. Moreover, the same condition of affairs has led certain contractors to put in overstock. Where this situation is discovered the contractor should be urged to reduce his overstock without sacrifice and to collect on the sale and meet his indebtedness. It seemed to be the general impression that it is a wise policy to urge customers with accounts against the companies to close out speculative stock so that credit lines may be well in hand against any possible slump.

JOBBER'S STOCKS IN THE EAST BEING REDUCED

No Tendency Noted Among Reliable Houses to Speculate—Incoming Stocks of Staples Are Small in Volume

Stocks in the hands of jobbers compare favorably as to variety and size with any preceding season of the year, except in connection with heating appliances and household specialties. A majority of dealers in this territory have responded to the public call by making every endeavor to keep a representative and adequate stock on hand.

Deliveries of appliances, etc., while possibly not meeting every expectation, are coming along, particularly from manufacturers and distributors operating in places accessible for better railway service. East of Pittsburgh the embargo has hindered prompt shipments, but it is figured that by the time the public has begun its holiday buying jobbers and dealers will be in a fair position to meet the unusual demand which is expected. The same conditions are reported as prevailing in connection with Christmas outfits and electrical toys.

With staple goods the supply of everything in the metal, glass and porcelain lines is reported to be short. Orders placed six and eight months ago at prices then ruling—much lower than present ones—are coming in, not in such quantities as was originally estimated, but in small lots—in dribbles, as some jobbers expressed it—and in many cases by express, in order to avoid freight delays. Rigid-iron conduit, dry batteries, copper and steel specialties, etc., are on the list as being scarce and difficult to get in anything but small lots, and as going out as rapidly as received. This statement applies to pretty nearly if not quite all articles of a similar nature. Manufacturers are living up to former contracts, but in many cases under protest, owing to the difference in price. In not a few instances this is sharp. Lamps of certain sizes are lacking, which is ascribed by the manufacturers to the abnormal growth of exports as well as the domestic sale.

Building operations show no indication of a revival, and this affects the contractor and in turn the jobber. In spite

of this drawback, however, trade has increased, owing in large measure to the demands of the government and the industries.

Inquiry as to whether jobbers or dealers were inclined to speculate in any line was replied to in the negative. Primarily, as far as the best known concerns may be quoted, there is no accumulation of stock. It would be impossible to get the merchandise if such a purpose were in view. Then, again, there is a tendency to reduce stocks preparatory to the yearly inventory, so as to free every dollar of capital to meet war and other tax obligations.

CONTRADICTORY CONDITIONS IN GUY ANCHOR MARKET

Certain Distributors Pessimistic Owing to Unsatisfactory Position of Raw Materials, Others Place Hope in Government and Export Demand

With the situation in guy anchors not altogether rosy in the view of several commentators, it is not altogether hopeless according to others. The former are inclined to rate the market on a par with everything else where malleable iron is the basic material. This applies to prices and deliveries, with the future rather hazy. Not being a stock proposition, factory readiness in material, producing capacity and definite shipping promises are vital considerations. The lack of new construction work is another reason offered why trade is not strong. Preparation in the way of additional strengthening and general repairing, in anticipation of the stress and strain incident to the winter storms, is almost normal.

On the other hand, an optimistic manufacturer of guy anchors avers that trade is better than it has ever been. Deliveries are made within thirty days and prices are advancing, so much so that all quotations are subject to change without notice. A heavy shipment was recently made to France on the order of a private customer. The improvement in domestic buying is ascribed to meeting the extraordinary demand from the military cantonnements. It is this new outlet and the export trade, which was never had before, that are swelling the volume of sales. The same optimistic authority may be quoted relative to the lessening of repair work, which is charged up to the high prices of the necessary material.

EXPORTS OF ELECTRICAL GOODS FOR MONTH OF AUGUST

Indication of Government War Activities in Europe Evidenced by Marked Slump in Volume of Goods Shipped for Foreign Consumption

The exports of electrical merchandise from the United States in August last amounted to \$3,607,278, as compared with \$3,601,518 in the preceding August. While there was an increase in the value of exports, this was so slight as to show, in view of the number of price increases which have gone into effect during the year, that the volume of electrical merchandise exported in August last was undoubtedly somewhat less than that exported in August, 1916. About this time the government began to be very actively employed in transporting troops and war materials to Europe, as was later reported, and for that reason the supply of bottoms available for export was considerably less than formerly. This figure for August last was considerably less than for the preceding months of the year, but, knowing conditions in transatlantic shipping, it was to be expected.

Some items, particularly those strong in war demand, such as batteries, the use of which in the trenches is very large, and tungsten lamps for industrial purposes, showed an increase over August of the preceding year. With one or two exceptions all other articles showed decreases. For the first eight months of 1917 the exports in electrical goods had amounted to \$36,032,820, as compared with \$23,536,406 for the first eight months of 1916 and \$14,976,659 for the first eight months in 1915.

Considering the extent to which exports have fallen off and considering also the government restrictions on exports, it is doubtful if the total value of electrical exports for the current year will exceed \$50,000,000 by any considerable amount. In fact, it would not be surprising if the figure for the current year lay between \$45,000,000 and \$50,000,000.

Articles	1916	1917	1916	1917
Batteries	\$161,513	\$242,668	\$1,174,003	\$2,380,382
Carbons		137,055		239,883†
Dynamos or generators	216,626	155,029	1,021,419	1,611,221
Fans	34,333	42,736	231,638	421,772
Heating and cooking apparatus		22,174		45,469†
Insulated wire and cables	406,526	389,909	2,498,372	4,717,837
Interior wiring supplies, including fixtures	80,707	111,961	574,784	865,051
Lamps:				
Arc lamps	1,672	486	11,964	12,222
Carbon - filament lamps	3,747	18,063	64,029	131,369
Metal - filament lamps	107,571	178,457	980,098	1,808,175
Magnetos, spark plugs, etc.		202,680		472,621†
Meters and measuring instruments	89,579	69,955	538,847	696,275
Motors	402,489	136,232	3,139,275	4,130,170
Rheostats and controllers		18,762		32,963†
Switches and accessories		123,546		300,598†
Telegraph apparatus, incl. wireless	25,488	47,735	110,090	452,644
Telephones	124,234	118,551	1,147,860	1,388,487
Transformers	107,619	95,311	698,684	949,990
All other	1,839,414	1,195,968	11,345,343	15,375,691
Total	\$3,601,518	\$3,607,278	\$23,536,406	\$36,032,820

† Figures cover period beginning July 1.

METAL MARKET SITUATION

Copper Still a Mystery on Futures—Resales, if Any, Are Under Cover—Aluminum Advances

Apparently no change has occurred in copper conditions. The metal, so far as reliable reports are dependable, continues scarce, although it is reported that an easier supply will be available along toward the first of the year. The much-talked-of government resale arrangement between buyers and sellers has not yet been announced. Further, it is declared in some quarters, producers are not selling 100 per cent of their output, though they declare that no copper for November or December delivery is for sale. On the other hand, usually accepted authorities insist that a shortage is in sight.

Otherwise the only differences in price pertain to lead, spelter, tin and aluminum, the latter scoring a sharp advance. In old metals the market is stagnant.

NEW YORK METAL MARKET PRICES			
	Nov. 12		
	£	s	d
Copper:			
London standard spot	110	0	0
Prime Lake	Govt. price	23.50	
Electrolytic	Govt. price	23.50	
Casting	Govt. price	23.50	
Wire base	30.00	to 31.00*	
Lead, trust price		5.50	
Nickel, ingot		50.00	
Sheet zinc, f.o.b. smelter		19.00	
Spelter, spot	7.50	to 8.05	
Tin, Straits		71.00	
Aluminum, 98 to 99 per cent..	34.00	to 36.00	
OLD METALS			
Heavy copper and wire	22.00	to 22.50	
Brass, heavy	14.15	to 16.00	
Brass, light	10.50	to 11.25	
Lead, heavy	5.25	to 5.75	
Zinc, old scrap	5.00	to 5.50	

*Nominal.

THE WEEK IN TRADE

THROUGHOUT the Pacific Northwest and on the Coast business continues strong, with no sign of abatement.

Shortage in lamps continues and the sale of energy-consuming devices promises to be large. A number of new enterprises, with large capital, are being projected which will call for a quantity of electrical apparatus and general equipment. The new sign-lighting order does not affect California's public utilities, oil instead of coal being used to carry the peak. Freight embargoes are not interfering seriously with the delivery of electrical goods.

In the Eastern, Middle and Southern sections the most active selling is reported in connection with governmental utilities—military camp and cantonment equipment. Labor disturbances are being adjusted on a basis that promises to be permanent during the continuance of the war. The demand for merchandise in all lines is excellent, with deliveries showing a slight improvement.

NEW YORK

The dominant note in the local market is the continuing uncertainty of deliveries in nearly every line of electrical merchandise. At present no relief is even predicted, the Eastern freight embargo upsetting all calculations. Notwithstanding this, the trade is not at all discouraged over current sales, reporting a state of business that is by no means small or unprofitable.

Collections almost universally are described as up to the mark, with so few delinquents as to be about negligible. Credits are therefore being held along firm lines.

CONDUIT.—Deliveries continue to be backward. In fact, so far as this territory's supply goes, conduit comes in by "fits and starts." Whenever the embargo against Eastern points is lifted temporarily a few carloads slip into the market, and then it is completely shut off.

LAMPS.—The situation is the same so far as deliveries and prices are concerned. Jobbers report a shortage in all sizes, particularly on automobile lamps. An order placed for standard grades for export eighteen months ago is still on delivery. One of the leading factories declines to supply any lamps for export.

FREIGHTS AND SHIPMENTS.—When goods are sent forward in car lots there is a better chance of the shipment being delivered in this section than on orders. The latter are likely to be held back at almost any point, and their final arrival at destination is extremely uncertain. The delays are reported as bound to affect the ultimate selling price.

SOCKETS, ETC.—Jobbers' stocks are said to be fair on sockets, as well as other schedule material. Porcelain sockets are slightly improved on delivery compared with the condition a month ago, and much better than they were three months since.

LAMP CORDS, FLASHLIGHTS.—The lamp-cord condition is mentioned as being very unsatisfactory, with stock limited and difficult to obtain. Flashlights are in a somewhat better position all around.

HOUSEHOLD SPECIALTIES.—Deliveries are being made in probably smaller lots at this time than was anticipated when orders were placed. With the approach of the holidays and the seasonable pressure incident to the greatly increased demand for every article so classified, perhaps the manufacturer and distributors may speed up. The time is drawing near when orders cannot be positively promised for delivery before the first of the year, and the outlook is for a scramble for merchandise on the part of jobbers and dealers. No immediate change in price is figured upon, unless a premium is given for expedited deliveries.

COLLECTIONS AND CREDITS.—Jobbing houses and general distributors are apparently satisfied with the regularity and promptitude with which the trade is meeting its bills. Credits are still carefully viséed and not allowed to run at loose ends.

CHICAGO

The heating device merger, involving as it does two Chicago factories and three Chicago sales organizations, is a live topic of discussion in the trade. The jobbers are frankly glad to hear of the merger and anticipate that it will be a good thing for them. They are particularly well pleased that the merger plan contemplates only one sales force for the Edison Electric Appliance Company. However, it is devoutly hoped that the jobbers' discount will be rearranged so that they will have an opportunity to make a profit on small orders, which they have not been able to do in the past. Viewed from the angle of stock, the merger will be seen again to benefit the jobber by reducing, in some degree at least, the number of lines he must carry.

The general business of the trade in the last week has been about normal as to volume. In a few lines prices have been a trifle weak. Credit men are watching the contractor risk more closely for overstock and are trying to find ways to collect money from the government promptly.

RUBBER-COVERED COPPER WIRE.—The majority of jobbers are on a 34-cent base, but during the last week one or two manufacturers came into the market offering some rubber-covered wire at 32 cents.

CONDUIT.—At least one jobber in Chicago has a fair stock of conduit. He states that this is all top-market goods, however, since he was able to secure it only by going into the open market and buying conduit when he became suspicious that his protective orders were not going to afford any protection to him. In some cases jobbers are now buying conduit from contractors. The hardest size to get seems to be 0.75-in.

SHIPMENTS.—Some of the shipments coming in from the East are slow on account of embargoes. This trouble, however, has not yet become serious.

ICE MACHINERY.—The local ice factories are beginning repairs and new construction for the next season, and new companies entering the ice business are placing orders for equipment. This market has been especially lively in the last week and promises to continue so for several weeks to come.

AUTOMOBILE SPECIALTIES.—The past season has been one which could be called merely fair for the automobile specialty departments of Chicago jobbing houses. The general condition of uncertainty in the automobile business accounts for this.

ELECTRIC RANGES.—One manufacturer reports that the sale of ranges during the month of November will nearly equal that of the average midsummer month. This confirms the statement that ranges are salable in winter as well as summer. The demand for hotel-type equipment is on the increase.

STORAGE BATTERIES.—There is a rumor abroad in the trade that the prices of storage batteries will be decreased in the near future. The decreasing price of lead is responsible for this change.

INDUCTION MOTORS.—Deliveries up to 30 hp. are being made out of stock by one manufacturer, and on sizes larger than this it is possible to get three weeks' delivery on certain machines.

BOSTON

No signs of a recession are to be seen in the electrical trade at this time. Jobbers continue very busy, and while little new building is in progress, industrial and government work show no abatement. The labor situation has cleared somewhat during the week, although several strikes involving electrical workers are still in effect. Labor has returned to service as a patriotic duty on most of the important government jobs. At a war conference of the New England branch of the National Metal Trades Association held here Friday of last week a vigorous attack was made on the closed-shop program of certain labor interests. This attitude is obstructing the production of munitions and other war material. Great encouragement was given to the advocates of the open shop by the setting forth of experience in Connecticut and in England.

Jobbers are well stocked, prices remain firm, and collections are reasonably good. Many concerns report record-breaking gross business. Though net profits do not measure up accordingly, the shrinkage is widely accepted with cheerful patriotism as a part of the war contribution of concerns and individuals.

COLLECTIONS.—Jobbers report that collections from industrial houses buying equipment and supplies in quantity are excellent. Small contractors are not in so favorable a situation, the route between buyer and seller being less direct and sometimes distorted by war conditions.

WIRE.—Price conditions are rather unsatisfactory, but one manufacturer of long standing believes that prices will become more stable when the government has had the opportunity to give more attention, as in the steel industry, to copper economics. Rubber-covered wire is quoted at 34 cents and weatherproof at 30 cents, with an irreducible minimum of three months on industrial deliveries not prepared to exhibit priority claims.

APPLIANCES.—The volume of business is very good indeed, especially in the higher-class heating equipment. Stocks are in fair shape, but deliveries are affected somewhat by the railroad congestion with which this section is struggling. No change in price prior to Jan. 1 is apprehended, but labor is pretty short and materials do not show any tendency to soften in price. Considerable interest appears in washing machines and vacuum cleaners.

SWITCHES.—A representative manufacturer shipped the largest output in his history last month. Prices show no increase, labor conditions are reported as very good, and heavy government orders are the rule. The railroad situation is one of the most trying conditions, as seen from the angle of the New England manufacturer with a continental or a cosmopolitan market. Raw material is spotty in its availability.

INDUSTRIAL ELECTRIC TRUCKS.—Inquiries are very active, and government business is occupying the attention of dealers to a large extent.

ASBESTOS AND EBONY BOARD.—Production is over-sold with prices unchanged. Commercial deliveries on 5/8-in. to 1.25-in. ebony board rule at from two to three months; on sizes under 1/2 in., from three to four weeks. On asbestos board four to five weeks are quoted. The capacity of the Johns-Manville plant at Nashua, N. H., has been doubled lately with respect to ebony board and sanding wood.

ELECTRIC RADIATORS.—These are moving slowly at present, owing to continued mild weather.

PORTABLE LAMPS.—Trade is improving, and increased sales for Thanksgiving demand are reported. Prices are ruling firm with little prospect of immediate change. Deliveries are better than heretofore except on high-grade glassware.

ATLANTA

Underlying conditions are good, and general business continues strong. Figures covering building reports from the larger cities of the country indicate that the Southeast is especially active, even in the face of high material prices and scarcity of labor. The inability of builders to secure structural steel has curtailed even greater activity in office building construction, and the necessity of the war needs having priority over building orders is influencing to some extent activity in certain lines. In an industrial way the Southeast is doing more than it ever did before.

During the last week twenty new industrial corporations were organized with minimum capital stocks aggregating \$1,000,000.

The Builders' Exchange of Atlanta is progressing rapidly with its plans for the "builders' display." This display will occupy two floors of the Rhodes Building and will feature the work and products of the numerous members of the Builders' Exchange. The electrical fraternity will be well represented by the displays of the large manufacturers, jobbers, dealers and contractors.

The jobbers are tightening credit on a few contracting concerns that have ridden in on the wave of rapid industrial expansion and abnormal conditions and have shown little

knowledge of the present economic situation. The jobbers realize that over-expansion at this time and a drop in material prices later would play havoc with all concerned.

TEXTILES.—More activity is shown in this line this week, as indicated by a number of proposed new structures and additions. The new duck mill at the Atlanta federal prison is now under construction, prison labor being utilized. Present plans call for 500 to 600 motors, aggregating 1800 hp. It is expected that this mill will be in operation by Aug. 1, 1918, the government, of course, securing preferential shipment on motors and machinery. Energy will be secured from the Georgia Railway & Power Company, Atlanta. The Chatham Manufacturing Company, Elkin, N. C., has plans for an additional mill, which calls for \$200,000 worth of machinery. The Barker Cotton Mills, Pritchard, Ala., are also planning the expenditure of approximately \$100,000 for additions. Considerable activity is noted in hosiery mill construction. Electric power will be used in the new Mount Airy Hosiery Mills, Mount Airy, N. C. The Holly Bush Hosiery Mills Company, Holly Bush, N. C., has just been organized, and the Davis-Alcott Hosiery Mills, Gadsden, Ala., are installing additional electric equipment.

DRY BATTERIES.—There is no let-up in the demand for these, it being almost impossible to fill orders. No improvement in deliveries is expected until the present freight congestion at the larger Eastern cities loosens up.

FLASHLIGHTS.—The call for flashlights is very large, and while a sufficient supply of cases is on hand, no batteries can be had to fill them. This general situation follows closely that of the dry cells mentioned above.

HEATING APPLIANCES.—During the summer months the volume of sales in appliances lagged somewhat, but beginning with the fall weather and up to the present time this line has been on the boom. One manufacturer, who carries a very complete line, reports that the volume of his sales for the Southeast to date has broken all records. Reports from a number of jobbing sources indicate an unprecedented business for the year. Flatirons are still the most popular appliance. The South is realizing more and more the advantage of electric devices, and heaters that in the past grew shopworn cannot be kept in stock now, even for display purposes. Activity is not confined to a few articles, but is reflected in shaving mugs, curling irons, percolators and round grids. Deliveries are in pretty good shape, and local stocks seem to be able to take care of the situation.

SEATTLE

There is no noticeable increase or decrease in sales during the week. Business with shipyards, mills, industrial plants and government utilities continued strong and with no evident signs of abatement. Shortages along the lines previously mentioned are still causing considerable worry. Shortages in lamps are particularly acute. This includes automobile lamps. The demand for lamps is increasing constantly, owing to the prevalent foggy winter weather and short days. The sales of farm lighting plants during the past week have dropped off appreciably. It is believed now that while sales along this line will be satisfactory, they will not come up to predicted expectations.

Washing machines and appliances are moving well, and dealers are expecting a volume of increasing sales between now and Christmas. Electric sewing machines particularly are moving well, and this line is expected to boom preceding the holidays.

Power and lighting companies throughout the Northwest, particularly those located in the outlying districts, are waging an advertising campaign with a view of increasing Christmas sales of energy-consuming devices. Public utility companies in Seattle, Tacoma and Portland are expected to begin advertising and pushing sales of appliances the latter part of November, as will department stores and jobbers.

Seattle dealers during the week received an inquiry for a large number of tailors' electric irons, ranging in weight from 9 lb. to 20 lb., to be used at the American Lake cantonment, near Tacoma. Orders are still coming in from cantonments for lighting equipment and fixtures.

Business building in Tacoma is showing considerable life, several structures, including two or more apartments, are projected and under way. There is no change in the situation in Seattle, Portland or Spokane. Smaller buildings in the outlying districts show a slight increase. Three power and lighting companies, two in the Puget Sound district and one in eastern Washington, contemplate early extension work.

A very conservative source of information states that a steel plant for Seattle or the immediate vicinity is assured. The project is backed by Seattle, Alaska and San Francisco capital. An ultimate investment of \$25,000,000 is promised. Several other industrial enterprises of far-reaching importance are projected.

Lumber production during the week is reported to be 84 per cent of normal, and orders are within 95 per cent of normal. The settlement of the telephone strike in Washington and Oregon, which has continued for two weeks, is believed near, with the opening of a peace conference in San Francisco.

The car service commission of the railroads' war board issued a general order to all transportation lines insisting upon the strictest economy in hauling cars. The freight situation locally is no better. It is reported that Oregon expects an embargo on shipments of rough lumber among other things. Seattle jobbers report shipments are coming through from the East in a fairly satisfactory way, everything considered. Stocks are being watched very carefully, and annual inventories are being taken.

SAN FRANCISCO

Because of the weather, which continues fine and clear toward the end of November, together with the pressure of important problems, there has not been much thought of Christmas goods on the part of consumer or dealer, although jobbers, in anticipation of a heavy Christmas demand and slow deliveries, placed their orders some time ago. There is now speculation as to whether heavy Christmas orders will come suddenly or whether holiday buying will be lighter than usual.

A material factor in California conditions is the recent fixing of foodstuff prices by the federal authorities. This assurance of continued profit to farmers has brought the power companies considerable business in small pumping and other farm loads. All available irrigable land is being brought under cultivation, and the demand for extensions to small consumers is now the business of the day rather than the construction of expensive trunk lines on the initiative of the power companies.

The Garfield order curtailing electric sign lighting is not effective in California, it has been decided by the Railroad Commission, because oil, instead of coal, is used there to carry the peak.

The freight car embargo, which has seriously affected business in many lines in the West, has not yet been felt seriously in the case of electrical supplies. Prices remain unchanged, and, on the whole, deliveries and stocks are not fluctuating.

CREDITS AND COLLECTIONS.—Collections continue to be in remarkably good shape, the jobbers report; and it is believed that this is in large measure due to the educational work that has been going on among contractors and dealers, fostered by their own associations.

METERS.—The demand for meters has been active recently, and although much of this business is on a contract basis, there has been some competition on terms of delivery. Delivery varies greatly from five weeks to four or five months. Stocks on the Coast are in fair shape.

LAMPS.—The lamp situation, described as rather tense, remains unchanged. So long as no large orders that are urgent come in, actual needs can be handled satisfactorily.

SMALL MOTORS.—Fuel-oil producers have complained to the fuel conservation committee that the increase of oil production has been hampered by the delay in getting motors. As a result the matter has been referred by manufacturers to the Priority Board, and it is hoped that the motor situation will be improved.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

E. & S. Size	List per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor

No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single Conductor

Less than coil.....	List net to \$61.00
Coil to 1000 ft.....	—5% to \$59.17
Less than coil.....	List net to \$71.00
Coil to 1000 ft.....	—5% to \$68.87

Twin-Conductor

Less than coil.....	List net to \$105.00
Coil to 1000 ft.....	\$70.00 to 10%
Less than coil.....	List net to \$135.00
Coil to 1000 ft.....	—10% to \$130.95

DISCOUNT—CHICAGO

Single-Conductor

Less than coil.....	List to +10%
Coil to 1000 ft.....	List to —10%
Less than coil.....	List to +10%
Coil to 1000 ft.....	List to —10%

Twin-Conductor

Less than coil.....	List to +10%
Coil to 1000 ft.....	List to —10%
Less than coil.....	List to +10%
Coil to 1000 ft.....	List to —10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10% to list net
1/5 to std. pkg.....	15% to 20%
Std. pkg.....	34% to 38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+20% to 12%
1/5 to std. pkg.....	List to 20%
Std. pkg.....	30% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31 to .3175	.32 to .3275
Barrel lots.....	.28 to .2875	.29 to .2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, Per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp.....	\$75.00 \$66.00 to \$69.75
3/8-in. d. stp.....	75.00 to 78.75 68.25 to 72.00
1/2-in. s. stp.....	100.00 88.00 to 93.00
1/2-in. d. stp.....	100.00 to 105.00 91.00 to 96.00

NET PER 1000 FT.—CHICAGO

Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip....	\$75.00 \$63.75
3/8-in. double strip....	78.75 71.25-71.75
1/2-in. single strip....	100.00 85.00
1/2-in. double strip....	105.00 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	2.....	.47
3/4.....	.15	2 1/2.....	.55
1.....	.18	3.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$25.00-\$55.00	\$20.50-\$24.75
1/4-in.—	\$28.00-\$60.00	\$22.50-\$27.00
		\$22.00-\$24.00

NET PRICE 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$36.67-\$55.00	\$27.50
1/4-in.—	\$40.00-\$60.00	\$30.00
		\$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4.....	\$0.0 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/4
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List Elbows, List

1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.60
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.....	4% to 6% 7% to 9%
2500 to 5000 lb.....	6% to 9% 9% to 11%
(For galvanized deduct six points from above discounts.)	

DISCOUNT—CHICAGO

1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.....	3.3% to 4.8% 6.3% to 7.8%
2500-5000 lb.....	5.3% to 6.8% 8.3% to 9.8%
(For galvanized deduct six points from above discounts.)	

FLAT IRONS

NEW YORK

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

CHICAGO

List.....	\$5.00 to \$6.00
Discount.....	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.00 to \$5.75
1/5 to std. pkg.	4.50
Standard package, 500.	List, each, \$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500.	List, each, \$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List.
Regular, clear:		Each
10 to 40-watt-B.	100	\$0.27
60-watt-B.	100	.36
100-watt-B.	24	.65
75-watt-C.	50	.65
100-watt-C.	24	1.00
200-watt-C.	24	2.00
300-watt-C.	24	3.00
Round bulbs, 3 1/4 in., frosted:		
15-watt-G 25.	50	.50
25-watt-G 25.	50	.50
40-watt-G 25.	50	.50
Round bulbs, 3 1/2 in., frosted:		
60-watt-G 30.	24	.72
Round bulbs, 4 1/4 in., frosted:		
100-watt-G 35.	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$30.00 to \$33.98
Coil to 1000 ft.	25.50 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$36.56
Coil to 1000 ft.	27.42

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	\$20.00 to \$29.00
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CHICAGO

Net per 100	\$19.25 to \$25.75
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OUTLET BOXES

Nos.	List.
per 100	
101—A, A1 1/2, 4 S.C., 6200, 320.	\$30.00
102—B.A., 6200 S.E., 300, AX, 1 1/2,	
4 S.	30.00
103—C.A., 9, 4R, B 1 1/2.	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list.	25% to 37%	20% to 32%
\$10.00 to \$50.00 list.	42% to 45%	37% to 40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list.	40%	35%
\$10.00 to \$50.00 list.	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$20.00 to \$38.00
1/5 to std. pkg.	19.00 to 20.00
Standard package, 2200.	List per 1000, \$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80 to \$20.54
1/5 to std. pkg.	14.80 to 19.24
Standard package, 2200.	List per 1000, \$20.

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net	Std. Pkg.	3500 Std. Pkg.	4000
		5 1/2 N.C.—Solid Nail-it—N.C.		

Less than 1/5 std. pkg.	\$27.50 to \$29.00	\$30.75 to net
1/5 to std. pkg.	15.60 to 20.75	24.20 to net

CHICAGO

Per 1000 Net Std. Pkg.	3500 Std. Pkg.	4000
5½ N.C.—Solid Nail-it—N.C.		
Less than 1/5 std. pkg.	....\$11.85	\$30.75
1/5 to std. pkg.	.....11.10 to 11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/8-in. cap key and push sockets	500	\$0.33
1/8-in. cap keyless socket.	500	.30
1/8-in. cap pull socket.	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List to net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List to net
1/5 to std. pkg.	List to —15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	\$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00

Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than \$10 list.	List net to + 5%
\$10 to \$25 list.	Net to 11%
\$25 to \$50 list.	14% to 15%

	Low Grade
Less than \$10 list.	5% to 10%
\$10 to \$25 list.	10% to 16%
\$25 to \$50 list.	14% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than \$10 list.	List to + 5%
\$10 to \$25 list.	List to —11%
\$25 to \$50 list.	List to —14%

	Low Grade
Less than \$10 list.	List to —5%
\$10 to \$25 list.	List to —16%
\$25 to \$50 list.	List to —24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole.	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole.	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point.	100	.54
10-amp. three-point.	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole.	100	\$0.45
10-amp. three-way.	50	.70
10-amp. double-pole.	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	25%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+ 20% to list
1/5 to std. pkg.	List to —15%
Std. pkg.	List to —30%

SWITCH BOXES, SECTIONAL CONDUIT

	List
Union and Similar—	Each
No. 155.	\$0.34
No. 160.	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list.	List to list net	List to + 10%
\$2.00 to \$10.00 list.	10% to 20%	5% to 10%
\$10.00 to \$50.00 list.	20% to 30%	15% to 20%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list.	25% to 50%	20% to 40%
\$2.00 to \$10.00 list.	25% to 50%	20% to 40%
\$10.00 to \$50.00 list.	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price.	\$5.00 to \$7.50
Discount	25% to 30%

CHICAGO

List price	\$5.00 to \$6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools.	\$0.44 1/4 to \$0.65
No. 18, full spools.	0.43 1/4 to 0.55

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	\$0.57 1/2 to \$0.65
No. 18, full spools.	0.50 1/2 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No.			
11.	\$15.00-\$18.00	\$13.00-\$14.00	\$11.25-\$12.00
12.	23.25-27.09	21.30-23.22	19.35-20.85
10.	32.40-37.80	29.70-32.40	27.00-29.25
8.	45.70-53.34	41.90-45.73	38.00-41.38
6.	72.40-84.42	66.35-72.35	60.30-65.50

CHICAGO

	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No.			
14.	\$18.00	\$13.50	\$12.00
12.	27.36-27.37	23.41-27.37	21.88-23.46
10.	38.15-38.25	32.40-32.72	29.97-30.60
8.	53.83-54.27	46.14-46.43	42.29-43.42
6.	85.19-92.61	60.85-79.23	54.76-74.09

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$35.25 to \$40.00
25 to 50 lb.	35.25 to 39.00
50 to 100 lb.	34.25 to 38.00

CHICAGO

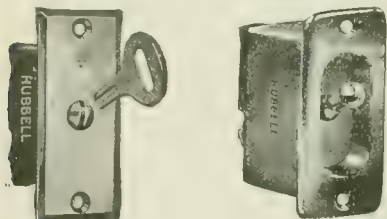
	Per 100 Lb. Net
Less than 25 lb.	\$40.00 to \$40.50
25 to 50 lb.	39.00 to 39.50
50 to 100 lb.	38.00 to 38.50

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Toggle Switch

Automobile toggle switches designed with a view toward effecting an improvement over the existing forms of switches for automobile use, such as those employing the miniature push button, or the single-plunger type,



TOGGLE SWITCHES FOR AUTOMOBILES

which consists of pulling out and pushing in a small handle, have been developed by Harvey Hubbell, Inc., of Bridgeport, Conn. The makers claim that the toggle, or lever or tumbler form of switch, as it is variously referred to, is the most convenient form for operating in an automobile. To throw on the current the toggle handle is simply pushed up, and the reverse operation opens the circuit.

Another feature pointed out is the indicating arrangement of the toggle. To the user of the switch it becomes second nature to press the handle up to turn on the lights, and down to turn them off. These switches have sufficient carrying capacity to carry the load of almost any battery or magneto circuit and have successfully withstood tests as high as 50 watts. The interior mechanism is very simply and strongly made. The switches can now be furnished in single-pole and three-way types with flush plate, single-pole and three-way with recessed plate, momentary-contact type, double form of momentary contact, battery magneto circuits, single-pole and three-way lock switches. Lighting systems of more or less special character can be arranged by gang combinations made up of these various types.

Small Wiring for Switchboards

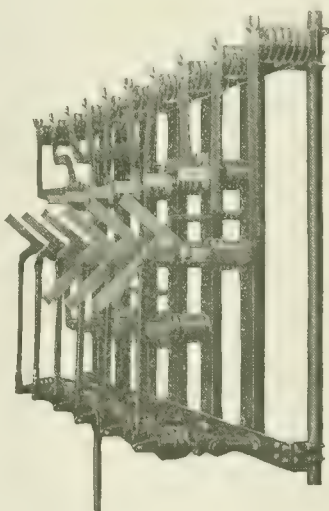
Where a large amount of instrument and control wiring must be installed on the rear of a switchboard the arrangement of the wires becomes of considerable importance. The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., runs the wires up the webs of the vertical supports of switchboards mounted on its standard angle-iron frames.

With the improved arrangement by placing the wires with due regard to

the apparatus to which they connect on the panel, it is possible to bring them out opposite the particular piece of apparatus and run them horizontally to it along the back of the panel itself. This means that all wires are accessible and that what would ordinarily mean a rear extremely crowded with instrument and control wiring or with a bulky group along each angle becomes a panel in which there is little crowded wiring. This workmanlike and accessible wiring, however, is only possible where an angle iron, such as the standard Westinghouse frame, is employed for supporting the switchboard.

Remote-Control Switch

The Booth-Hall electric furnaces are so arranged that the transformers are connected in series, giving full arc voltage when melting down. When holding



SWITCH IS USED FOR ELECTRIC FURNACE INSTALLATIONS

a heat or refining, the transformers are connected in parallel, giving one-half voltage but maintaining the full normal current. To make this change quickly in transformer connections, the Delta-Star Electric Company of Chicago has designed the manually operated remote-control six-pole switch shown in the accompanying illustration.

When melting down, the switch blades are thrown from the open position shown to the upper—all six blades making contact. For reducing the voltage the switch blades are thrown down, in which case only the three double-throw blades make contact. This development in switching equipment for electric furnace installations is of particular interest, as it enables better furnace operation, the manufacturers point out.

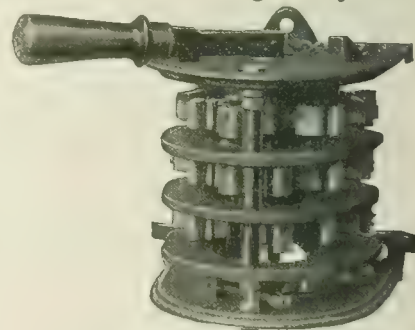
Drum Reverse Switch

One of the latest products of the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., is a small drum reverse switch for operating motors in machine-tool, woodworking and other services requiring reversing of the motors. The small size and neat appearance of this reverse switch make it especially adapted for mounting directly on the machine.

A terminal board of heavy micarta forms the back of the switch, and on the front side of this board are mounted the stationary contacts. The movable contacts are mounted on cast-brass brackets clamped on the shaft, from which they are thoroughly insulated. Good contact is insured by phosphor-bronze springs on the movable contacts, these being protected by copper shunts. Heavy barriers of asbestos lumber separate adjacent sets of contacts so that cross-arc-ing is impossible, it is pointed out. All live parts are protected from exposure by an inclosing cover of sheet steel lined with asbestos and held in place by two ring latches, which permits its easy removal for renewal of contacts.

These switches are made for alternating-current or direct-current circuits. For alternating-current service and for direct-current service without dynamic braking they are provided with "forward," "off" and "reverse" positions. For alternating-current service the motor is connected directly across the line.

For direct-current applications with dynamic braking the switch handles have five positions as follows: "Forward," "drift," "off and brake," "drift," and "reverse." They may be used with automatic starters for shunt and compound-wound motors. With compound-wound motors having heavy series

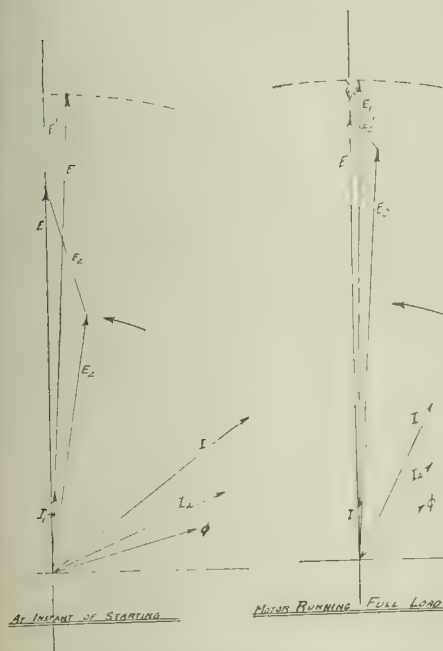


DRUM REVERSE SWITCH WITH COVER REMOVED

winding for tail-stock and cross-rail service they may be used to connect the motor directly to the line, either with or without resistors permanently connected in series with the armature.

Voltage Stabilizer

In electrical systems of distribution an instantaneous or sustained increase or decrease of current produces a corresponding voltage change, more or less pronounced, depending on the combined regulation of the line and transformer



ACTION OF STABILIZER SHOWN VECTORIALLY

I = line current. I_1 = lamp current.
 I_2 = motor current (starting, running)
 E = line volts, E_1 = lamp volts.
 $E'1$ = regulator lamp coil volts.
 $E'2$ = regulator motor coil volts.
 E_2 = motor volts; ϕ = regulation flux.

from which power is derived. If the system is a mixed one supplying a combination load of lamps and motors, then the changes of voltage produce serious results in the form of lamp flicker—even if the voltage varies by only 1 or 2 per cent.

An alternating-current stabilizer has been developed by the General Electric Company of Schenectady, N. Y., which eliminates these objectionable features and makes possible the operation of motors in places where the lighting service must not be impaired, it is said. The stabilizer is essentially a highly reactive transformer having a primary through which the motor current flows and a secondary which is connected in series with the lamp load and boosts by an amount proportional to the voltage drop caused while starting.

The stabilizer consists of a laminated core in which an adjustable air gap has been interposed. On the middle leg of the core structure are interwound the motor and lamp coils. When starting, the rush of current through the motor coil excites the magnetic circuit of the stabilizer and induces a voltage in the lamp coil which is substantially in phase with the lamp voltage. This action is shown in the vector diagram where E is the voltage added vectorially by the lamp coil in order to maintain E_1 , the lamp voltage, at a constant value. If, however, a transformer or reactance is inserted

permanently in series with the motor, its terminal voltage is excessively lowered, and this might be detrimental since in some cases full load could not be delivered. In the stabilizer this effect is overcome in two ways—first, by designing so that at normal full load running current the flux density in the iron core is low, which means a correspondingly low voltage drop; second, by inserting an air gap in the iron core, by which means the stabilizer is made highly reactive and most of the drop over the motor coil is in quadrature with the line voltage except for copper and core loss. These losses can and must be kept low in order to make the apparatus efficient. This is shown in the diagram, where E , is motor terminal voltage and $E'2$ the voltage drop over the motor coil of the stabilizer.

The stabilizer may be applied to any power apparatus operating in combination with lighting loads. Thus it may be used for general industrial purposes for hotels and apartment houses and small isolated stations of limited capacity. The nature of the load influences the method of applying the stabilizer, especially where it is required to operate over a wide difference of starting power factors.

Electric Suction Cleaner

One of the latest models of electric suction cleaner made by the Kent Vacuum Cleaner Company, Rome, N. Y., is made in two separable parts, the upper section containing the dust can. The suction plant is mounted in the aluminum base and is driven by a Westinghouse universal motor. The equipment includes carpet nozzle, wall brush, hardwood floor pad, upholstery cleaning tool, 12 ft. (3.7 m.) of hose and 20 ft. (6.1 m.) of flexible cord.

Weatherproof Plug and Receptacle

The latest addition to the Ralco line of heavy-duty plugs and receptacles handled by the Central Electric Company of Chicago, Ill., is known as the No. 22, designed for use on three-phase alternating-current or three-wire direct-current circuits, the plug being non-reversible. This device is a three-pole weatherproof receptacle with fuse connection that has a capacity of 30 amp. on 250 volts. It is regularly furnished with a D. & W. inclosed fuse cut-out, No. 91,103, set in place and wired to the receptacle. It can also be furnished when specified with a plug fuse block.

The body is of cast iron, provided with a door at the top for ready access to the fuses when necessary, but the entire front is removable for wiring. Receptacles are protected by the spring door, which closes automatically as the plug is withdrawn. The hinged door for the fuse and the spring door to the receptacle are provided with gaskets.

Flux Paste

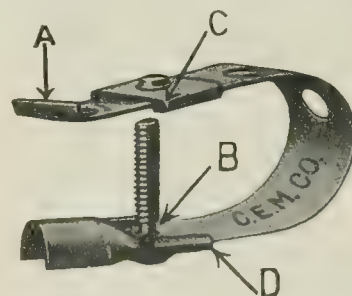
Flux paste which, it is claimed, does not eat or rust copper, brass, iron, steel or any other metal has been developed by Hess & Son of Philadelphia. This paste as it evaporates leaves behind it a thin coating of clean, bright tin to which the solder takes readily. It is said that this paste will instantly tin a new, clean iron. Attention is called to the fact that this paste will not injure the most delicate fabrics, such as the silk insulation on electric wires.

Direct-Current Ratio Relay

Two noteworthy features pointed out for the direct-current ratio relay made by the Western Electro-Mechanical Company of Oakland, Cal., are its size and its guaranteed accuracy. The manufacturers point out that the troubles usually encountered in the service calibration of high-rating direct-current meters are: (1) Difficulty of shunting meter out of service, (2) stray fields from shunt leads affecting meter under test or standards, (3) difficulty of calibrating high-rating standards, (4) large, cumbersome leads, shunts, etc., requiring considerable investment, time and caution if test is to be reliable. These difficulties, it is said, are largely overcome by use of the ratio relay. An iron core carrying a secondary winding, similar to the well-known current transformer, is slipped over the bus or feeder, and the current flowing through the winding on the iron core is metered by means of low-capacity standards. This relay is made in capacities ranging up to 10,000 amp.

Ground Clamps

An improved design of ground clamps has been produced by the Connecticut Electric Manufacturing Company of Bridgeport, Conn. Attention is called to the construction shown in the accompanying illustration whereby the nut and screw are attached to the clamp itself, thus eliminating the possibility of the workman reaching the job with some of these parts missing. The sliding band or nut screw with undercut thread are also features which

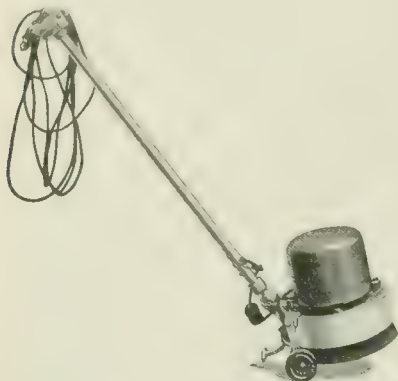


CONSTRUCTION OF GROUND CLAMP

make this device easy to install. Referring to the illustration, A is a stop for the sliding band C, B the undercut screw which cannot drop out, and D a reinforced band giving strength under the screw head.

Machine for Polishing, Sanding and Scrubbing Floors

The floor machine manufactured by the Kent Vacuum Cleaner Company, Inc., of Rome, N. Y., is provided with four interchangeable attachments, one for polishing waxed floors, one for



PROVIDED WITH FOUR INTERCHANGEABLE ATTACHMENTS

scrubbing floors of all types, one for removing varnish and one for sanding floors. These attachments are a steel wire brush, a palmetto scrubbing brush, a tampico polishing brush and a sand-paper disk. They are circular and are rotated continuously in one direction as the machine propels itself over the floor.

When the operator raises the handle slightly the machine moves to the right. Lowering the handle causes it to move to the left. Twisting the handle slightly in one direction causes the machine to move forward. Twisting it in the opposite direction causes it to move backward.

The machine is operated by a 1/6-hp., 1750-r.p.m. motor. The speed of the brush is reduced to 200 r.p.m. through a reduction gear drive. The motor is completely inclosed and the entire machine is provided with an aluminum case, thus obviating any danger of the revolving part striking and injuring furniture, baseboards, etc., and making it possible to operate the machine against baseboards and into corners. The motors used are a special design made for the Kent Vacuum Cleaner Company by the Robbins & Myers Company. They can be furnished for operation on 110 volts or 220 volts direct current or on alternating current of 110 volts or 220 volts at 25, 40 and 60 cycles.

Portable Storage-Battery Spotlight

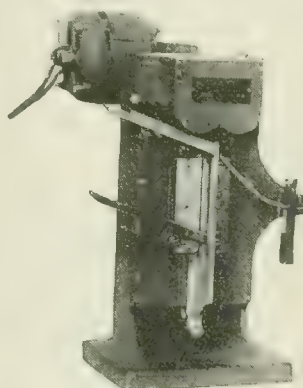
A design of searchlight adapted for projection that can be operated on a set of storage batteries is now made by the Penfield Manufacturing Company, 49 Randolph Avenue, Meriden, Conn. This searchlight is mounted on the top of a pipe support and has a hinged joint, so that a wide vertical swing is possible. A parabola reflector is provided which, it is claimed, will throw a strong light 900 ft. (274.3 m.). The construction of both the lamp and the

battery box is waterproof so that the outfit can be used exposed to the weather. An "on" and "off" switch is provided in the body of the lamp. The storage battery furnished has a rating of 100 amp.-hr. and for ordinary use requires charging about once a week.

This company also makes a spotlight for bracket mounting, finished in black and polished nickel and provided with a rear-view mirror. This spotlight can be used for stationary use or on automobiles and trucks.

Motor-Operated Space-Band Cleaner

The List Manufacturing Company of Clare, Mich., has developed a machine to clean automatically space bands used with linotype machines. This machine also graphites the bands. Unless the bands are kept free, the work of the machine is imperfect and the linotype itself deteriorates. Since cleaning the space bands by hand tends to flatten them and leads to imperfect casting, the machine here illustrated was developed. It cleans and graphites fifty space bands per minute and is actu-



OPERATED BY A FRACTIONAL-HORSEPOWER MOTOR

ated by a fractional-horsepower motor manufactured by the General Electric Company. These motors are standard equipment and operate on the currents obtainable from an ordinary lamp socket.

Snubber for Guy Wires

The National Telephone Supply Company of Cleveland, Ohio, has developed a special device for use with a breaker in guy wires. This device consists of a one-piece malleable casting galvanized by the hot-dip process and made in three sizes for use with 1/4-in. (6.4-mm.) strand guy wire, 5/16-in. to 3/8-in. (7.9-mm. to 9.5-mm.) strand guy wire and 7/16-in. to 1/2-in. (11.1-mm. to 12.7-mm.) strand guy wire. The features of this device are pointed out by the maker to be its simplicity, its ease of installation and its ruggedness. There are no bolts or other parts to rust, corrode or get loose, and no special tools are required for its installation. Further, it is pointed out that this snubber does not break the galvanizing on the strand and saves 3 ft. (0.91 m.) of guy wire.

Porcelain Current Taps

Porcelain current taps, manufactured by the Bryant Electric Company of Bridgeport, Conn., are virtually a ready-wired socket adapter with a slotted receptacle in the side for cap or plug. One end of the body is fitted with a standard screw plug, similar to a regular lamp base, while the other end is designed to receive a standard medium-base lamp. Thus a lamp may be removed from its socket, the tap put in its place and the lamp screwed into the outer end of the tap. The tap, therefore, not only provides for the retention of the lamp in its original location, but provides a suitable approved receptacle for attachment plug.

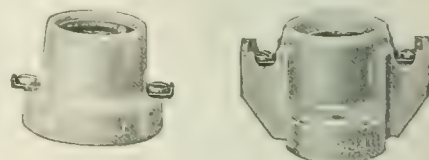
This device can be furnished for multiple connection or series connection.

Automobile Spotlight

An automobile electric spotlight produced by the Pittsburgh (Pa.) Electric Specialty Company is designed so that it may be equipped with locking clamps to comply with various city statutes. Many rulings have recently been passed forbidding the use of spotlights which throw any direct rays over a horizontal line 42 in. (106.7 cm.) from the ground. Used with the new clamp this spotlight complies with the regulations. This spotlight uses a triple reflector designed to concentrate all the rays into a beam of uniform intensity, eliminating glare. The lamp has an outside focusing adjustment and a 4-in. (10-cm.) adjustable vision diminishing mirror is provided. The standard finish is black japan.

Porcelain Receptacles

Three porcelain receptacles have just been placed on the market by Harvey Hubbell, Inc., of Bridgeport, Conn. Catalog No. 9171 is a cleat receptacle which is supported by one screw through the center of the device. Catalog No. 59,275 is another type of cleat receptacle made with lugs on each side to accommodate wiring raised 1 in. (2.54 cm.) from the surface. Catalog No. 61,988 is a receptacle for conduit box and metal-sign work. This receptacle is constructed with five notches in the base. Bending one projection from the metal plate into any one of the notches will guarantee a



LINE OF PORCELAIN RECEPTACLES

permanent location for the receptacle after its installation. Another feature pertaining to this device is the screw ring which will permit the removal of the shell without disturbing the wiring. All of these receptacles are rated at 660 watts and 250 volts.

Trade Notes

CHARLES W. MALCOLM, formerly sales manager for the Geyser Electric Company, Chicago, was recently appointed general manager.

THE WARD LEONARD ELECTRIC COMPANY of Mount Vernon, N. Y., is now represented in San Francisco, Cal., by the Electric Material Company, 589 Howard Street.

H. P. G. NOSTAND, for thirteen years general superintendent and later vice-president and general manager of the Rathbone-Sard Electric Company, Albany, N. Y., has resigned.

FRANK O. WALLENE of the Electric Machinery Company, Minneapolis, Minn., has been transferred from the factory to Cleveland, Ohio, where he is opening an office as district manager.

W. H. JEFFERSON is now stationed in the New York City office of the Cutler-Hammer Manufacturing Company of Milwaukee, Wis. Mr. Jefferson will handle Thomas meter sales for the company in the East.

THE HARTFORD MACHINE SCREW COMPANY, Hartford, Conn., has made large additions to the extensive plant of its main works, which have recently been completed and now comprise over 200,000 sq. ft. of floor space.

THE CIRCUIT is the title of a new house publication from the Elliott-Lewis Electrical Company, Inc., Philadelphia, the first number making its appearance for October. The letterpress, illustrations, etc., are pertinent and well selected.

THE WAGNER ELECTRIC MANUFACTURING COMPANY of St. Louis announces the opening on Nov. 15 of a sales office at 116 Auburn Avenue, Atlanta, Ga., in charge of Charles M. Welch, formerly branch office manager at Indianapolis, Ind.

THE SMITH-SERRELL COMPANY, INC., New York City, is giving preference to all orders for its product which either directly or indirectly help in the production of munitions and other necessary war supplies. Orders must be so classified, giving destination and how used.

THE WESTBURG ENGINEERING COMPANY, Chicago, which handles the line of the Ward Leonard Electric Company, Mount Vernon, N. Y., is the new corporate name of what was formerly the Badt-Westburg Electric Company. This involves no change in management.

THE NAGLE CORLISS ENGINE WORKS, Erie, Pa., have opened an office at 39 and 41 Cortlandt Street, New York City. Frank W. Richardson is in charge. This gives the company direct representation and insures immediate personal attention to all inquiries as to prices and delivery promises.

THE GENERAL ELECTRIC COMPANY'S repair shop at Atlanta, Ga., is fully equipped to give repair service on all classes of direct-current and alternating-current apparatus. Correspondence in regard to work of this kind should be addressed to the Engineering Department, Third National Bank Building, Atlanta, Ga.

GEORGE H. MORRIS, who was formerly assisting operating and construction engineer for the Electric Storage Battery Company at Chicago, has resigned to become president and treasurer of the Morris Battery Service Company of Evanston, Ill. Mr. Morris has been engaged in manufacturing, construction and maintenance of storage batteries for eighteen years.

THE CRANE COMPANY'S new exhibit rooms at 23 West Forty-fourth Street, running through to Forty-fifth Street, New York City, "symbolize the character of the goods for which they furnish an architectural setting," to use the words of Frederick Stanley, manager of the Chicago company's branch house. A complete sample line of products is arranged and displayed in a striking manner, each exhibit having a plate giving the name of the piece, catalog number and sizes in which it is made.

W. J. DRURY, sales manager for five years at Dallas, Tex., has been promoted to the managership at Cleveland, Ohio, of the Western Electric Company, Inc., New York City. Mr. Drury has been in the service of the company since 1904, when he graduated from Furdue University as an electrical engineer. Henry P. Hess, who has been in charge of sales at Houston, Tex., goes to Dallas in Mr. Drury's place. George L. Chestnut, formerly in the sales department at St. Louis, Mo., later at Dallas, succeeds Mr. Hess at Houston.

H. N. GOODELL, who was the manager of the Western Electric Company's Omaha (Neb.) house since 1912, has been made assistant central district manager, with the Minneapolis organization reporting to him hereafter. Mr. Goodell, who will continue his work as manager at Omaha, where he will reside, has been with the company for eleven years in various positions in the West and East. Alfred H. Bannister, who becomes sales manager at Minneapolis, has been on the Western Electric Company's staff for eleven years, first entering the service at New York, later going to Minneapolis and Omaha.

Trade Publications

SOCKETS.—Harvey Hubbell, Inc., of Bridgeport, Conn., has prepared a leaflet descriptive of its quick-catch sockets.

INSULATORS.—The Locke Insulator Manufacturing Company of Victor, N. Y., has prepared supplement No. 2 to its insulator book.

MOTORS.—Phoenix induction motors, two-phase and three-phase, are described in a booklet prepared by the Phoenix Electric Company of Mansfield, Ohio.

ELECTRICAL APPARATUS.—The General Electric Company of Schenectady, N. Y., has issued two indexes, one to supply-part bulletins and the other to descriptive bulletins and sheets.

WOMEN'S WORK IN WAR TIME.—The Merchants' National Bank of Boston, Mass., has published a book entitled "Women's Work in War Time," by W. Irving Bullard, manager of the textile department.

HARDNESS TESTING MACHINE.—A useful bulletin has been prepared by the Scientific Materials Company, 711 Forbes Street, Pittsburgh, Pa., descriptive of an improved American model Brinell hardness testing machine with special depth-measuring gage.

METERS AND CIRCUIT BREAKERS.—The General Electric Company of Schenectady, N. Y., has prepared bulletin No. 46,201A, descriptive of its single-phase watt-hour meters, types I-14, IS-4 and IS-5. This company has also prepared bulletin No. 47,469, descriptive of its type FK-24 oil circuit breakers.

MAGNETIC GEAR SHIFT.—The Cutler-Hammer Manufacturing Company of Milwaukee has just published a 100-page booklet containing reproductions of letters received from motorists giving opinions on the C-H magnetic shift. The letters are photographically reproduced and are interesting in that they indicate a well-defined liking by the motor-car driver for pre-selection of speeds as provided by the magnetic shift.

SPEED MOTORS.—The General Electric Company, Schenectady, N. Y., in bulletin No. 41,021, describes the R. F. line of adjustable-speed motors, which are the results of many years of experience and numerous tests under actual shop operation. Among the advantages of this R.F. type motor is the practical elimination of commutation troubles arising from abuse or careless operation. Special attention has been given to efficiency regulation, stability and insulation.

DRYING APPARATUS.—The J. P. Devine Company has just published bulletin No. 104, covering its patented vacuum drying and impregnating apparatus. This bulletin gives detailed information of the equipment referred to, which is used very extensively for the impregnation of armature, field, magnet and transformer coils, power and telephone cables, insulator pins and electrical work of any nature. The bulletin describes the operation of the apparatus, giving data as to its exact use in the electrical field and comparing the old method of impregnating by the baking oven with this process of vacuum and pressure impregnation. The publication is profusely illustrated with pictures covering installations that this company has made in this field.

WATER-TUBE BOILERS.—The Bigelow Company of New Haven, Conn., has prepared a cloth-bound book descriptive of its Bigelow-Hornsby water-tube boiler. This book describes several notable foreign installations, size of units and flexibility of construction, feed and circulation, sustained economy, the large percentage of direct heating surface, baffling and smoke-flue connection, free liberation of steam, superheating, accessibility and other important features. A list of some installations of these water-tube boilers is given, as

are illustrations of installations in various well-known power plants. In the back of the book are given a saturated-steam-pressure table, a superheated-steam table and other useful tables. This book is well illustrated and shows great care in its make-up.

FIXTURES.—"Lightoliers" for correct illumination and interior decoration of modern homes are illustrated and described in a book prepared by the New York Gas & Electric Appliance Company, 569 Broadway, New York City. This book is very attractive in its make-up and illustrations and gives complete information regarding the line of fixtures made by this company. It should be in the hands of every dealer in electrical fixtures. By referring to the illustrations any one can readily select designs in harmony with furniture and hardware, as well as shades and globes blending pleasantly with wall tints, rugs and draperies. This book is really a lighting-fixture display room in printed form, which faithfully represents the merchandise offered, showing at a glance where each design may be used effectively. On the introductory page to each distinctive group of "Lightoliers" representative designs from that group are illustrated as they would appear actually installed amid home surroundings.

New Incorporations

THE CHALLENGE SPARK PLUG COMPANY of Joliet, Ill., has been incorporated by William Heggie, C. L. E. Miller and C. McNaughton. The company is capitalized at \$20,000.

CHARLES A. JACKSON, INC., of Boston, Mass., has filed articles of incorporation with a capital stock of \$10,000 to manufacture electrical appliances and machinery. Charles A. Jackson of Newton, Mass., is treasurer.

THE VECCHIO MANUFACTURING COMPANY of Albany, N. Y., has been chartered by L. Vecchio, J. A. Fabula and F. Mondello. The company is capitalized at \$10,000 and proposes to manufacture electrical machinery.

THE BARIO METAL CORPORATION of New York, N. Y., has been chartered with a capital stock of \$90,000 to manufacture electrical furnaces. The incorporators are: N. Herbschleb, P. Demiles and H. Jenkins, 31 Park Row, New York City.

THE PEERLESS WATCHMEN'S CLOCK COMPANY of New York, N. Y., has been chartered with a capital stock of \$75,000 to manufacture special clocks. The incorporators are: H. T. Stetson and R. L. Kritzer, 1081 Union Avenue, New York City.

THE STEELE MANUFACTURING COMPANY of Indianapolis, Ind., has been chartered with a capital stock of \$50,000 to manufacture machinery and electrical devices for automobiles. The incorporators are: B. Steele, Gottfried D. Yeager and Frank Fertig.

THE STANDARD ELECTRIC & ELECTRIC COMPANY of Baltimore, Md., has been incorporated with a capital stock of \$500,000 by Frank Stark, Cyrus A. Yarrington and Carroll B. Roberts. The office of the company is located at 118 West Pratt Street, Baltimore.

THE HEATING SPECIALTY COMPANY of Toronto, Ont., has been incorporated with a capital stock of \$50,000 by James Parrish, William A. Ross, Harry W. Page, 12 Richmond Street, East, and others. The company proposes to manufacture stoves, grates, furnaces, boilers and gas and electric heaters, etc.

THE DIRIGIBLE AUTO LIGHT COMPANY of St. Joseph, Mo., has been chartered with a capital stock of \$25,000 by Dr. U. G. Crandell, Dr. E. H. Bullock and John P. Strong. The company proposes to manufacture devices for focusing, adjusting and turning headlights on automobiles, locomotives, interurban cars, etc.

THE LAKEWOOD-GALION COMPANY of Galion, Ohio, has been incorporated by interests associated with the Lakewood Engineering Company of Cleveland. The plant of the Galion Dynamic Motor Truck Company was recently acquired by the Lakewood Engineering Company, and in it it will manufacture electric trucks and tractors, storage batteries and trolley locomotives. The capital stock of the Lakewood-Galion Company is placed at \$100,000. The general offices will be located in Cleveland in connection with the Lakewood Engineering Company.

New England States

OAKLAND, ME.—Plans have been filed by the American Woolen Company, Shawmut National Bank Building, Boston, Mass., for the construction of a new power house, to cost about \$75,000, at its local plant. The E. W. Pitman Company, Bay State Building, Lawrence, is contractor.

MONTPELIER, VT.—The Vermont & Quebec Power Company of Richford has purchased the Fessenden power about 3 miles south of Brome Lake in Canada. The company, it is reported, expects to erect a transmission line this fall and connect this power with that used at Stevens Mills for operating the talc works at Johnson. It is expected that 2000 hp. for 24 hours can be developed at the new site. Charles H. Thompson of Montpelier is manager.

GARDNER, MASS.—Plans have been prepared by the Central Oil & Stove Company, 205 School Street, for the construction of a transformer house and pumping station at its plant. Roger E. Coolidge, 34 Chapin Street, Southbridge, is architect.

SEEKONK, MASS.—The Massachusetts Gas and Electric Light Commissioners have granted the Seekonk Electric Company permission to erect and operate an electric transmission line between Seekonk and Attleboro, where connection will be made with the plant of the Attleboro Steam & Electric Company. By means of this line the Attleboro company will be able to secure energy from the large generating station of the Narragansett Lighting Company situated on tidewater and from the transmission system of the New England Power Company.

SPRINGFIELD, MASS.—Contract has been awarded by the War Department to Fred T. Ley & Company of Springfield for extensive additions and extensions at the Hill and Watershop plants. For the Ordnance Department the contract calls for the construction of a power house at the Hill plant, including turbines, generators, condensers, motors, etc., a rest room and lavatory and barracks for 150 men; for the Quartermaster's Department at the Hill plant, two barracks, one large lavatory, one officers' quarters, one guard house, one storehouse, one recreation building, hospital and heating plant; at the Watershop plant, one barracks, one lavatory, one guardhouse, one officers' quarters and heating plant will be erected. The contract amounts to about \$200,000.

WEST SPRINGFIELD, MASS.—The Boston & Albany Railroad Company has abandoned its plans for the construction of a 200,000-kw. power house at West Springfield. The company has now decided to erect a transformer station, at a cost of about \$35,000, and secure electricity from the Turners Falls Power Company.

PAWTUCKET, R. I.—Steps have been taken by the Chamber of Commerce to secure better lighting facilities for the business section of the city.

BRIDGEPORT, CONN.—Plans have been filed by the Fairbanks Storage Battery Company, 438 Atlantic Street, Stamford, for the construction of a new storage battery station, 40 ft. by 120 ft., at Bridgeport, to cost about \$20,000. Contract has been awarded to W. A. Smith & Son, 188 Cannon Street, Bridgeport.

Middle Atlantic States

BATAVIA, N. Y.—The Genesee Light & Power Company has submitted a proposal to the City Council for furnishing Niagara power for lighting the streets of the city and for operating the sewage disposal machinery.

BUFFALO, N. Y.—Contract has been awarded by the Erie Railroad Company for extensions and repairs to its East Buffalo shop, which will include the installation of a Robbins coal-handling plant.

BUFFALO, N. Y.—Plans have been filed by the Fore River Shipbuilding Corporation of Quincy, Mass., for the construction of a one-story machine shop at the site of its new turbine plant on Vulcan Street, Buffalo.

BUFFALO, N. Y.—Plans have been prepared by the Ferguson Steel & Iron Company, 1399 Bailey Street, Buffalo, for the construction of a new power house, 30 ft. by 130 ft., at the plant of Farrar & Trefits, 67 Perry Street.

HOOSICK FALLS, N. Y.—The Village Trustees have entered into a new contract with the Twin State Gas & Electric Company for lighting the streets of the village for a period of five years, under the terms of which the company will install a new type of lamp. The new system provides for 80 lamps of 250 cp. and not less than 143 of 20 cp.

JOHNSTOWN, N. Y.—The Glen Telephone Company has filed notice of an in-

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

crease in capital stock from \$300,000 to \$400,000, the proceeds to be used for expansion of system.

NIAGARA FALLS, N. Y.—Plans have been filed by Hydrofats, Inc., 98 Delaware Avenue, for the construction of a new power house, in connection with another shop building, the entire work to cost about \$20,000. Contract has been awarded to John W. Cowper, Fidelity Building, Buffalo.

ROCHESTER, N. Y.—Contract has been awarded by the Rochester Light & Power Company to the Turner Construction Company, 244 Madison Avenue, New York, N. Y., for the construction of a four-story addition, 35 ft. by 50 ft., to its power plant.

SEWARD, N. Y.—The Seward Electric Lighting & Power Company has petitioned the Public Service Commission for permission to issue \$44,000 in capital stock, the proceeds to be used to pay for extensions.

SKANEATELES, N. Y.—The Skaneateles Paper Company is building a new power house at its Draycott mills.

ATLANTIC CITY, N. J.—Bids are being received by proprietors of Haddon Hall Hotel for the construction of a power house, 25 ft. by 80 ft. Addison H. Savary of Atlantic City is architect.

DOVER, N. J.—Work has begun on the erection of a large addition to the plant of the New Jersey Power & Light Company. Orders have been placed for new equipment, including a 3500-kw. turbine, equipped with a Westinghouse condenser and two Babcock & Wilcox boilers, equipped with Westinghouse stokers.

JERSEY CITY, N. J.—The American Sugar Refining Company, 153 Washington Street, is contemplating alterations and improvements to its power house, for which a permit has been taken out.

JERSEY CITY, N. J.—Permission has been granted the Great Atlantic & Pacific Tea Company to lay conduits in Provost Street, to connect with nearby buildings, which will be supplied with electricity by the company. The conduits will be short lines in Provost and First Streets.

TRENTON, N. J.—The American Telephone & Telegraph Company is planning to install underground conduits in various streets in the city to replace its overhead wires.

CHALFONT, PA.—The Borough Council has entered into a contract with borough of Lansdale to supply energy in Chalfont for a period of 15 years.

PHILADELPHIA, PA.—Plans are being prepared and permit taken out by Francis Thole, Fifty-eighth and Hoffman Avenue, for an addition to power house at his plant.

PHILADELPHIA, PA.—The Commercial Engineering Company, 1527 Sansom Street, has been awarded contract for the installation of a new electric system at the local navy yard, to cost about \$25,000.

PHILADELPHIA, PA.—Contract has been awarded by the city of Philadelphia to the Standard Construction Company, 1713 Sansom Street, for the construction of a new power house at Vintage and University Avenues, at about \$238,000.

PHILADELPHIA, PA.—Considerable locomotive shop equipment and cranes will be required for the large erecting shop now under construction by the Baldwin Locomotive Works. The cost of the cranes is estimated at \$500,000 and will include four 100-ton, two 50-ton trolleys; four 150-ton, two 75-ton trolleys; two 70-ton, two 35-ton trolleys; two 50-ton, two 25-ton trolleys; eight 20-ton, 10-ton trolleys; all are to be of 74 ft., 8 in. span.

PHOENIXVILLE, PA.—Plans have been prepared for an addition, about 26 ft. by 55 ft., to the pumping station of the Springfield Water Company.

STROUDSBURG, PA.—Bonds to the amount of \$84,000 and \$100,000 in capital stock have been issued by the Stroudsburg Traction Company, the proceeds to be used for extensions and improvements.

WAYNESBORO, PA.—The Waynesboro Electric Light & Power Company has begun work on the erection of a high-tension electric transmission line from Waynesboro to Smithsburg, Md. This line will connect Waynesboro with Hagerstown and Security, Md.

YORK, PA.—An ordinance authorizing a contract with the Edison Electric Light & Power Company for lighting Center Square

for a period of five years has passed its first reading in the City Council. The contract provides for the erection of 12 ornamental standards, mounted with nitrogen lamps of 100 cp.

BALTIMORE, MD.—Plans are being prepared by Cockran, Hill & Company, 221 South Howard Street, for an addition (three stories) to its power station at Sixth Street and Wilkens Avenue.

BALTIMORE, MD.—Contract has been awarded by the Baltimore Dry Docks & Shipbuilding Company for the construction of a power house, 57 ft. by 69 ft., to the West Construction Company of Baltimore.

BALTIMORE, MD.—Contract has been awarded by the Bartlett-Hayward Company, Scott and Henry Streets, to the Morrow Brothers, Fidelity Building, for the construction of a new power house, 44 ft. by 46 ft., at its plant.

SINGERLY (P. O. ELKTON), MD.—Contract has been awarded by T. W. Bacchus to A. M. Stricklin & Son, Elkton, for the construction of a new one-story power house.

MORGANTOWN, W. VA.—The West Virginia Traction & Electric Company is installing new stoker equipment in its local power plant, and will also install a new Westinghouse 1250-kw. turbine.

GLENLYN, VA.—Plans and specifications have been completed by Viele, Blackwell & Buck, consulting engineers, 49 Wall Street, New York, N. Y., for the construction of a steam-driven electric generating plant on the New River for the Appalachian Power Company of Bluefield. The plans provide for an ultimate capacity of 60,000 kw., with an initial installation of 20,000 kw. The steam plant will supplement the Appalachian hydroelectric plants already built on the New River in transmitting energy to the Pocahontas coal field and other power consumers in southwestern Virginia and southern West Virginia.

NEWPORT NEWS, VA.—The Newport News Shipbuilding & Dry Dock Company is reported to be in the market for a large number of electric hoists for new destroyer ships, and other equipment.

RICHMOND, VA.—Plans have been filed by the Richmond Terminal Company for the erection of a new signal tower, 20 ft. by 30 ft., three stories high. Contract has been awarded to the John T. Wilson Company, Mutual Building, Richmond.

WASHINGTON, D. C.—Plans have been prepared by the Bureau of Yards and Docks, Navy Department, Washington, for the installation of a refrigerating plant at the Naval Hospital, to cost about \$63,000.

WASHINGTON, D. C.—Plans have been prepared by Milburn, Heister & Company, Union Savings Bank Building, Washington, for the construction of an addition to the plant of the Potomac Electric Power Company, to cost about \$27,000.

WASHINGTON, D. C.—The United States government will establish three large terminal stations on the Atlantic seaboard, one near Norfolk, Va., one near Baltimore, Md., and the third on the Raritan River, New Jersey, at a cost of about \$18,000,000. A large number of locomotives will be required.

WASHINGTON, D. C.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 10 for the installation of an electric elevator in the gun shop in Washington, D. C. Drawings and specifications (No. 2695) may be obtained on application to the above bureau or the commandant of the navy yard named.

North Central States

DETROIT, MICH.—The Public Lighting Commission has awarded the contract for additions and alterations in the substation of the municipal electric-lighting system on Lawton Avenue, between West Warren and West Hancock Avenues, to Corrick Brothers.

BOLIVAR, OHIO.—Work has begun on the erection of a large electric generating plant at Bolivar by the Doherty Organization, 60 Wall Street, New York, N. Y. The plant when completed will supply electricity in Alliance, Massillon, Orrville and other cities in this part of the state. The initial installation calls for an expenditure of about \$2,225,000. It is expected to have the plant completed by July, 1918.

CHARDON, OHIO.—The Council has voted to call an election to submit to the voters the proposal to issue \$25,000 in bonds for the construction of a new electric-light plant.

CINCINNATI, OHIO.—The Union Gas & Electric Company is planning to convert its Canal Street power station into a dis-

tributing plant when its new river power plant is completed. Connections are being made between the Canal Street plant and the new plant for that purpose.

CLEVELAND, OHIO.—The Parish & Bingham Company is planning the construction of a one-story steel structure, 50 ft. by 265 ft., for storage purposes, and a two-story building, 50 ft. by 200 ft., for which contract has been awarded to the W. I. Thompson & Sons Company of Cleveland. The one-story building will be equipped with a 5-ton electrically operated traveling crane.

DAYTON, OHIO.—Electric lamps will be installed on Hillcrest Avenue, between Main Street and Riverside Drive, and on Todd Street, near Linden Avenue, as soon as the necessary funds are available.

MIDVALE, OHIO.—Plans have been prepared by the Northern Ohio Traction & Light Company of Akron for the construction of a power house, 25 ft. by 25 ft., in Midvale. F. C. Warner, Hippodrome Annex, Cleveland, is architect.

TOLEDO, OHIO.—Plans are under consideration for improvements to the street-lighting system in this city.

LOUISVILLE, KY.—The Louisville Gas & Electric Company, it is reported, contemplates the construction of a transformer station, 50 ft. by 200 ft.

RICHMOND, IND.—The installation of ornamental lamps on North E Street and on North Eighth Street, near the Union Station, has been recommended by the public improvement committee.

CHAMPAIGN, ILL.—The Urbana & Champaign Railway, Gas & Electric Company has petitioned the Illinois Public Utilities Commission for authority to issue \$32,000 in capital stock.

CHICAGO, ILL.—The Hotpoint Electric Heating Company, Ogden Avenue and Twenty-second Street, Chicago, Ill., it is reported, is considering the construction of a factory, to cost about \$250,000.

CHICAGO, ILL.—Plans have been completed by the Chicago Shipbuilding Company, a subsidiary of the American Shipbuilding Company, for an electric power plant at its South Chicago shipyards, located at 101st and Calumet River, to cost about \$15,000.

DANVILLE, ILL.—The Danville Street Railway & Light Company has filed application with the Illinois Public Utilities Commission for permission to issue \$49,000 in capital stock.

DECATUR, ILL.—The Decatur Railway & Light Company has petitioned the Illinois Public Utilities Commission for authority to issue \$180,000 in capital stock.

URBANA, ILL.—Application has been filed with the Illinois Public Utilities Commission by the Urbana Light, Heat & Power Company for permission to issue \$35,000.

WAUKEGAN, ILL.—Improvements are contemplated by the Public Service Company of Northern Illinois, 72 West Adams Street, Chicago, Ill., which will treble the output of its local plant.

DENMARK, WIS.—Preparations are being made by the Denmark Condensed Milk Company for the construction of a new power plant, 40 ft. by 60 ft. Bids, it is understood, will soon be asked for.

GREEN BAY, WIS.—The installation of an ornamental lighting system in the business districts in the east and west sides is under consideration by the Green Bay Association of Commerce.

MANITOWOC, WIS.—The Wisconsin Public Service Company of Green Bay has been granted a franchise to operate in Manitowoc.

MARATHON, WIS.—The Wisconsin Valley Electric Company of Wausau has been granted a franchise for the erection of an electric-light plant in Marathon.

MINNEAPOLIS, MINN.—The Northern States Power Company (the Minneapolis division) has accepted a contract from the Minneapolis Steel & Machinery Company amounting to 6500 hp., during the continuance of the war. The steel company is operating a large portion of its plant on a 24-hour basis.

CONWAY, IOWA.—An ordinance granting a 25-year franchise for the installation of an electric-lighting system in Conway has been passed by the Council. At a special election to be held Dec. 3 the proposal to grant the franchise to A. A. McKay will be submitted to the voters.

JOPLIN, MO.—The Empire District Electric Company is planning to increase its electric generating capacity by 55,000 kw., at a cost of about \$75,000. Machinery, it is understood, has been purchased.

KANSAS CITY, MO.—Plans are being considered by the Fire and Water Board for the construction of an additional pumping station to cost about \$500,000.

ST. JOSEPH, MO.—The City Council has rejected the latest proposal of the St. Joseph Railway, Light, Heat & Power Company for lighting the streets of the city.

GARRISON, N. D.—The installation of an electric-lighting plant in Garrison is under consideration.

HARTINGTON, NEB.—The Nebraska Electric Company of Crawford has been awarded a contract to install an electric-lighting system in Hartington.

ATCHISON, KAN.—The Blair Milling Company has leased a tract of land south of the Union Station, on which it will erect an electric generating plant to supply energy to operate the Blair wheat and corn product mills. The proposed plant will have a generating capacity of 1200 hp. and will also furnish electricity for the Blair elevator, located at the corner of Tenth and Main Streets.

EL DORADO, KAN.—Plans are being considered to install ornamental lamps on North Main Street, north of Sixth Avenue.

IRVING, KAN.—The City Council has passed an ordinance authorizing the city of Irving to enter into a contract with the Marshall County Power & Light Company of Blue Rapids to supply electricity here.

Southern States

BURLINGTON, N. C.—The Alamance Railway Company, recently incorporated with a capital stock of \$60,000, proposes to construct and operate electric, steam or other railways in Alamance, Guilford, Orange, Durham and other adjacent counties and to connect Burlington, Graham, Haw River, Hopedale, Carolina and Glencoe. Its charter gives it the privilege of operating street railways. George W. Hatch of Burlington and J. Bridgers of Henderson, N. C., are among the incorporators.

AUGUSTA, GA.—A contract has been awarded by the fire-alarm and police telegraph committee to the Evans Brothers Construction Company of Augusta for the construction of a fire-alarm and telegraph station, at \$10,387.

NEW PORT RICHEY, FLA.—The local electric-light plant has been acquired by the Richey Construction Corporation, which proposes to enlarge the plant and supply electricity for lighting the central part of the city. Later the company contemplates the installation of an alternating-current, 2200-volt, three-phase system. The company will also take over the present water-works system and extend same and build an ice factory. Clyde F. Burns is general manager.

OLDSMAR, FLA.—The construction of an electric-light plant, ice factory and laundry in Oldsmar is under consideration. J. Bornstein is reported interested in the project.

PENSACOLA, FLA.—Improvements involving an expenditure of \$75,000 have been authorized by the Pensacola Electric Company, which include removing the tracks of the Bayshore line farther from the beach. It is proposed to start at about Palmetto Beach and build a new car line around behind the settlement at Big Bayou.

RIDGELY, TENN.—The Domestic Ridgely Light & Ice Company, recently incorporated with a capital stock of \$10,000, proposes to construct and operate an electric-light plant and ice factory. J. S. Riley, J. T. Foster and others are interested in the company.

BIRMINGHAM, ALA.—The Alabama Interurban Development Corporation, Jefferson County Bank Building, Birmingham, contemplates the construction of a railroad from Bessemer and Birmingham to the Warrior River, a distance of about 28 miles. The company is also considering the construction of a system of interurban railways throughout Alabama, with both north and south and east and west trunk lines and branches to county seats as far as possible. Thomas L. Cannon is president.

NATCHEZ, MISS.—Steps have been taken by local business men for the installation of an ornamental lighting system in the business district.

CAMDEN, ARK.—The boiler room of the local plant of the Arkansas Light & Power Company was destroyed by fire recently. The company, it is understood, will rebuild at once.

AFTON, OKLA.—The Public Service Corporation is contemplating building a 2000-ton ice storage house and installing a refrigerating plant. W. M. Glass is local manager.

BLACKWELL, OKLA.—The Modern Refining Company, recently incorporated with a capital stock of \$250,000, is planning to equip a pipe line and install a 1200-bbl. pumping station. J. W. Squires of Blackwell is engineer.

CANADIAN, TEX.—Improvements are contemplated by the Canadian Water, Light & Power Company, including the installation of a new engine and other equipment.

DALLAS, TEX.—Plans are being prepared by the Dallas Power & Light Company for improvements to the local system, involving an expenditure of approximately \$2,500,000 within the next five years. Additional machinery will be installed in the power plant and extensions made to the street railway system.

SAN MARCOS, TEX.—The San Marcos Utilities Company is contemplating improvements to its electric-light plant and water works system, to cost about \$20,000.

UVALDE, TEX.—The Uvalde Electric Light Company is planning to enlarge its plant to supply power for pumping water from shallow wells for irrigation purposes.

VICTORIA, TEX.—Work will soon begin on the construction of the new municipal electric-light plant, to cost about \$40,000.

Pacific and Mountain States

PROSSER, WASH.—The City Council is considering the installation of a new street-lighting system, in connection with making a new contract for lighting the city.

SHELTON, WASH.—The Puget Sound Pulp & Paper Company, which proposes to construct a large paper mill near Port Angeles, has applied to the Mason County Commissioners for a 50-year franchise to erect and operate an electric transmission line.

SPOKANE, WASH.—The control of the Spokane Heat, Light & Power Company has been taken over by a Cincinnati (Ohio) syndicate. Ludwig Kemper has been re-elected president and manager. Messrs. Field & Richards of Cincinnati, who floated the concern, have purchased a large portion of the local holdings.

VANCOUVER, WASH.—The Northwest Electric Company has been granted a 50-year franchise by the Commissioners of Clarke County to erect electric transmission lines in the county around Camas and Washougal, and farther up the Columbia River.

ASTORIA, ORE.—The Pacific Power & Light Company of Portland has applied to the City Council for permission to erect a small substation on Taylor Avenue at the intersection of the port thoroughfare. The station will supply energy to the port terminals, shipyards in that vicinity and to other industries located along the port terminals.

BAKER, ORE.—The Fremont Power Company is installing an electrical system at the Buffalo Mines, near Baker.

HELIX, ORE.—The Portland Power & Light Company of Portland has been granted a five-year franchise to supply electricity for lamps and motors in Helix. The system will be installed as soon as supplies can be assembled.

WENDLING, ORE.—The Booth-Kelly Lumber Company of Springfield is planning to rebuild its local plant immediately. The saw mill and planing mill will be equipped for electrical operation throughout. An electric generating plant will be installed, which will have sufficient output to operate both mills and also to operate electrical cranes and other handling devices.

ALAMEDA, CAL.—The Board of Electricity has awarded a contract to Powell Brothers Construction Company for the construction of a new garage, at \$3,562. The present garage will be used as a machine shop.

ALAMEDA, CAL.—The Great Western Power Company, 14 Sansome Street, San Francisco, has submitted a new proposal to sell energy in large quantity to the city of Alameda. The municipal electric plant is not able to meet the increasing demand for electrical service.

HANFORD, CAL.—The People's Ditch Company is considering the installation of an electric-light and power plant at the headgate of its irrigation system.

LOS ANGELES, CAL.—The Council has adopted the report of the finance committee recommending that the city attorney, city engineer and city electrician prepare an ordinance for the installation of an ornamental lighting system in the Van Nuys district.

ALBION, IDAHO.—A. M. Ohl of Albion has been awarded a contract by the United States Reclamation Department for the erection of about 9 miles of electric transmission lines in connection with the Minnidoka irrigation project in Idaho, at \$6,245. The transmission line will supply electricity generated at the Minnidoka power plant to the Melcher Mining & Milling Company at Albion.

BRIGHAM CITY, UTAH.—The Reclamation Power Company has filed an application with the State engineer for 28 sec. ft. of water in Boxelder Creek, to be used for generating electricity.

EAST HELENA, MONT.—The Forestry Department has granted Jacobs & Flatlow of East Helena permission to divert water from the McClellan Creek to develop power to be used in mine development work.

ELY, NEV.—Plans are being considered for the construction of a large hydroelectric

development to supply electricity to the large copper mines in Ely. The installation will provide for an output of 4800 hp. and will cost about \$1,200,000. The company expects to develop 10,000 hp. in three years. F. B. Ench of Oakland, Cal., is interested.

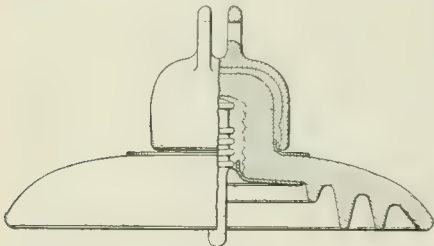
TEXICO, N. M.—The State Line Utilities Company has been granted a franchise by the Board of County Commissioners to erect a high-tension transmission line from its power plant, which is to be located at Texico, along the road connecting Texico and Clovis and south to Portales.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Dec. 7 for furnishing elevators, rolling mill scale, electric motors, shop machines, etc. Blanks and information relating to this circular (No. 1186) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York; Audubon Building, New Orleans; and Fort Mason, San Francisco.

1,245,038. PROTECTIVE MEANS FOR ELECTRICAL DISTRIBUTION SYSTEMS; David Basch, Schenectady, N. Y. App. filed Nov. 13, 1916. Applies more particularly to systems in which insulated cables are employed as transmission conductors.

1,246,042. FLASHLIGHT; Bernard Benedict, New York, N. Y. App. filed Nov. 19, 1915. Pocket.



1,245,940—Insulator

1,246,054. INCLOSED-ARC DEVICE; John H. Clough, Schenectady, N. Y. App. filed Oct. 30, 1915. Relates to inclosed arc devices having a cathode consisting of high refractory material operating at incandescence in a gaseous atmosphere.

1,246,083. ELECTROPLATING; Harvey N. Gilbert, Brookline, Mass. App. filed April 24, 1915. Has for its primary object to reduce the time and cost of the plating operation to a minimum and to insure against any waste of the plating material.

1,246,088. OVERFLOW RELEASE MEANS; Charles L. Goodrum, New York, N. Y. App. filed April 27, 1916. Relates to circuit arrangements for overflow release of line finder and selector switches.

1,246,099. PROCESS FOR THE EXTRACTION OF CHLORINE; Paul L. Hulin, Grenoble, France. App. filed Sept. 15, 1916. Has for its principal object to enable the more or less dilute chlorine contained in certain gaseous industrial mixtures to be extracted in a sufficient state of purity to permit it to be liquefied.

1,246,102. JUNCTION-BOX CONNECTOR; Max Janofsky, Washington, D. C. App. filed July 24, 1915. Provides junction box connector of simple construction, insuring a secure fastening and perfect bond between the cable sheath and junction box.

1,246,105. REFILLABLE CARTRIDGE FUSE; Oscar H. Jung, Milwaukee, Wis. App. filed March 8, 1917. Improvements.

1,246,106. ELECTRIC WELDING SYSTEM; Alvin D. Keene, Schenectady, N. Y. App. filed May 1, 1916. Provides a system in which the overload protective device operates at substantially a constant percentage of overload, although, if desired, the character of the load itself may be changed with a consequent change of normal load current.

1,246,118. INCANDESCENT LAMP; Irving Langmuir, Schenectady, N. Y. App. filed Sept. 4, 1913. Applies more particularly to lamps having filaments of refractory material such as tungsten.

1,246,165. ELECTRICAL-RESISTANCE MATERIAL; Charles Ruzicka, Gravesend, England. App. filed May 16, 1914. Relates to electrical resistance materials made from a comminuted carbide-containing mixture whose essential ingredients have been bound together into a homogeneous mass.

1,246,210. AUTOMATIC CHECKER AND TALLY; George L. Woodward, Yonkers, N. Y. App. filed Aug. 10, 1915. Adapted to operate in connection with two-wheel and four-wheel trucks for tallying.

1,246,225. PORTABLE ELECTRIC LIGHT; Bernard Benedict, New York, N. Y. App. filed July 19, 1917. Improvements.

1,246,260. WINDING MACHINE; John O. Goodwin, Akron, Ohio. App. filed Feb. 23, 1917. Is designed more especially for laying cord about an annular mandrel or core in the manufacture of cord carcasses for pneumatic tires.

1,246,282. ELECTRICAL SWITCH; Frank T. Kobayashi, Kenilworth, Utah. App. filed Jan. 17, 1916. An important purpose of

Record of Electrical Patents

Notes on United States Patents issued on November 13, 1917

the invention is to enable installation without the complication of structural details that characterizes fixtures ordinarily employed at present.

1,246,303. HIGH-TENSION LINE SWITCH; Earle A. Muckey, San Francisco, Cal. App. filed March 26, 1917. Pole switches.

1,246,333. FITTING FOR CONDUITS FOR ELECTRICAL CONDUCTORS; Arthur W. Sclater, Westminster, London, England. App. filed Dec. 17, 1915. Improvements.

1,246,363. MAGNET SWITCH; Theodore Varney, Pittsburgh, Pa. App. filed Aug. 12, 1912. Improvements.

1,246,380. CIRCUIT INTERRUPTER; Harold G. Baxter, Wilkingsburg, Pa. App. filed April 29, 1915. Applies particularly to contact members for the same.

1,246,417. INCLOSED FUSE; Edwin H. Gilbert, Wilkingsburg, Pa. App. filed May 1, 1913. Renewable type.

1,246,422. CIRCUIT CLOSER; Gerald M. Hart, Wilkes-Barre, Pa., and Lewis L. Evans, Bridgeport, Conn. App. filed Sept. 11, 1916. Improvements.

1,246,441. METALLIC TERMINAL FOR ELECTRODES; George M. Little, Pittsburgh, Pa. App. filed Aug. 11, 1913. Arc lamp.

1,246,461. STRAIN INSULATOR; Bentley A. Plimpton, Victor, N. Y. App. filed June 28, 1917. Object of the improvement is to provide a cementless connection between an insulator section and a metal cap by means of a mechanical joint which does away with the necessity of a cementitious binder between the parts.

1,246,470. BARRIER SEAL; Edward E. Rose, Swissvale, Pa. App. filed Jan. 4, 1916. Improvement.

1,246,481. INSULATOR; Karl A. Simon, Edgewood Park, Pa. App. filed Dec. 9, 1916. Strain.

1,246,493. PULL SOCKET; George B. Thomas, Bridgeport, Conn. App. filed Dec. 18, 1915. Angle type.

1,246,533. ELECTRIC LAMP SUPPORT; Harry J. Bosworth, Chicago, Ill. App. filed April 26, 1917. Improvement.

1,246,602. ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINE; Louis J. Hunt, Sandycroft, Wales. App. filed Dec. 10, 1915. Applies particularly to the secondary windings of such motors.

1,246,617. SYSTEM OF DISTRIBUTION AND CONTROL; Benjamin G. Lamme, Pittsburgh, Pa. App. filed March 23, 1914. Has special reference to so-called "phase converters," which are employed for converting single-phase energy into poly-phase energy for the operation of poly-phase induction motors.

1,246,622. ELECTRIC TABLE STOVE; Edwin N. Lightfoot, New York, N. Y. App. filed Oct. 4, 1916. Improvements.

1,246,623. ELECTRIC ELEVATOR - CONTROL SYSTEM; Nils O. Lindstrom, Nutley, and Carl F. E. Olofson, Jersey City, N. J. App. filed Sept. 1, 1914. The provision of a system which, while the major changes of speed of the motor are controlled from the car, is semi-automatic in its operation to insure a gradual starting or stopping of the car under varying load conditions.

1,246,625. MULTI-CONTACT SWITCHING DEVICE; Alben E. Lundell, New York, N. Y. App. filed Sept. 22, 1916. May be used as either a make-before-break or a break-before-make device, the change from one to the other being a very simple matter

in which the intervals before mentioned may readily and easily be changed without bending the contact springs.

1,246,643. METHOD OF AND APPARATUS FOR TRANSMITTING POWER; Alfons H. Neuland, New York, N. Y. App. filed July 31, 1915. Improvements.

1,246,647. LAMP SUPPORT; Ralph D. Parker, San Francisco, Cal. App. filed Feb. 19, 1916. Improvements.

1,246,677. PLUG AND RECEPTACLE; Hart A. Stoddard, Philadelphia, Pa. App. filed Jan. 16, 1914. Provides a receptacle comprising spaced resilient jaws and a plug having a member adapted to enter said jaws, said jaws and plug being provided with co-operating means for removably locking the latter in the former.

1,246,686. APPARATUS FOR PROTECTING ELECTRIC CIRCUITS; Kalman von Kando, Vado Ligure, Italy. App. filed Dec. 9, 1914. Provides an improved arrangement by means of which the influence of alternating currents on neighboring electric circuits (hereafter simply called circuits) is eliminated.

1,246,687. REMOTE CONTROL FOR ELECTRIC MOTORS; Chalmers P. Wells, New York, N. Y. App. filed Oct. 22, 1914. Improvements.

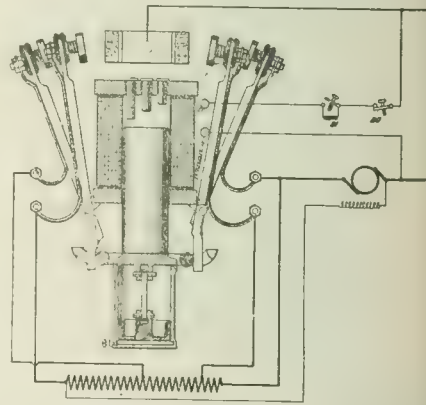
1,246,702. ROTARY CONVERTER; John B. Bassett, Schenectady, N. Y. App. filed Feb. 18, 1916. Particularly to rotary converters provided with commutating poles and operated in connection with boosters mechanically connected thereto, the field of the boosters being variable for the purpose of varying the ratio between the alternating-current and direct-current voltages.

1,246,711. ELECTRIC FUSE; Leonard B. Buchanan, Woburn, Mass. App. filed April 14, 1917. A type adapted to show conspicuously, by the displacement of an indicator element visible at the outside of the fuse, when the fuse is blown out.

1,246,712. LIGHTNING ARRESTER; Frederick H. Burkhardt, Trenton, N. J. App. filed March 6, 1917. Improvements.

1,246,741. SWITCH-BOX STAY; Samuel L. Hancock and John J. Ortner, Oakland, Cal. App. filed Sept. 27, 1916. Relates to a stay for switch boxes, an attachment used for installing and fastening a switch box in place.

1,246,767. OIL-LEVEL INDICATOR; Jesse B. Knowles, Oakland, Cal. App. filed Nov. 1, 1916. Provided with electrical contacts so positioned that they will not be



1,246,687—Remote Control for Electric Motors

affected by sediment in the oil or by other foreign matters which may settle at the bottom of casing.

1,246,792. FUSE DEVICE; Edmund O. Schweitzer and Nicholas J. Conrad, Chicago, Ill. App. filed Dec. 31, 1914. Especially adapted for extra-high potentials.

1,246,810. FLAME-PROOF INSULATION; Carleton Ellis, Montclair, N. J. App. filed July 2, 1917. Applies particularly to the use of chlorinated material of an organic nature, especially chlorinated wax.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN

Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, DECEMBER 1, 1917

No. 22

Engineering Management of State Affairs

WHEN the Governor of Illinois recently replaced 128 boards and commissions with a business organization of nine departments to handle the public affairs of that State he took a forward step in practical politics and did something commendable from an engineering standpoint, for one of the departments dealing directly with engineering matters is the Department of Public Works and Buildings. There the engineering work is now divided among four technically trained men of high standing in their respective professions, who have been selected without regard to politics and have had a free hand in organizing their departments for efficiency. Thus the operation and maintenance of all existing plants, as well as the design of new heating, lighting, ventilating, power and pumping plants, is brought under the direct supervision of a trained engineer with a capable staff. Undoubtedly this will make for uniformity, efficiency and economy. If now this organization can be permanently kept out of politics, what an excellent example it would be for other state executives to follow and what great possibilities for good and for encouragement it will hold for the engineering profession!

Rural Line Problems

MOST of the problems connected with the operation of rural transmission lines are those of other transmission lines, but there are problems which are peculiar to rural lines or which are at least acute for this type of transmission. Compared with transmission lines which supply industrial centers and cities, rural lines are required to carry relatively small loads per unit of length, therefore the apparatus used for protection must be very inexpensive and at the same time quite durable and reliable so as to reduce the maintenance and service expenses to a minimum. In many cases the operating company is faced with the dilemma of either purchasing expensive oil switches, lightning arresters, etc., the same as for large and prosperous systems, or adopting the alternative of getting along without these things and using crude home-made apparatus, with the resultant interruptions and damage to equipment. The importance and extent of rural transmission systems are certainly sufficient to warrant manufacturing companies and consulting engineers going specifically into the needs of this class of transmission and developing devices which such lines will justify and without which they cannot be operated successfully and economically.

Of the problems existing at present, that of a satis-

factory inexpensive lightning arrester is probably the most important one and the most difficult to solve. The arrester must be sufficiently yielding, like a static condenser, to respond instantaneously to a small over-voltage, and at the same time it must act as a check valve promptly and effectively to suppress any power arc which may occur, such arcs usually causing an interruption in service.

Another important problem is that of providing fuses on branch lines which have no attendants at the junction. Such a junction may be miles away from the nearest lineman or troubleman, and long interruptions caused by a ruptured fuse may result in considerable inconvenience to both the consumer and the company. The fuse should preferably be self-resetting and of the magazine type, and it should also be connected with some low-tension system, say a telephone wire, so as to indicate the trouble automatically at the proper supervision point.

The problem of a large charging current on long lines was discussed at length in our issue of Oct. 13, and we need only again emphasize its importance now. The prevention of insulator failure will probably be solved in due time for all overhead transmission lines, but the specific problems which are hampering successful operation of rural transmission lines should receive immediate attention. With the extension and spread of large transmission systems all over the country, these rural lines gradually become parts of huge overland electric plants, and any lack of reliability in their operation will therefore interfere with the successful operation of the ultimate system.

Automatic Hydroelectric Stations

WE HAVE from time to time described several substantially automatic hydroelectric plants designed for work in conjunction with regularly manned stations. The system which we have the pleasure of describing this week is of particular importance as being quite the largest of the kind yet erected and as possessing some unusual features of automatic control. It is a feeder for the transmission system of the Iowa Railway & Light Company and is situated on the Cedar River at Cedar Rapids, Iowa. The hydraulic plant is situated some five-eighths of a mile from the main steam station of the company, to which it is connected by three groups of cables for power, instruments and control respectively. The hydraulic plant is therefore susceptible of remote control in the ordinary sense; aside from being automatic in a much broader sense in its regular operation. From the hydraulic stand-

point the plant is under rather unfavorable conditions, having a somewhat variable head, averaging about 10 ft. (3 m.). The three 500-kw. generators are driven by vertical single-runner wheels at a speed of 60 r.p.m. The generators were wound two-phase, since the main steam plant happens to be equipped with two-phase generators. The current for the excitation of these is furnished by two motor-driven, compound-wound exciters, each capable of handling the whole present equipment of the plant and the extra generator which will later be installed. The plant also contains the automatic control apparatus, although all the instruments are installed at the end of the control cable in the main power house.

The work of starting the station is intrusted to three motor-driven drum controllers which perform all the necessary operations in their regular sequence. When it is desired to start up a machine a drum controller is started by the appropriate bush-button on the remote-control board. Then the following set of operations goes on in order: An exciter set is started by throwing the motor directly across its 2300-volt lines. Then the hydraulic gate motor is started and opens the gates to about one-fifth of full opening. The drum is then stopped until the generator reaches a speed of 55 r.p.m., at which time a centrifugal speed switch closes the contacts to again start the drum, by which the main-line contactor throws the machine, unexcited, in on the line in series with a set of reactances which limit the current during the synchronizing period. Then the field contact is closed in two steps, the protective reactances are short-circuited, and a contact-making ammeter starts the gate motor again and opens the gate to a point sufficient to carry the predetermined load for which the equipment is set. Inasmuch as the station runs entirely without attention except for a visit every eight hours from a station man just off his regular shift at the main plant, special provisions are made for taking care of possible trouble with the machines. The bearings are protected by thermostats set to operate at 45 deg. C. The protective reactances are equipped with thermostats set at 75 deg., and the stator coils are protected for 65 deg. If any of these temperatures are exceeded, the unit is promptly shut down automatically.

To avoid any possibility of the machines running away from dropping the load a 1-hp. induction motor, running light, carries a centrifugal switch set to shut down at 64 cycles, the normal frequency being 60. Under test it is found that this device will start the closure of the gates within a second and a half. A float switch guards against trouble from low water. By similar means the generators can be thrown on automatically with the regular sequence of operations when the head rises to a proper working point, after which they remain in operation as long as the head of water justifies. Ordinarily, however, the station is taken care of by the remote control. Since the plant has been started the engineers have racked their brains to imagine possible conditions which might cause trouble, and each of these, rising to the astonishing number of forty-eight, has been brought about artificially. In every case the plant was automatically shut down until conditions were

remedied. Comparatively few changes had to be made in the equipment after the start, really nothing more than a little refinement of some of the automatic operations. The success of this installation ought strongly to stimulate interest in the possibilities of automatic operation already tried out to an encouraging extent in other stations and substations. The saving of labor is a considerable item always, particularly in the case of smaller stations than this in which the labor cost apportioned against the output runs higher than here. For example, cases not infrequently arise in which two or three small water powers, either on the same stream or on neighboring streams, can be made to co-operate and give a conjoint output of very respectable size. If connected for automatic operation, one man per shift may be able to operate with entire success two or three small plants several miles apart, bringing each into service as it is needed and controlling the entire equipment almost as easily as if it were under a single roof. In the example before us the work is on so large a scale and carried out so successfully as to encourage future installations of this very interesting nature.

The Prevention of Accidents

WE ARE publishing this week a very pertinent abstract of a paper before the National Safety Council with respect to lessening the accident risk in electric service companies. The subject is one which is of very definite importance both from the standpoint of proper safeguarding of employees and from that of casualty insurance. In any industrial establishment accidents, serious or otherwise, are likely to be surprisingly numerous. Most of them are utterly trivial, simply recorded as accidents for the sake of completeness. A few are grave or even fatal. Electric light companies are no more exposed to casualties than many industrial organizations engaged in miscellaneous manufacturing in which power and tools find daily use indoors and out. The special risks of the electric company are those which have to do with the direct effect of shock and the secondary concomitant of burns from the electric current. But it is altogether a mistake to suppose that such accidents form any large proportion of the total list in the every-day experience of an electric company. In fact, to judge from some recently published records of one very large company extending over five years past, electrical accidents are altogether the exception. In the case referred to they formed barely over 4 per cent of the complete record. In point of numbers electrical causes of every kind stood rather low among the causes of accidents, as the figure given should witness. For instance, there were more than twice as many accidents from falls as there were from electrical causes. More than twice as many, too, were injured by being accidentally struck by material, while cuts, bruises and sprains made up nearly half the total.

One must therefore dismiss from the mind purely electrical risks as being the commonest sources of difficulty, especially in city stations, but nevertheless elec-

trical accidents run a chance of being somewhat serious, and a considerable proportion of the fatal accidents, always very small with respect to the total, are likely to be due to shock. It is therefore an obvious duty in any electrical service company to pay particular attention to the elimination of the risks peculiar to its business. It is frequently necessary to work on live circuits, sometimes on live circuits of high potential, and the company that does not provide all necessary tools and safety appliances for such circumstances and instruct its workmen in their proper use fails of its plain duty. Public service corporations having widely ramifying high-tension lines must generally exercise exceptional caution in this respect on account of the frequency of conditions that call for working on live circuits. Electrical risks in this class of plants are very much greater than in the regular service of a big city central station. On any high-tension system the only safe assumption is that all live wires are in effect uninsulated. The uninsulated wire is certainly dangerous; the insulated one very likely is not, but may be without showing any signs of its potential dangers.

High-tension and low-tension wires ought to be carefully distinguished from each other, and those carrying dangerous voltage should if possible either be completely inaccessible except over very limited stretches or be out of reach and plainly traceable so that no doubt may exist as to their identity. On circuits carrying either very high voltages or very heavy currents careless switching is a prolific source of danger, and no employee should be allowed to take a hand in the switching operations without knowing exactly what he is about. Modern remote-control systems eliminate a good bit of this risk, but there are many places about a plant where danger may exist if switches are incautiously handled. Switchboards in particular are often too crowded for space in the rear, so that dangerous, although perfectly innocent-looking, wires cannot be readily distinguished unless so plainly marked as to be visible at the most casual glance. Instrument leads need particular attention, as was put in evidence not long ago when a single inquisitive long-tailed rat ran foul of a potential transformer and started an arc that put the lighting of a whole city temporarily out of business. Proper care in high-tension wiring and proper tools for work upon it get rid of the most dangerous, although not the most numerous, chances of accident in electric service. The data quoted in the article before us show that the chances of fatal accidents are by no means at a maximum in the electrical industries.

Machine-Tool Driving

ANOTHER of Professor Clewell's pointed articles considers in some detail the relative advantages of the group and individual drive for machine tools touched upon in our last issue. Speaking in very general terms, the advantages of individual drive are in lessened constant losses in the power supply, in extremely facile control and in the independence which may be secured in the placing of various machines. The contrary factors are enhanced first cost of individual motor drive, particularly in machines requiring motors of small output, and the consequent gain from dispensing with separate motors altogether in the cases where a number of machines are operated simultaneously like a unit and practically at full load. There are also collateral advantages from belt drive including a number of machines in cases where each individual machine is subject to extreme changes of load which in case of a separate motor would require such high overload capacity as to increase the cost and decrease the efficiency. The friction losses due to shafting in an ordinary machine shop are rather large—at least 25 per cent on the whole, and often 30 per cent. This therefore gives a reasonable opportunity for actual saving of power by the use of individual motors.

In the somewhat exceptional cases where the power cost of an operation is a very material factor this saving might of itself be enough to justify the individual drive, but, as Professor Clewell indicates, there is very much to be said for the separately driven machine merely from the standpoint of that flexibility which means increased output. Anything which can cut down the relative importance of the element of human labor should in these days be sought earnestly, and if by the use of carefully regulated electric drive the speed of operations can be increased and the finished product delivered with less time spent with the laborer, there is a very definite gain irrespective of whether the work is piece work or day work. In the one case there is, of course, a direct saving in cost of labor, in the other, an indirect saving by that increased production which raises the efficiency of the whole shop. Beyond this there is in the individual drive the advantage on which we laid stress in commenting on Professor Clewell's previous article.

The balance of the argument therefore stands in a large percentage of cases in favor of the individual drive, save in the operation of small and homogeneous groups of machines under nearly constant load and a few exceptional cases of extremely variable load.

OPERATING subjects which should be of interest to many engineers will be discussed in the next issue of the **ELECTRICAL WORLD**. Among the articles which will be presented will be one on the question of increasing present steam pressures with an estimate of the increased cost of equipment and curves showing improvement in water rates and thermal efficiencies. The sixth installment of Prof. C. E. Clewell's series on industrial motor and control

The Coming Issues

applications will dwell on the considerations that should be given speed, torque and power relations in machine-tool work. Emphasis will be placed on the remarkable changes wrought by the introduction of adjustable-speed motors, and some of the limitations on the use of constant-speed motors will be outlined. Special attention is directed toward an article by James F. Pollard in which are discussed service extension problems in California.

Features of an Automatic Hydroelectric Plant

Rise of Water Level Causes Proper Number of Generators to Start to Utilize Water Most Economically—Simplicity of Construction and Arrangements for Supervisory Control in Emergencies

A HYDROELECTRIC generating station which is entirely automatic in all of its operations has recently been placed in service by the Iowa Railway & Light Company on the Cedar River, only a few blocks from the business district of Cedar Rapids. The plant, which will have an ultimate capacity of 2000 kw.,

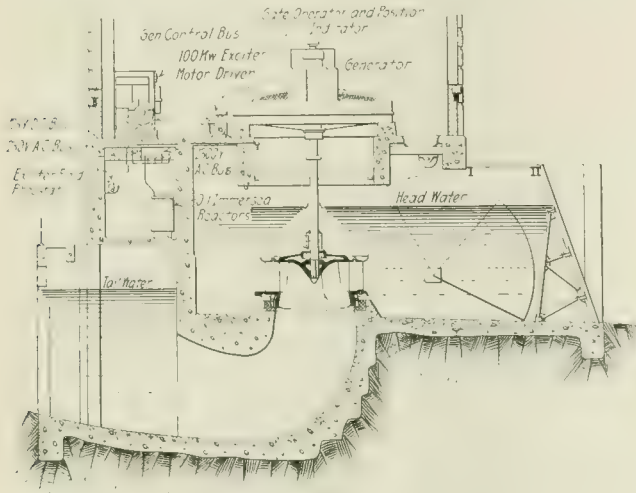


FIG. 1—USE OF TAINTER GATE AND POSITION OF BUSES WITH RESPECT TO CONTROL CABINETS

operates in parallel with an extensive transmission system which already reaches practically across the State of Iowa, except for a 28-mile (45.06-km.) break near Marshalltown. There are no instruments in the hydroelectric plant, these being installed in the company's steam station, which is about 0.6 mile (0.97 km.) distant. Three groups of conductors—power cables, instrument cables and control cables—connect the two plants; hence, while the hydroelectric station is self-controlled and entirely automatic, it is possible for the steam-plant operators to supervise the action of the waterwheels and generators.

Perhaps the most spectacular and surprising feature of the whole plant is the speed with which the station goes into service. It requires just thirty-seven seconds from the time the first switch operates until the first generator is under full load. A somewhat formidable array of mechanism might be expected in a plant of this nature, but the contactors and switches are inclosed in cabinets and the buses and control wires are run through bus chambers beneath the floor, so that the interior of the station appears very simple. With this arrangement, and by making each generator and its circuits, except for excitation, an independent unit, every element of the wiring and control apparatus has been made readily accessible.

The excitation for each machine is maintained at a fixed value at all times, thus simplifying the excitation problem, eliminating the necessity of voltage regulators, making it possible to take advantage of the full capacity of the river, and at the same time improving

the power factor of the system through the operation of underloaded, overexcited machines. No oil governors are used for any of the machines, the gates being operated by motors which are upon complete automatic control at the hydroelectric station or remotely controlled from the steam station.

EITHER AUTOMATIC OR REMOTE-CONTROL
OPERATION IS POSSIBLE

In general, the operation of the plant may be managed in either one of two ways. In either case the plant operates automatically, but in one case the control is vested in float switches and contact-making ammeters in the hydroelectric plant, while in the other case it is vested in remote-control switches on the benchboard at the steam power house. With the plant under the control of the float switches, the generators are automatically started as the head of the dam rises above certain definite levels owing to the increasing supply of water and the rising of the automatic flashboards. Likewise, the machines are automatically stopped if the head is lowered. With this system as many machines will come into operation and remain in operation as the supply of water justifies. Through the control on the benchboard at the plant, however, it is possible to start any or all of the machines at any time and to control the gate opening and load on any machine at any time.

As a rule, the latter plan of operation will probably be followed, running as many machines during the daytime as it is possible to operate and still permit the river to store up water for use at night. Then during the night the entire hydroelectric plant will be in operation under the control of the operators at the steam plant. This method of operation has been selected as that which fits in best with the conditions on the system. With all three machines at the hydro-

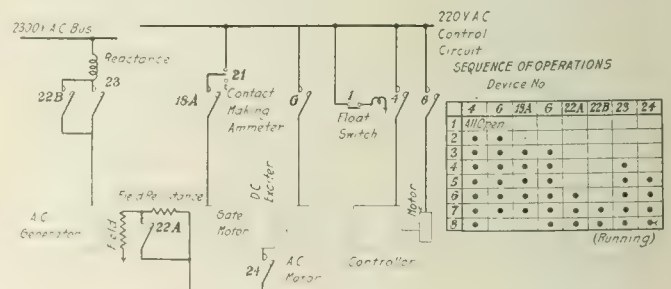


FIG. 2—SEQUENCE IN WHICH SWITCHES OPERATE

electric station operating, one boiler at the steam station may be shut down at night.

The hydroelectric plant is a particularly valuable adjunct as a safeguard against interruption to service. For instance, if one of the large turbine units in the power house loses its vacuum it will be possible for the operators there to place 1500 kw. of hydroelectric capacity on the line in less than a minute by the oper-

ation of three buttons on the benchboard. Moreover, the operator who pushes these buttons need not stand at the benchboard and wait for the hydroelectric plant to come to the line, but can immediately leave the benchboard for the vacuum pumps and assist in getting the steam turbine back on the line promptly.

Another unusual operating plan is made possible by the fact that the excitation furnished to the hydroelectric machines is of a constant quantity. For example, in case there is enough water flowing in the river to permit the operation of one machine at full load and to produce 100 kw. on another, full use can be made of the water and of the windings on the second machine by taking the control away from the contact-making ammeter and using the underloaded hydroelectric machine to absorb a large part of the wattless component of the system load. This, of course, will greatly help the power factor of the system.

THE HYDRAULIC EQUIPMENT

The normal head at the plant is 10 ft. (3.04 m.), but the head may vary from 8 ft. (2.43 m.) to 11 ft. (3.35 m.). Records which have been taken to ascertain the characteristics of the river show that during 180 days out of 365 the average discharge is about 2100 cu. ft. (59.4 cu. m.) per second. The lowest flow per day is 500 cu. ft. (13.15 cu. m.) per second. This low-water period lasts for about four days in the year. The maximum flowage of the river is 50,000 cu. ft. (1315 cu. m.) per second, about twelve or fourteen days in the year being flood days. These flowage data should be considered in connection with the fact that

the Allis-Chalmers plate type, which is a modified Kingsbury bearing. The oiling system is driven by a direct-connected pump, Uresel oil being used exclusively. The oil will need replenishing about four times a year.

THE ELECTRICAL END OF THE STATION

The generators are two-phase, 60-cycle, 60-r.p.m., 2200-volt, 109-amp. (per phase) vertical Allis-Chalmers machines, and are arranged in a single row. Two-phase units were selected because the company's large steam plant still operates two-phase. There would be little difference between the control in this hydroelectric station and that in a three-phase plant, since a four-wire system would be used in either case. Two induction, motor-driven, compound-wound interpole exciters, each capable of exciting the ultimate equipment in the plant, are installed.

The control cable, which consists of fifty-two No. 12 rubber-covered wires in a lead sheath between the hydraulic and steam plant, was not combined with the instrument cable, as breakdown in one of the current transformers might apply a high potential to the control circuits. Of the fifty-two wires in the control cable, thirty-eight are used for indicating the gate positions. All cables between the plants, some 3300 ft. (1005.8 m.), were laid underground to guard against lightning.

The control equipment at the hydroelectric plant consists of standard control apparatus, much of which is of the so-called steel-mill type. This type of equipment was selected because it is rugged and is not too

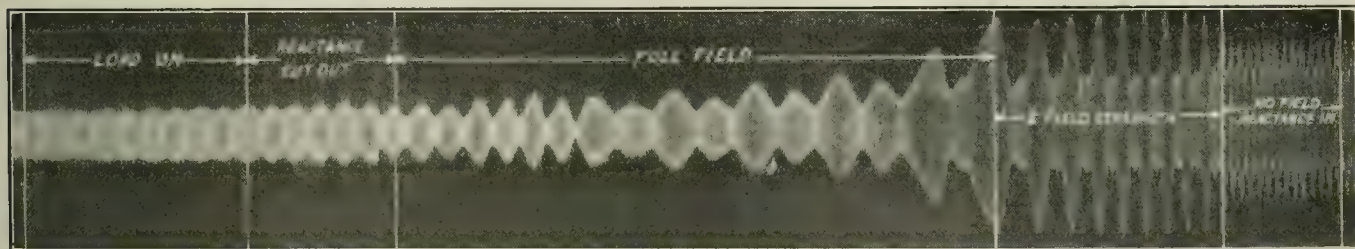


FIG. 3—OSCILLOGRAM OF GENERATOR CURRENT DURING STARTING PERIOD (PEAK VALUE OF CURRENT IS 234 AMP.)

each runner in the plant takes 720 cu. ft. (22 cu. m.) of water per second, three 500-kw. units now being in service.

The dam is composed of nine 60-ft. (18.28-m.) spillway sections, each of which automatically rises and falls with the flowage of the river, giving an automatic flashboard effect. Four motor-driven Tainter gates are installed at the intake to the flume. The wheel pits at the power house are independent of each other and are equipped with 20-ft. (6.09-m.) Tainter gates on the upstream side and stop logs on the downstream side. This makes inspection easy, and did not complicate the layout or cost much more. The waterwheels, which are of the Francis single-runner type, measure 171 in. (435.9 cm.) in diameter and are rated at 540 brake-hp., 60 r.p.m., and 84 per cent efficiency under a 10-ft. (3.04-m.) head. This type of wheel was chosen since they must necessarily operate at low speed, and since it was desirable to install direct-connected units. Having had previous experience with wheels made by the Allis-Chalmers Company, the operating company decided upon that manufacturer's equipment. The thrust bearings on the machines are of

sensitive. Hence, while the plant itself is something entirely new in the field of hydroelectric development, its greatest feature, the automatic control, consists of an assembly of standard equipment arranged to perform special duties. The control equipment is assembled on three generator control cabinets and one exciter control cabinet, a fourth cabinet serving as a terminus for all control and instrument wires. The instrument wires and transformers are so arranged that it is possible to "cut in" portable instruments, this being considered advisable since there are no permanent instruments at the hydroelectric plant. In addition to the equipment mounted on the cabinet boards there are three motor-driven drum controllers which control the sequence of operation of the remaining control equipment, thus preventing mistakes.

Starting with the station at rest, the only live parts in the plant are the control transformers and the induction-motor speed-limiting device. To begin with buttons Nos. 1, 2 and 3 on the benchboard in the steam plant, which are normally open, are closed. The drum controller then starts to run. The action to this point could also be accomplished by the action of automatic

float switches if the plant were being operated on that plan. The first function the drum performs is to start one of the exciter sets. The 150-hp. motor of this set is thrown directly across a 2300-volt line. It comes up to full speed and full voltage in 3.5 seconds. The motor, in starting, takes eight times full-load current momen-



FIG. 4—THREE GENERATORS IN IOWA AUTOMATIC HYDROELECTRIC STATION

tion. The drum continues to run, and closes the necessary contact to drive the gate motor, which opens the gates on the waterwheels to about two-tenths full opening. The control circuit is then de-energized and the drum stops until the generator reaches a speed of 55 r.p.m. At this time a centrifugal speed switch on the top of the generator shaft makes a contact which closes other contacts to start the drum again.

The functions next performed by the drum are: First, the main-line contactor is closed, putting the machine in on the line without excitation, and in series with a set of reactors which limit the generator current to about two and a half times full-load current during the synchronizing period. Two of these reactors, which are of the single-phase, oil-immersed type and are designed for five-minute duty, are installed with each machine. The time element between the closing of the speed switch on the main generator and the closing of the main-line contactor is of such an interval as to permit the generator speed to increase from 55 r.p.m. to 60 r.p.m., or synchronous speed, before the main-line contactor closes. The next function performed by the drum is to close the field contactor, the field rheostat being divided into two sections, so that when the field is connected with the line the current is only approximately one-fourth its normal value. Next, the drum closes the contactor, which shunts out a section of the field rheostat, increasing the field current to its normal value. Then current-limiting reactors are short-circuited, and the contact-making ammeter closes a circuit actuating the gate motor, which opens the gate to a point that will permit the machine to carry a predetermined load.

Since the station is to be left attendantless except for one visit every eight hours by an employee just off shift at the steam plant, it must take care of its own cases of trouble, if any arise. To that end the machines are protected against hot bearings by thermostats of the spiral-spring type installed on each bearing. These thermostats are set to operate at 45 deg. C. In com-

mon with all other thermostatic control in the station, these bearing units operate to shut down the machine affected entirely and keep it shut down until conditions again become normal, when the machine will start of its own accord. Thermostats are also placed on the current-limiting reactors and are set to operate at 75 deg. C. Thermostats on the stator coils of the generators are set to operate at 65 deg. C. The speed-limiting device consists of a 1-hp. induction motor running light, with a centrifugal switch attached to the end of its shaft. When the frequency of the station reaches 64 cycles the centrifugal switch operates to shut down the plant. To test out this device the main oil switch at the steam station was tripped from the benchboard, cutting all load off the hydroelectric plant, which, of course, would tend to make it run away. In 1.4 seconds after the oil switch was tripped the frequency-limiting device had operated and the waterwheel gates were beginning to close.

Single-phase operation is prevented by the fact that a part of the relays are in one phase and a part in the other, and the wiring is laid out so that any one of the relays opening will open all contacts and shut down the machine. Of course, no voltage failures on alternating current are guarded against, since under these conditions there would be no energy to hold in any of the contactors. The loss of excitation is guarded against by a relay in series with contacts which in opening shut down the plant. The machines are protected against surges by a time element in the setting of the relays, which under abnormal conditions cuts the reactors into circuit for an interval before the machine goes off the line. Ordinarily, two 5-kva. type H transformers furnish energy for the control. In case of an emergency, however, a throw-over switch connects the steam station power and lighting transformers with the control circuit.

The float switches guard against trouble from low water. No special provision has been made to guard against frazil ice, and the only precautions taken in



FIG. 5—GENERAL VIEW OF CONTROL CABINETS WITH CONTROLLERS BETWEEN

guarding the water supply are standard trash racks at the intake to the wheel pit and at the intake to the flume. It is interesting to observe in this connection that a sudden stoppage of all units in the plant produces a water-hammer effect in the flume, piling this water up at the gates to such an extent that the

back wash effectively clears all trash from the racks and causes material which has gathered at the upstream trash rack to be washed over the spillways.

Since the plant has been in operation the engineers of the central-station company and of the manufacturing company conceived forty-eight conditions and combinations of conditions which might occur to cause trouble at the plant. Each one of these conditions was brought about artificially, and the result in each case was the automatic shutting down of the plant until normal conditions were restored. In these tests everything from dead short-circuits to exciter failures was tried out.

One of the striking things about the design and construction of this station was that relatively few changes were necessary in the original layout in order to make the plant operate as planned. The changes consisted of the addition of four relays. One relay was added to short-circuit the exciter-field rheostat to make the exciter set come up to voltage as fast as it came up to speed. This provision was thought wise in that the failure of the exciter to come up to voltage rapidly might necessitate making the control drum revolve twice before the generator could be put on the line. Relays were also placed so that shutting down or starting up of any one of the generators would stop or start an exciter set. The addition of these relays makes it possible to shut the machines down in any sequence or to start them up in any sequence, the first machine started up always starting the exciter set and the last machine shut down always shutting down the exciter set.

HISTORY OF THE DEVELOPMENT

The preliminary work on this water power was being done at about the time Taylor and Allen were working on the automatic rotary converter substation at Union, Ill. (See *Proceedings A. I. E. E.*, Vol. 34, Part 2, page 1801.) The original idea at Cedar Rapids was to install a station with remote control and operate it from the steam plant very much in the way that the

saving of some \$3,600 to \$4,000 a year in labor. Owing to the fact that apparatus already standardized has been used exclusively, and to a rather liberal policy of the manufacturer in absorbing such development charges as were necessary in working up the layout, the actual investment in this plant is no greater than

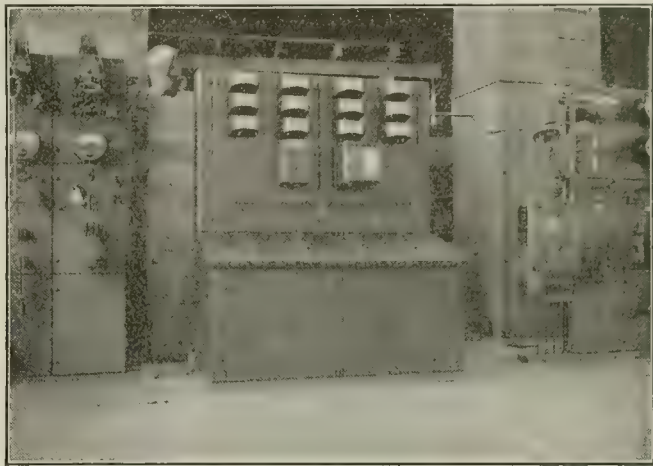


FIG. 7—BENCHBOARD AT STEAM STATION FROM WHICH AUTOMATIC HYDROELECTRIC PLANT MAY BE SUPERVISED

would have been required for a first-class manually operated station.

The design and construction of the station have been carried out under the direction of John M. Drabelle, electrical engineer of the Iowa company. Of the manufacturing company's representatives, L. B. Bonnett and A. C. Thompson of the General Electric Company have contributed liberally of time and experience in getting the station under way. The hydraulic engineering was carried out by the Fargo Engineering Company of Jackson, Mich. The turbines and generators were furnished by the Allis-Chalmers Manufacturing Company, while the control equipment, exciter set, transformers and underground cables were supplied by the General Electric Company.

Tungsten Wire Patent Upheld in Germany

According to the *Elektrotechnische Zeitschrift*, the German patent No. 269,498 (1910), granted to the Allgemeine Elektrizitäts Gesellschaft, with priority from Oct. 6, 1909, on claim 1 and from Feb. 23, 1910, on claim 2, has been upheld successfully against the annulment suit brought by the Wolframlampe A.G. (Augsburg), the Radium G.m.b.H. (Wipperfurth), and the J. Pintsch A.G. (Berlin). The text of the actual claims is: (1) Process for manufacturing tungsten wire for electric glow lamps, characterized by coherent pieces of tungsten being subjected to mechanical "working" until they become flexible and ductile at ordinary temperatures; (2) use of initial material in the form of a comparatively coarse powder, the porous body formed therefrom being heated to a very high temperature. Opposition to this patent and the subsequent action contesting its validity were based on the contention that prolonged mechanical working was a well-known means of securing flexibility and ductility in metals, and its application to an individual metal (tungsten) not previously considered ductile was not sufficient ground for granting patent rights. The courts did not support this view.



FIG. 6—AUTOMATIC CONTROLLERS AND EXCITER CABINET WITH FREQUENCY-LIMITING DEVICE AT TOP

so-called automatic substations at Detroit are operated. Such an arrangement was finally considered inadvisable, as it involved many complications and provided too great an opportunity for an operator to make mistakes. It was believed that by installing an automatic plant there was an opportunity to effect a

Safety Methods in the Electrical Industry

Rules, Practices and Precautions That Should Be Observed—Instruction to Employees Must Supplement Mechanical Appliances—Hints from Michigan Company's Experience

BY H. J. BURTON*

Consumers' Power Company, Jackson, Mich.

FIGURES taken from the records of several public utilities show that 55 per cent of the accidents to employees are caused by falls, handling tools or handling material and that only 7 or 8 per cent are due to electric current, but the accidents due to electric current are the serious ones and in most cases are fatal.† It is not the purpose of this paper to disregard the importance of looking after and trying to prevent the minor accidents, as it is realized that in the aggregate they are important. Slight injuries which are neglected are liable to become serious. Furthermore, slight injuries should be reported as they sometimes indicate that something is radically wrong and needs attention before a serious accident does occur. However, it should not be forgotten that the serious accidents incident to the operation of electric generating stations and substations are due to the electric current and not to causes that are common to all industries. In accident prevention work it is not always the number but often the nature of the injuries that should receive most attention.

In some industries, with mechanical protection properly designed and placed, it is possible so to safeguard some machines as virtually to eliminate the serious accidents incident to the operation of the machines. In the electrical industry it is not always possible to safeguard and protect mechanically the equipment used to generate, transmit and utilize electricity. A wire that is energized does not look different from one that is not energized, and the electrical worker must learn what is safe to touch and what should be given a wide berth.

INSTRUCTIONS MUST SUPPLEMENT APPLIANCES

In the operation of electric generating stations and substations it is necessary at times for switchboard operators, linemen and other employees to handle live equipment and lines, and in order to do this safely they must be properly qualified for the work they have to perform. Instructions to employees as well as mechanical safeguards to apparatus are essential if accidents are to be avoided.

Employees should be taught that high-potential currents are dangerous to life, and they should know the voltage carried by every conductor in their station or under their supervision. They should be instructed that not only the bare conductor but the insulation on high-voltage conductors should not be touched or approached too closely. A wire insulated for and carrying a potential of 110 volts might be, and is, reasonably safe to handle; but the same or a similar wire carrying a potential of 1000 volts, although to all appearance perfectly insulated and harmless, would be extremely dangerous to handle, and the higher the voltage the greater danger to life. It cannot be too often repeated or too strongly im-

pressed upon all employees that insulated as well as bare cables or wires carrying high potentials are dangerous to handle or approach unless they are inclosed in a grounded metal sheath. Insulation on high-tension conductors gives a sense of false security to the uninstructed, and many serious accidents to employees have occurred because such a conductor was thought to be safe.

OPENING AND CLOSING SWITCHES

Employees are often injured, sometimes seriously, in opening or closing circuits. Accidents of this kind are generally due to haste, forgetfulness or lack of instruction. Employees must know the proper sequence of switching necessary to start and stop machines safely and to connect or disconnect apparatus from its source of energy. Opening or closing a switch or circuit in a power station may be extremely dangerous if not properly performed, and many an employee has had his hands, face and eyes injured by the electric arc resulting from an error in switching. "Think which and then switch" is a good slogan for switchboard operators.

Goggles should be worn when there is any danger of the eyes being flashed by an electric arc. It has been demonstrated that a pair of plain glass goggles will protect the eyes from the injurious effects of a momentary electric arc, and they are more suitable than colored glass goggles as they can be worn with more comfort to the eye and around tight places where colored glasses might obstruct the vision and introduce a stumbling hazard.

Employees should be taught how to replace fuses. The safe way depends upon the voltage of the circuit and the location and kind of fuses. After replacing a low-voltage fuse care should be exercised when closing switch as there is always danger of the fuse exploding and causing injury to the operator's face or hands. Circuits on which drop cords are used and handled should always be lightly fused, so that should trouble occur on a cord that is being handled the fuse will blow readily and possibly prevent a serious burn or shock.

Great care should always be exercised when replacing high-tension fuses such as those used on instrument transformers. Fuses of this kind are generally installed in out-of-the-way places, but can be replaced safely while the circuit is alive with insulating tongs of proper length. On extra-high-voltage circuits insulated stools or ladders should be used in addition to the tongs.

Employees should be instructed not to work immediately above live lines or equipment, because a tool, rope or branch of a tree dropped across a high-tension line might result in a flash which would flare upward with serious consequences. The rule "Work from below" is a good one.

The use of steel measuring tapes should be forbidden around power stations, and employees should be instructed to use due care when carrying or using metal

*Presented before the National Safety Conference, New York City.

†See report of accident prevention committee of N. E. L. A.

rods, tools or articles of any kind around live conductors. Accidents have occurred when articles carried over the shoulder have come in contact with live or moving parts.

Station employees should be provided with protective devices for handling live parts so that they will not resort to makeshifts that are inadequate for their own protection, and they should also be instructed how to use the devices provided. For instance, if a long-handled switch hook is provided for some high-tension disconnecting switches, the operator should be instructed to get the length of the insulating rod between him and the live parts and not to take hold of the rod in the middle. He should be instructed to keep the rod, when not in use, in a convenient and dry place and it should be used only for the purpose for which it is provided. Instances are on record where high-tension switch hooks have been painted with metallic paint and defective or broken rods have been replaced with ordinary broom handles, rendering their use dangerous.

The practice of using the bare fingers or hands to determine whether or not a low-voltage circuit is alive is dangerous and should be discontinued. The very fact that a test has to be made indicates that the circuit is in trouble and may be crossed with a high-tension wire.

New employees should be instructed not to replace fuses, change brushes, clean commutators or do any work on or around live parts unless they have received special permission to do so from their superior officers. Serious accidents have occurred to new men because they have attempted to do something they have seen some one else do safely. For example, it looks easy and is reasonably safe for an experienced man to change a brush on some low-voltage direct-current generators; but a new man might easily receive a serious injury doing so unless properly instructed.

Great care should always be exercised when using private telephone lines that parallel high-tension lines. Insulating transformers, fuses and insulated platforms should always be used, because when there is transmission line trouble the telephone is liable to be highly energized and dangerous.

CARING FOR LIGHTNING ARRESTERS

Electrolytic lightning arresters, which are now used almost universally on high-tension installations, need attention at least once daily, and they are reasonably safe to take care of if they are correctly installed and the operators properly instructed. Numerous instances are on record where arresters of this type have not received proper attention because an uninstructed employee was afraid to perform his duties in connection with them and have been left uncharged for long periods, the arresters being rendered practically useless as a protection against lightning and dangerous to other employees should they attempt to charge them.

All circuits, lines and switches should receive a distinguishing name or number and should be plainly and conspicuously marked, and employees must learn the names and location of the switches so as to be prepared to do emergency switching when life or property is in danger. It is a good plan to designate switches and lines with a letter and a number such as A—1 or the B—2 line or switch instead of the north or south line as the case may be. Serious accidents have occurred when employees have operated the wrong switch.

The public, and especially children, should be instructed through the newspapers and schools not to interfere with electrical equipment or lines. Quite often young "would-be" electricians are allowed to attempt repairs on defective equipment that should be handled only by experienced employees, and boys have been killed while climbing poles for birds' nests. Children flying kites with wire attached have been injured by the wire coming in contact with electric lines.

The prone-pressure method of resuscitation from electric shock should be taught all employees. In addition to being prepared for emergencies, the teaching of this method seems to emphasize the presence of danger and makes employees more careful and keeps them from getting shocked. Resuscitation should be tried in all cases, as accidental contact is nearly always imperfect and the voltage received doubtful.

SAFETY IN THE BOILER ROOM

Regular, frequent and careful inspections of boilers, externally and internally, for defects and weaknesses of material, also the inspection for defects in operating conditions of all auxiliaries, are among the best ways to insure safety around a boiler room.

Gage glasses should be properly protected so that flying particles will not injure eyes of attendants should they burst, and the guard should be such that it will not obstruct a clear view of the water. It is generally necessary to remove the guard while replacing a broken glass, so care should be taken that an accident does not occur before the guard is replaced. Water in the glass should be blown down frequently to prove that it is working all right and is not plugged up. Gages should be well lighted and water tenders should be subjected to an eyesight test. A man with defective vision is not competent for a job of this kind.

In working around all kinds of stokers men using wrenches and bars should be careful that they are in a safe position before straining on the tools. Manhole plates in the floor should be placed securely in the holes and made to fit.

Because of the danger of being burned by hot pokers and slice bars and other irons which are used on the fires, firemen should be careful in handling these bars to see that they do not swing around and hit somebody. When they are removed from the furnace they should be placed in the racks provided for them.

Before any one is allowed to go into a boiler or furnace the head fireman and water tenders should be notified and steam valves and blow-off valves should be tagged "Man in boiler." It is important that the insulation on the portable extension lamp cords used by repairmen in and around boilers should be extra heavy, and the voltage used should not exceed 110. Cords should be carefully and regularly inspected for defective insulation. The ash pit and basement of all boiler rooms should be kept well lighted.

In conclusion it may be stated that the electrical industry at the present time is about fifth on the list of industries when it comes to fatal accidents. Nothing is more clear than that hazardous places and unsafe practices swell the chances of accidents and death; and if we are to have fewer accidents, we must decrease the hazards as much as possible with mechanical safeguards and lessen the number of unsafe practices by educational methods.

A Study of Group and Individual Motor Drives

Conditions Under Which Group Drive Is Favorable—Advantages of Individual Drive—Increased Production an Important Factor That Should Not Be Forgotten

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

SYNOPSIS.—While the advantages of individual motor drive for large machine tools are generally conceded, there are differences of opinion concerning the wisdom of an investment in such equipment for medium or small-sized machinery. One of the purposes of the present article, therefore, is an analysis of the relative advantages of the individual and group methods of machinery drives with conclusions based on the merits of each case. While the article points to the savings which may be effected by the elimination of line shafts and belts, it emphasizes other more important economies which should determine the policy to be followed in any given case.

WHILE there is a marked tendency at present among the leading machine-tool plants toward individual-motor drive, particularly for the larger machines, there is also a tendency to sell a much larger proportion of smaller machines for belt drive, it not being generally agreed so far whether the investment for individual motors for small tools is warranted.

As a basis for an analysis of these two methods of electric drive, it should be noted at the outset that the power consumption of a typical machine tool is usually a relatively small item in comparison with the other charges against the machine (Fig. 1). Any degree of saving in the power consumption will have a relatively small effect on the total cost of production by this tool, whereas any saving in wages brought about by the ability of the operator to perform a given operation in less time will obviously tend to a much greater effect on the cost of production.

The interest and depreciation on a machine tool to-

increases rapidly for the smaller sizes of motors; hence the fixed charges on the smaller machine tools when equipped with individual motors are relatively higher than with larger tools where the rating of the motor is higher.

While the use of individual motors can hardly in any case be justified solely on a basis of power saving, any

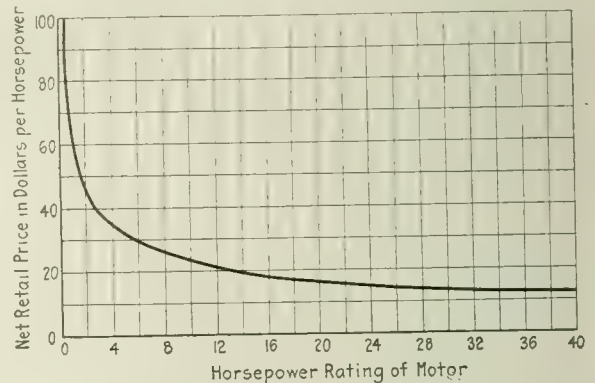


FIG. 2—APPROXIMATE VARIATION IN COST PER HORSEPOWER FOR DIFFERENT-SIZE MOTORS

reduction in the power required to drive a given machine is a factor in the gross efficiency of the plant. Table I, therefore, is of considerable interest because it shows the friction losses connected with the line shafting in various typical shop departments.² The losses given show the order of magnitude which may be reached, and hence give an indication of the economy which may be effected by the substitution of motor drive for any system of mechanical power distribution.

CONDITIONS FAVORABLE TO GROUP DRIVE

In a general way the term "group drive," as here used, relates to those cases where one relatively large motor supplies a group of machine tools through line-shafting and counter-shafting, the sources of power thus being placed at load centers and the total supply being broken up into relatively small units. The excessive mechanical losses of the long main-line shafts usually employed with purely mechanical power distribution are thus reduced by the electrical distribution up to the group motors, but the mechanical losses usually present with line-shafting and belting still occur between the group motor and the machine tools to which it supplies power.

Several fairly well-defined conditions occur under which group drive is usually preferable to individual-motor drive, and these may be listed as follows²:

- Group of machines operated at constant speed, all machines being in operation simultaneously.
- Machinery close together and counter-shafts thus short; diversity factor that permits the installa-

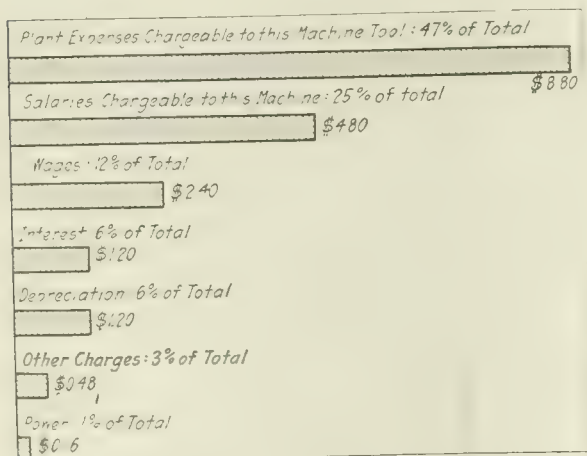


FIG. 1—RELATIVE AMOUNTS CHARGEABLE TO A GIVEN MACHINE TOOL PER EIGHT-HOUR DAY FOR DIFFERENT ITEMS WHICH MAKE UP TOTAL PRODUCTION COST

(Based on data of A. G. Popcke, *Electric Journal*, December, 1907.)

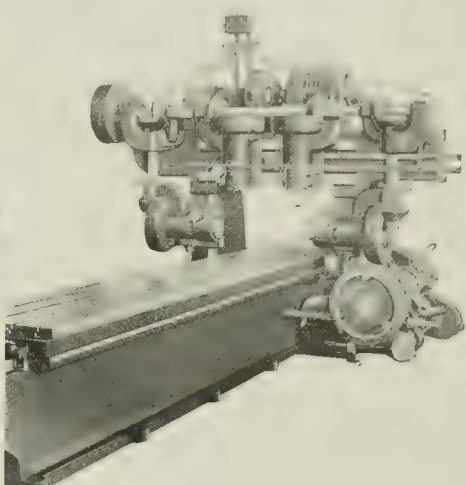
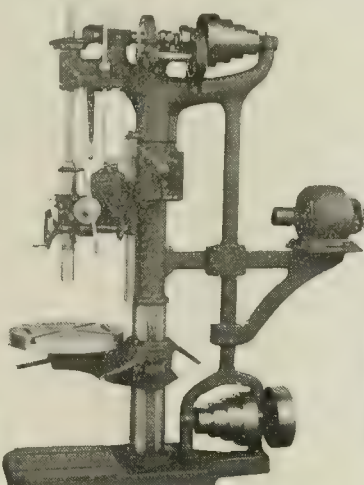
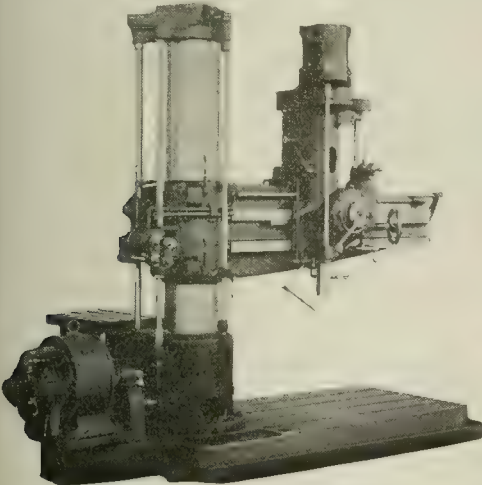
gether may form an item of importance. In this connection Fig. 2 indicates that the cost per horsepower¹

¹From a discussion by H. R. Johnson, *Trans. A. I. E. E.*, Vol. 34, p. 757. Referred to also in the treatment of group driving, where the cases favorable to group drive are listed.

²As given in F. A. Halsey's handbook.

tion of less gross horsepower with a single group-drive motor than when several individual motors are used. (This case applies with special force to the smaller motors of say 2 hp. or less.)

(c) Constant-speed machines requiring excessive currents at certain points in the duty cycle and when, owing to such conditions, the gross horsepower rating



FIGS. 3, 4 AND 5—LARGE RADIAL DRILL WITH ADJUSTABLE-SPEED-MOTOR DRIVE; SPECIAL ATTACHMENT FOR MOTOR WHERE BELT DRIVE IS EMPLOYED; LARGE MACHINE TOOL WITH MOTOR FORMING AN INTEGRAL PART THEREOF

of individual motors would necessarily be higher than the horsepower rating of a single group motor.

(d) Where a group of relatively very small machines is found and where the investment in a motor for each machine would be unduly high.

Under any of these conditions, however, the higher first cost of individual motors might easily be offset in a very short period if any considerable increase in production would result from their use in preference to a group motor. Furthermore, the first cost of individual-drive installations has often been increased in the past by the additional cost of mechanically attaching the motor to the machine. This objection is disappearing

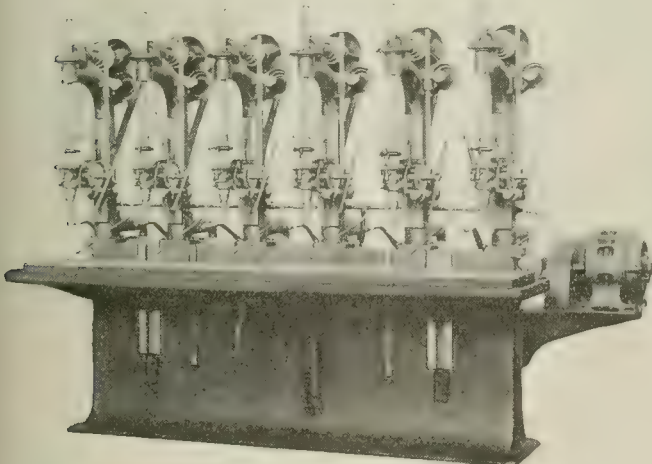


FIG. 6—SIX-SPINDLE HIGH-SPEED GANG DRILL EQUIPPED WITH MOTOR FOR INDIVIDUAL DRIVE

at the present time because of the growing tendency of the machine-tool manufacturers to design their machine tools so as to accommodate the motor. This feature is illustrated by Figs. 3, 4, 5 and 6, which refer to special designs of modern machine tools to which the motors may be effectively and readily attached.

The fact that at least 50 per cent of the output of

some of the larger machine-tool plants is now arranged for individual motor-driving is due partly, no doubt, to the increased demand of industrial plants for motor-driven machines, and also to some extent to the appreciation on the part of the machine-tool builders of the advantages of the motor-driven tool.

Turning now to some of these advantages of indi-

vidual drive, it is important first to note how large a factor the reduced friction losses may be in the individual-motor problem. Figures gathered by A. G. Popcke for a typical case on which careful estimates were made for both methods of drive show that the increased first cost for individual motors may be offset in a relatively short time by the lower frictional losses brought about by their use.³

In a case of group drive the total first cost per floor amounted to \$8,700, proportioned as follows: For the main shaft, 27 per cent; counter-shafts and pulleys, 57 per cent; group motor, 5 per cent. The losses due to

TABLE I—FRICTIONAL LOSSES IN SHAFTING FOR VARIOUS TYPICAL SHOP DEPARTMENTS

Per Cent of Total Transmitted Power		Per Cent of Total Transmitted Power	
Department		Department	
Pattern making.....	17	Chucking	26
Grinding	21	Planing	26
Light drilling.....	23	Cutter making.....	27
Lathe	25	Heavy drilling.....	34
Milling	25	Jig and fixture making.....	37
Cam cutting.....	26	Cutting-off	43

friction with the group system were estimated at \$2,500 per annum.

The first cost of an individual-motor drive for this same floor was estimated at about \$10,400 per floor, proportioned as follows: For the 136 motors, 83 per cent of the first cost of the driving system, and for wiring, etc., about 13 per cent. The losses due to friction in this case were estimated at \$700 per annum. In this instance the extra first cost of the individual motors amounts to \$1,700, whereas the saving in frictional or mechanical losses by the use of individual motors amounts to about \$1,800. In such a case, therefore, the increased cost of the individual-motor system would pay for itself through reduced mechanical losses in approximately a year's time.

³A discussion of this problem by the author from a somewhat different angle may be found in the *American Machinist* of 1914, Vol. 41, No. 11, p. 445.

The foregoing case is not presented because of any special interest attached to such a general example, but merely for the purpose of showing that, without any regard to the major advantages of the individual motor, it may justify itself on a basis of power efficiency alone in some cases. However, the economy of the individual-motor-driven machine rests largely on the increased production it makes possible and on certain other secondary advantages, rather than on savings in power.

PRINCIPAL ADVANTAGES OF THE INDIVIDUAL MOTOR

As is so often the case in a problem of this nature, the advantages of the individual-motor-driven machine may be classified into primary and secondary divisions. Under the former there may be placed the direct economies which result from reduced power consumption and from increased production for the same labor cost, and under the latter all those more or less secondary advantages which are of course important but less tangible, as typified, for example, by clearer overhead space due to the absence of belts, increased safety to the operator by the use of individual motors, and similar items.

Under the principal advantages, then, are included power savings (already discussed) and increased production. The latter is brought about largely by cutting down the time required to perform some or all of the elements which constitute the cycle of the operation. Thus the cycle for a planer includes the time required

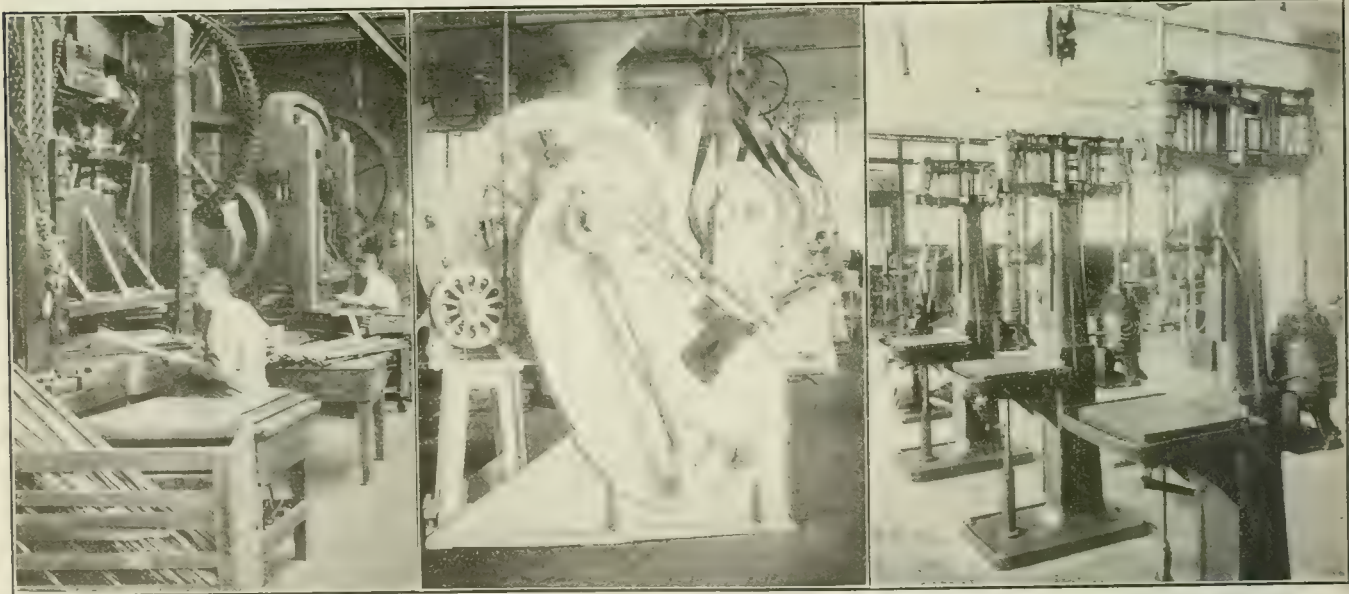
to the efficiency of the plant and will be of a magnitude which is far greater than any corresponding percentage saving in the power consumption of the same machine. Many other advantages for the individual-motor

TABLE II—COMPARATIVE FACTORS TO CONSIDER

GROUP DRIVE	INDIVIDUAL DRIVE
Constant friction loss in shafts and belting.	Friction loss in motor and machine when operating, only.
Control of speed limited by the number of cone pulley steps	Control of speed limited only by the number of notches on the controller and by the gear ratios.
Reversing must be accomplished by a clutch or by crossed belts.	Reversing may be accomplished by the handle of a controller.
Difficulty in stopping the machine tool at any given point.	The machine tool can readily be stopped at any desired point.
Speed increments are usually large.	The speed increments may be made as small as desired
The size of the cut is limited by belt slippage.	The size of the cut is limited only by the mechanical strength of the machine and by the motor torque.
Difficulty is experienced in locating causes of delay in the work.	Delays in the work may easily be detected by the use of the graphic meter.
Changes in the location of machinery difficult because shafts are fixed in position.	An individually motor-driven machine may be moved readily to suit the convenience of production.

drive might be added, but they were covered rather thoroughly in the last installment of this series; hence only those points which contrast the group and individual-drive methods are summarized here in Table II.

In conclusion it may be stated that the foregoing



FIGS. 7, 8 AND 9—GROUP OF PUNCH PRESSES DRIVEN BY SLIP-RING MOTORS; GROUP AND INDIVIDUAL DRIVE CONTRASTED (MACHINE IN FOREGROUND INDIVIDUALLY DRIVEN); VERTICAL SQUIRREL-CAGE MOTORS RUN ADJUSTABLE-SPEED DRILL PRESSES

for (a) the cutting stroke, (b) bringing the platen to rest, (c) reversing the platen, (d) the return stroke, and (e) again bringing the platen to rest and starting in on the cutting stroke. The analysis of the operation of such a machine is largely one of studying how each of the components of the cycle may be affected by the individual motor in comparison with the counter-shaft or group drive, keeping in mind that a 20 or 40 per cent saving in the time required for such a cycle means (according to Fig. 1) a corresponding percentage saving in the total cost of production. Obviously, any appreciable saving in the total cost of production by a given machine tool will be an item of great importance

study into these two methods of factory driving has had for one of its principal objects a general survey of the items involved in each method. While it is generally conceded that the individual motor is best and the most economical for the larger machine tools, such as milling machines, which require from, say, 10 hp. to 75 hp. each, for large lathes and planers and other large machine tools, the problem is not so definite when smaller machines are concerned, and in cases of the latter class due weight must be given to the various factors which are involved in the application of power to the machine, and the decision arrived at must be based on these factors.

September Central Station Operations

Income Derived from the Sale of Electrical Energy Reached a Total for the United States of \$36,200,000, While the Output Sold Amounted to 2,130,000,000 Kw.-Hr.

REPORTS to the ELECTRICAL WORLD from central stations representing 59 per cent of the generating capacity of the industry of the country indicate the following results from operation for September for the entire industry: Income from sale of energy only, \$36,200,000; output sold, 2,130,000,000 kw.-hr. The increase over September, 1916, was 13.8 per cent in income and 13 per cent in output.

With the exception of the New England States, there

TABLE I—CENTRAL STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percent- age of Industry Represented	INCOME FROM THE SALE OF ENERGY			Kw.-Hr. OUTPUT		
		1916	1915	Per Cent In- crease	1916	1915	Per Cent In- crease
Oct.	64	22,882,000	20,164,000	13.5	1,347,502,000	1,125,132,000	19.9
Nov.	64	24,819,000	21,744,000	14.4	1,396,537,000	1,148,221,000	21.7
Dec.	62	25,306,000	22,029,000	15.0	1,345,883,000	1,112,280,000	21.0
1917		1917	1916		1917	1916	
Jan.	63	27,408,000	23,969,000	14.4	1,495,829,000	1,180,884,000	26.7
Feb.	63	25,204,000	22,295,000	13.1	1,240,995,000	1,036,014,000	20.0
March.	64	23,949,000	20,913,000	14.6	1,409,129,000	1,139,453,000	23.6
April.	63	22,927,000	20,165,000	13.8	1,328,092,000	1,085,554,000	22.5
May.	62	23,369,000	20,307,000	15.2	1,459,085,000	1,163,483,000	25.3
June.	63	23,279,000	20,168,000	15.6	1,407,860,000	1,165,629,000	20.8
July.	63	22,768,000	19,680,000	15.8	1,397,482,000	1,159,410,000	20.5
August.	63	22,706,000	19,961,000	13.8	1,451,765,000	1,223,210,000	18.7
Sept.	59	21,383,000	18,769,000	13.8	1,253,891,000	1,111,329,000	13.0

was a general tendency throughout the country to show smaller percentages of increase over the corresponding months of the previous year than has been the case in the preceding months of the current year. On investi-

TABLE II—CENTRAL STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

Month	Percentage of Indus- try Represented	New England States			Percentage of Indus- try Represented	Atlantic States			Percentage of Indus- try Represented	Central States (Illinois Excluded)			Percentage of Indus- try Represented	Pacific and Mountain States		
		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase
October...	65	2,684,000	2,331,000	15.2	65	8,887,000	7,930,000	12.1	56	6,968,000	5,895,000	18.2	87	4,213,000	3,889,000	8.3
November...	65	2,912,000	2,516,000	15.7	65	10,061,000	8,859,000	13.5	56	6,313,000	5,754,000	17.4	87	4,246,000	3,947,000	7.5
December	65	3,203,000	2,814,000	14.0	66	11,059,000	9,348,000	19.6	56	7,898,000	6,997,000	13.0	75	2,987,000	2,735,000	9.3
1917		1917	1916			1917	1916			1917	1916			1917	1916	
January...	64	3,181,000	2,762,000	15.1	66	11,400,000	9,874,000	15.6	56	8,081,000	7,013,000	15.2	86	4,602,000	4,020,000	9.5
February...	64	3,039,000	2,686,000	13.1	65	10,249,000	9,021,000	13.6	55	7,471,000	6,530,000	14.4	86	4,284,000	3,926,000	9.2
March...	64	2,861,000	2,547,000	12.3	65	10,203,000	8,902,000	14.7	56	6,692,000	5,754,000	16.5	86	4,193,000	3,780,000	11.0
April...	64	2,756,000	2,357,000	17.0	65	8,601,000	7,765,000	10.7	56	7,132,000	6,094,000	7.0	86	4,282,000	3,821,000	12.1
May...	64	2,640,000	2,253,000	17.2	65	9,495,000	8,118,000	16.9	52	6,912,000	5,914,000	16.9	86	4,173,000	3,883,000	7.5
June...	64	2,641,000	2,290,000	15.4	65	9,281,000	8,017,000	15.7	53	6,718,000	5,563,000	20.9	86	4,480,000	4,174,000	7.4
July...	64	2,634,000	2,205,000	19.4	65	8,919,000	7,687,000	16.1	53	6,690,000	5,643,000	18.6	86	4,482,000	4,110,000	9.2
August...	64	2,352,000	2,025,000	16.2	65	9,021,000	7,881,000	14.5	53	6,910,000	5,718,000	20.9	86	4,807,000	4,259,000	13.0
September	56	2,379,000	1,980,000	20.1	61	8,215,000	7,191,000	14.3	48	6,430,000	5,489,000	17.1	81	4,316,000	4,070,000	5.9
October...	65	107,756,000	83,705,000	28.8	65	426,151,000	373,705,000	14.2	56	408,364,000	324,509,000	25.9	87	355,014,000	306,828,000	15.8
November...	65	111,873,000	89,015,000	25.7	65	533,252,000	424,746,000	25.6	56	415,491,000	334,044,000	24.4	87	346,847,000	293,518,000	18.2
December	65	117,763,000	97,387,000	21.0	66	535,410,000	444,923,000	20.4	56	425,510,000	354,258,000	20.0	75	256,006,000	206,838,000	23.8
1917		1917	1916			1917	1916			1917	1916			1917	1916	
January...	64	120,211,000	93,163,000	29.1	66	564,699,000	429,432,000	31.5	56	437,923,000	351,335,000	24.5	86	363,094,000	298,990,000	21.4
February...	64	110,114,000	88,324,000	24.7	65	418,407,000	341,877,000	22.5	55	373,988,000	323,158,000	15.8	86	326,891,000	274,079,000	19.3
March...	64	121,434,000	95,515,000	27.2	65	539,028,000	425,376,000	27.0	56	383,046,000	311,841,000	23.0	86	365,541,000	301,721,000	21.3
April...	64	108,968,000	87,237,000	25.0	65	449,445,000	362,752,000	24.0	56	390,103,000	317,505,000	22.9	86	368,557,000	309,474,000	19.1
May...	64	110,991,000	86,675,000	28.3	65	527,004,000	405,719,000	30.3	52	415,795,000	325,986,000	27.7	86	394,554,000	336,541,000	17.3
June...	64	106,817,000	87,345,000	22.4	65	496,784,000	392,905,000	26.5	53	393,770,000	318,316,000	23.6	86	399,622,000	358,727,000	11.2
July...	64	109,399,000	83,451,000	31.4	65	494,965,000	396,538,000	24.8	53	379,087,000	311,931,000	21.5	86	412,635,000	366,237,000	12.7
August...	64	105,848,000	85,113,000	24.5	65	514,254,000	420,806,000	22.3	53	415,966,000	333,549,000	24.7	86	413,299,000	381,190,000	8.0
September	56	97,019,000	77,265,000	25.6	61	449,138,000	379,035,000	18.6	48	358,883,000	311,911,000	15.1	81	347,633,000	342,028,000	1.6

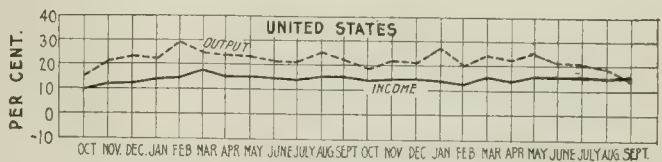
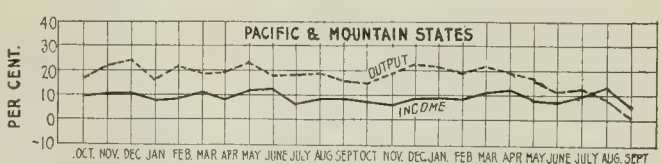
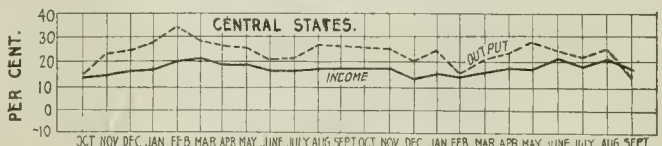
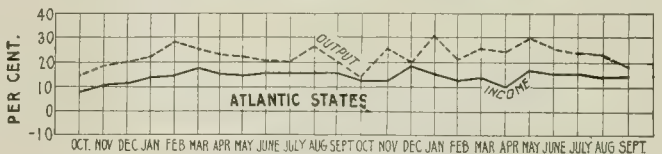
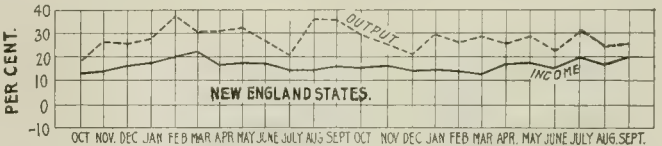


FIG. 1—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES



FIGS. 2 TO 5—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

gation, however, it was noticed that this condition arose because of returns, not from a majority of the companies reporting, but rather from a few large properties where local conditions were unsatisfactory.

In this respect the most notable feature was the unsettled condition of labor. Labor disturbances being generally local, what affects one factory in a community frequently spreads through sympathetic strikes to other factories in that community, with the result of a very much curtailed local production. The effect on energy consumption is apparent. It was some such condition that was in a considerable measure at the bottom of the falling off in consumption for September. This is best brought out by the fact that the situation in the Western copper mines is virtually such a condition as is reflected in the Pacific and Mountain State percentages.

In addition, the release of a large number of men to the army caused a reduction in output of many industrial establishments. Some factories had a considerable percentage of their machines idle.

On the other hand, many central stations reported for September larger gains both in percentage and gross than ever before. With better rates for power in force in so many properties, the co-operative earnings, it will be noticed, held up well.

The accompanying curves show graphically the percentages of increase over corresponding months of the previous year as contained in Tables I and II.

WATER-POWER DEVELOPMENT IN NEW ENGLAND STATES

Henry I. Harriman Brings Out the Features of the Principal River Systems with Reference to the Fuel Problem and Cost of Energy

President Henry I. Harriman of the New England Power Company addressed the Boston Society of Civil Engineers recently upon New England water-power development, reviewing the characteristics of the principal river systems and touching briefly upon the features of the fuel conservation problem as influenced by the production of low-cost hydroelectric energy. Speaking of New England as a market for electrical energy, Mr. Harriman said that there are now more than 12,000 separate manufacturing establishments in this section of the country, and that whereas New England represents only 2 per cent of the United States in area and 4 per cent of its population, the value of its manufactured products is 10 per cent of the entire country's output. He predicted that as soon as financial conditions permit railroad electrification will be greatly extended. Few realize the importance of electrochemical power demands at present.

Mr. Harriman outlined the fundamentals of hydroelectric energy production from the economic standpoint (see *ELECTRICAL WORLD*, March 20, 1915, page 751, "Harriman on New England Water Power"), and emphasized the low relative cost of labor in water utilization. In many industries labor costs represent 50 to 70 per cent of the total compared with 10 per cent in a hydroelectric system. The outlook is most promising for a central station load in New England of 1,000,000 hp., in view of the fact that the manufacturer's money yields a higher return if placed in the productive side

of his business instead of in the private power plant.

Normal costs, say those prevailing early in 1914, indicate that in general the initial outlay for a hydroelectric development will approximate double that for an equivalent steam plant. A fair range for the former is \$100 to \$150 and for the latter \$50 to \$75 per kilowatt. The water-power station, however, has distinct advantages on the side of lower depreciation and maintenance. Dams, station structures and water rights either do not depreciate perceptibly or else depreciate at a very low annual rate compared with boiler and steam-turbine equipment. Operating costs are extremely low in water-power stations, frequently reaching \$0.0005 per kilowatt-hour, whereas with coal at the erstwhile figure of \$4 per ton, an energy production cost of from 4 mills to 8 mills is common. In most successful hydroelectric stations the plant is so designed that it can utilize the twenty-four-hour flow of the river; that is, it is provided with dam and storage facilities sufficient to impound that flowage. It is far easier to start additional waterwheels than to place additional steam turbines in operation. Within the last few years about 250,000 hydroelectric horsepower has been utilized on New England streams. Notable achievements have also been accomplished in storage work, especially at the outlet of Moosehead Lake, Maine, where a dam has doubled the flow of the Kennebec River at Augusta. By the construction of the Somerset Reservoir of the New England Power Company on the upper Deerfield, in Vermont, 25,000,000 kw.-hr. is made available which otherwise would be wasted and river developments are stabilized which without the reservoir would be of little value.

Passing rapidly over the engineering features of various hydroelectric stations in New England, Mr. Harriman said that within the last eight years remarkable improvements have been attained in the design of waterwheels. When the pioneer Connecticut River plant was built at Vernon, Vt., vertical units of relatively high speed were installed, together with auxiliary wheels to permit the use of flood water. If the plant were to be built to-day, large slow-speed single-runner wheels of higher efficiency would be provided, although the auxiliary runner plan would probably be retained, at least in principle, to enable the plant to operate through a very wide range of river flow. At this point on the river the flow ranges in a single year from a minimum of 1500 cu. ft. (42.4 cu. m.) to a maximum of 150,000 cu. ft. (4243 cu. m.) per second. By the use of motor-operated gates in the dam and flashboards carried to the unusual height of 10 ft. (3 m.), the river is turned to excellent account at this point between flowages of 2000 cu. ft. (56.5 cu. m.) and 25,000 cu. ft. (705 cu. m.) per second. The station contains eight units and is giving good service, although its design is far from present-day standards. The speaker paid a high tribute to the bold and efficient engineering shown in Pacific Coast water-power enterprises, and in closing referred appreciatively to the good service yielded by the single-frame flexible type of steel tower when connected by a tie cable of ½-in. (1.25-cm.) steel. Such towers will hold, even when all the conductors are cut, though normally the latter are useful in tying these structures together. Up to 66,000 volts, wooden-pole lines with wishbone arm construction are giving very good service in New England.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

POPPET-VALVE AND UNIFLOW ENGINES' DIFFERENT FIELDS

Former Principally for Non-Condensing Conditions and Latter for Condensing Operation with Fluctuating Loads.

Some misunderstanding still exists regarding the difference between poppet-valve engines and uniflow engines as to both construction and use.

The poppet-valve engine has lift valves like those of a gas engine and is usually understood to mean a four-valve engine—that is, one with two steam inlet and two exhaust valves—whereas the uniflow exhausts through cylinder ports uncovered by the piston. In developing the poppet-valve engine the passages in the head have been so arranged that efficient jacketing is obtained, as well as elimination of leakage and wire-drawing losses in the valves and ports. Efficiency ratios of between 75 and 80 per cent of the Rankine cycle are obtained under non-condensing conditions with ordinary mill or power plant loads.

The uniflow engine is primarily adapted to loads of widely fluctuating nature and to condensing operation, for example, rolling-mill drive. The latter type is not recommended by one large manufacturer of both types of engines for condensing conditions or ordinary loads.

SPECIAL BEND DESIGNED FOR UNDERGROUND LAMP LATERALS

Construction Which Can Be Employed with Good Effect in Cases Where Cutting Away of Curbing Is Objectionable

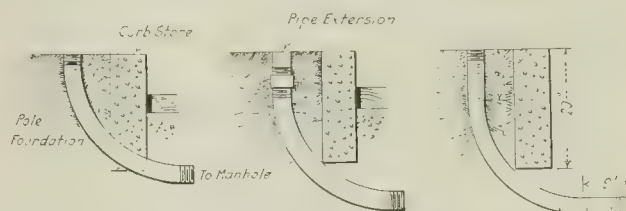
BY C. W. CULLINAN

In supplying electricity for street lighting along public highways it has usually been the practice where underground service is employed to run lead-covered cables from the manhole through a 2.5-in. (6.3-cm.) lateral pipe to the lamp-post base. Where there is a concrete foundation under the pole many companies have used a standard pipe bend having an 18-in. (91.4-cm.) radius at the end of the horizontal lateral. In order to have the end of the pipe flush or a little above the top of the foundation, it was necessary to cut away the curb as shown in Fig. 1a. This practice weakens the curb and is rather costly, since the work of cutting away the curb requires the time of two laborers for approximately two or three hours. In addition, there is the possibility of breaking the curbstone.

Cutting away of the curbing became so general that a number of cities prohibited the practice when the new 20-in. (50.8-cm.) curbing set on a 6-in. (15.2-cm.) concrete base was adopted. One method which has been tried to avoid this objectionable construction was to attach a 7-in. (17.8-cm.) extension to the bend by a coupling at the upper end, lengthening it to reach

up through the foundation as shown in Fig. 1b. This method was very expensive, as a threaded end was cut from each length of pipe and the remainder had to be returned to the storeroom for re-threading, or if it was retained on the job for use in straight lateral work, a sleeve had to be used to join the various unthreaded lengths.

To overcome these difficulties, it was decided to use a special bend as shown in Fig. 1c. This bend was of the standard 18-in. (45.7-cm.) radius but had a 9-in. (22.9-cm.) extension at each end. The bend gives am-



FIGS. 1A, 1B AND 1C—LAMP-BASE CONDUIT CONNECTION REQUIRING CUTTING OF CURB; ONE WITH EXTENSION THAT OBVIATES CUTTING CURB, AND ANOTHER WITHOUT DISADVANTAGES OF FIGS. 1A AND 1B

ple clearance in passing under curbstones, and in many cases it is unnecessary to disturb the concrete foundation upon which the curb rests. The cost of supplying service has been materially reduced per lamp, and much time and labor have been saved. This bend is not limited to lamp laterals, but may be used in supplying service to buildings.

EFFECTS OF HIGH-PRESSURE TEST UPON RUBBER GLOVES

Current Through Gloves Limited to 10 Milliamp.—Results of Test Indicate that This Method Has No Harmful Effects on the Rubber

BY C. G. BROWN

Laboratory Director Rochester Railway & Light Company

All new gloves received by the Rochester (N. Y.) Railway & Light Company are tested before they are placed in service and in addition receive occasional tests afterward. The test is different from the ordinary one in that 10,000 volts is applied while an ammeter is connected in series with the glove so that the current passing through the glove can be observed. Tentatively, all gloves are considered unsatisfactory if the current exceeds 10 milliamp.

One objection which has sometimes been raised to this test is that the glove might be weakened thereby, especially if the test is conducted frequently. To determine whether there was any ground for this objection, an ordinary glove which had been used considerably was subjected to 10,000 volts for twenty-six hours, at the end of which time it broke down at the surface of the water. As an effect was noticed just above the point of breakdown, which appeared to have been

caused by corona, it seems probable that a brush discharge had been given off at this one point and that it was the gradual weakening effect of the brush discharge rather than the high tension applied to the glove which caused the breakdown.

Following this test, the glove was returned to the water without being immersed quite so far and subjected to a similar test for 118 hours before it broke down the second time. The second failure started a fire in the upper part of the glove, so that it was impossible to examine it to see whether there were any small cracks in the glove or not.

When it is realized that the part of the glove which is above water in this test is not a part which needs careful testing—in fact, if it is weakened there is no special damage done—and when it is considered further that the tests are not liable to be applied more than one minute or one and a half minutes a month, it should be evident that this method of testing is harmless, even if the experiments do not prove it.

RAPID DEVELOPMENT CAUSES HIGH RATE OF OBSOLESCENCE

Modern Equipment with Higher Economy Justifies
Scrapping of Less Efficient Apparatus
in St. Louis Stations

The effect which rapid development in power plant apparatus has had on the rate of obsolescence is very vividly illustrated by the radical changes which have been made in the stations of the Union Electric Light & Power Company of St. Louis in the last few years.

In 1904 the Lewis Street station had two 500-kw. turbines with a steam rate of 25 lb. (11.3 kg.) per kilowatt-hour, and the Ashley Street station contained two 2000-kw. vertical turbines with a water rate of 23 lb. (10.4 kg.) per kilowatt-hour. Later there were installed in the latter station four 5000-kw. turbines with a water rate of 20.5 lb. (9.3 kg.) per kilowatt-hour. After that came four 12,000-kw. turbines with a water rate of 16.4 lb. (7.5 kg.) per kilowatt-hour, and the new 20,000-kw. unit recently installed has a water rate of 11 lb. (4.98 kg.) per kilowatt-hour, or about one-half that of the 5000-kw. units installed in 1904.

Equally remarkable has been the development in boiler equipment. With the original Scotch marine boilers 55 per cent efficiency at barely rated load was the best performance that could be realized. The Edge Moor boilers with chain grates, under normal operating conditions, had about 63 per cent efficiency with a rating of 125 per cent. The new boiler installation is guaranteed for 80 per cent efficiency, and the maximum capacity obtained in the last few months is about 300 per cent of rating, or 1700 hp. out of a 558-hp. boiler.

In 1905, with the completion of the first 12,000-kw. installation, the cost was \$250 per kilowatt installed. In 1915, when the capacity had reached 68,000 kw., the cost of the development had been reduced to \$108.70 per kilowatt installed. In 1918, with the complete development of the station to 116,000 kw., the cost will be \$71.20 per kilowatt installed. The values quoted do not include investment in land. The last unit cost, being much less than a new station could be built for at this time, indicates why the company installed new equipment in the Ashley Street station.

FIGHTING THE KAISER

IN THE BOILER ROOM

Twelve Time-Tried Methods of Improving the
Boiler-Room Economy Suggested in Poster
by Massachusetts Fuel Administrator

How each central station fireman can do his bit in his own plant toward winning the war against the imperial German government is indicated by the accompanying poster reproduction. The bulletin was issued for power and boiler plants by the Massachusetts Fuel Administrator, James J. Storrow of Boston, and shows



SAVE YOUR COAL FIRE THE KAISER HERE'S HOW!

1. Keep boiler tubes clean from soot and scale both inside and outside.
2. Stop air leaks in boiler settings, flue doors, and cleaning holes.
3. Repair leaky steam pipes and valves.
4. Keep side and bridge walls free from ashes and clinkers.
5. Keep ash pit cleaned out.
6. Keep your fire thin as your draft allows.
7. Fire at short intervals and in small quantities.
8. Keep your fire bed level by spreading coal over thin spots.
9. Do not stir your fire unless necessary. To do so will cause clinkers.
10. Do not fire lumps larger than your fist.
11. Regulate draft with dampers not with ash pit doors.
12. Work your fire by your automatic damper, not your steam gauge.

JAMES J. STORROW,
Massachusetts Fuel Administrator

in a dozen terse, practical lines of instruction how fuel can be saved to the disadvantage of the enemy and consequently to the advantage of Uncle Sam.

BELT TIGHTENER FOR PORTABLE MACHINES

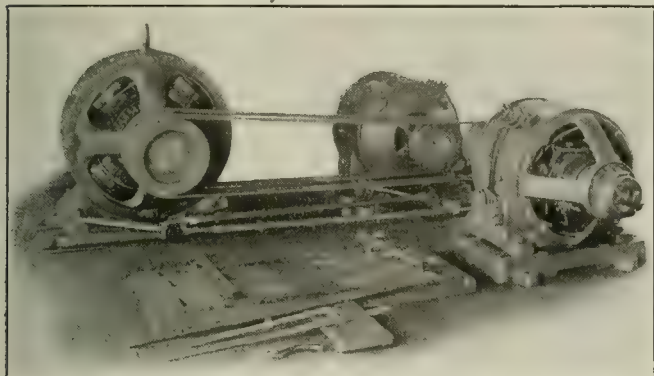
Consists of an Adjustable Strut Which Overcomes
Tendency of Machine to Rotate Around
a Vertical Axis

BY F. W. SPRINGER

Shown in the accompanying illustration is an arrangement that has been used in the laboratory of the University of Minnesota where portable machines must be held in a fixed relation to each other so that they may be connected by belts. The device is simple, inexpensive, and no doubt could be applied to advantage in various ways in other laboratories and industrial plants using motors. The belt tightener consists of an adjustable strut attached to the two machines to be belted together in such a manner that a restraining force is

applied just below the middle of the pulley on each machine, thereby preventing the tendency of the machines to rotate around a vertical axis. Hence the friction of an oiled floor is sufficient to hold the machines in line when running under full load.

As shown, the tightener is constructed of a piece of gas pipe drilled at 6-in. (15.2-cm.) intervals to receive a



TEMPORARY INSTALLATION MADE POSSIBLE BY RIGID SPACERS BETWEEN MOTORS

pin such as a large spike. Telescoping into the pipe are two rods, the positions of which may be adjusted relatively to each other by shifting the pin mentioned and the nuts on the ends of the rod. The ends of the rod are bent at right angles for insertion into suitable receptacles placed below the middle of each pulley. Usually a V-shaped bracket with a hole in the bottom of the V is attached to the machine. In some cases the hole may be drilled vertically or horizontally in the base in case it extends under the pulley.

In the foreground of the illustration is shown a floor frame upon which a machine may be mounted and fastened for applying the belt tightener. In case of excessive vibration, as in the use of a gas engine belted to generators, it might be necessary to use a U-shaped bracket.

MOTOR BEARINGS SHOULD RECEIVE MORE ATTENTION

The Practice of Feeling the Bearings so Common with Steam-Engine Attendants Could Be Followed to Advantage with Motors

It is to be regretted that electric motor maintainers do not acquire the habit of feeling the bearings of motors and of their dependent machines when making the wiping-off rounds. If they did, much expensive trouble would be avoided. The following experience illustrates what the proverbial "ounce of prevention" might have done in the way of saving a pound of cure.

A freight elevator the electric equipment of which, though very old, had given years of satisfactory service began to blow fuses with such frequency as to become a nuisance. The motor and the control apparatus had been "gone over" several times and the commutator of the motor had been turned because sparking had roughened it. In the meanwhile the 25-amp. fuses had been replaced with 50-amp. fuses, which, while not to be commended, gave relief for a few days, then the outfit refused to do anything but blow fuses.

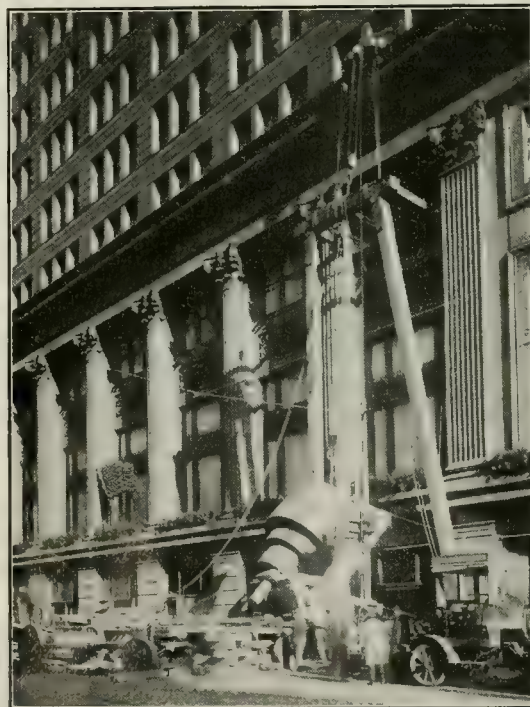
An elevator man was sent for who disconnected the motor, tested it and found it in proper condition. Then

with a bar he tried to turn the gears that the motor pinion had engaged, but could not do so. Inspection then disclosed that two bearings not far from the motor had "frozen fast."

MOVING HEAVY EQUIPMENT INTO UNDERGROUND SUBSTATIONS

Method of Lowering Rotary Converter and Auxiliary Apparatus Into Sub-Basement, with Some Necessary Considerations

Recently a Middle West company had to move two 4000-kw. rotary converters and the accompanying apparatus into two of its sub-basement type substations. As each rotary weighed 196,500 lb. (89,140 kg.) and the transformers 56,500 lb. (25,627 kg.), special arrangements had to be made for hauling these heavy and bulky pieces of apparatus through the city streets, taking them off the truck and lowering them through narrow spaces to sub-basements 15 ft. to 30 ft. (4.5 m. to 7.9 m.) below. The clearances, both horizontal and vertical, were very small and sharp turns some times allowed only 1 in. (2.54 cm.) clearance. The apparatus was handled as shown in the accompanying illustration. Owing to the great weight of the equipment, special attention had to be given to the location of the frame used in lowering the apparatus, so that the permissible bearing pressure upon the side walls, street or foundation upon which they rested would not be exceeded, whether or not the passageways permitted the apparatus to be lowered without crates and the space in the sub-



MOVING ROTARY CONVERTER FROM TRUCK INTO BASEMENT

station permitted unpacking. Where apparatus must be turned around it can usually be done more easily in the air. As there was not a direct passage from the street to the sub-basement in one case, a turn intervening, the apparatus was let down to the turn, moved around the corner and let down another 15 ft. (4.5 m.). Each job was completed in about thirty-six hours.

CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

JOINT BILLS FOR GAS AND ELECTRIC SERVICE

Economies in Various Directions Prompt Combination Companies to Discontinue Separate Billings to Customers in the Two Branches

Some combination companies supplying both gas and electric service are now recognizing their ability to economize on billing and mailing expense through joint bills for both services. Thus a customer using from one company both gas and electricity will have only one bill, on which will be his account for both services. The saving is, of course, apparent, and its effect on collections and on bookkeeping are to be considered. The customer receiving one bill instead of two at different times is not faced with the annoyance of the double service. Besides, with one customer account the necessity of going over his account twice is eliminated.

One of the latest companies to take this step is the Springfield (Ill.) Gas & Electric Company, which will render joint bills commencing Jan. 1, 1918.

Another interesting case of this character occurred recently in Atlanta, Ga. The Georgia Railway & Power Company supplies electric energy to the city, while a subsidiary (a separate company), the Atlanta Gas Company, furnishes the gas service. Customers using both commodities now receive but one bill. While this scheme has not been in effect very long, the results so far obtained, it is understood, have been satisfactory from the standpoint of all concerned.

METHODS OF CHARGING FOR ENERGY TO STEEL MILLS

Minimum Rate Cannot Be Obtained Without Taking Both the Power Factor and the Load Factor Into Consideration

Some figures presented by the central station power committee of the Association of Iron and Steel Electrical Engineers at its Chicago Convention, on the average rate offered by twenty companies furnishing power to steel mills, are given below:

Demand (Kw.)	Rate (Cents per Hour)		
	Maximum	Minimum	Average
1,000	1.246	0.700	0.9147
5,000	1.060	0.667	0.8464

The power factor, when specified, varied from 60 to 90 per cent. The average rate for mills having the power factor specified in their service contracts was lower than that for mills where the power factor is ignored. However, the minimum rate cannot be obtained without taking both the power factor and the load factor into consideration.

In some contracts the power paid for is that which is delivered to the high-tension side of the trans-

formers. In others the power paid for is that which is delivered at the low-tension side of the step-down transformers, the power company paying the losses of the first transformation, the purchaser paying for all others.

Several methods are followed for charging the cost of the power to the steel mills, and the design of the electrical equipment of a steel mill must necessarily depend on the conditions under which the energy is obtained. In some cases payments are reckoned on the maximum demand for a fixed number of hours per month at a given price, and the remainder of the power is paid at a flat rate per unit. If, however, the power used during the working hours was reduced to the average, energy would be charged for at a lower rate which would materially reduce the amount of the monthly bill.

In other cases, when a large number of motors working at intermittent loads in several plants are getting the energy from the same supply, an equalizing effect of the power demand of all the motors at any time can be expected to take place, and the supply authorities can afford to sell energy to the steel-mill operators at a flat rate. Sometimes a flat rate is applied whenever the duration of the peak loads does not extend over a given period of time. On the other hand, when the peak loads last several minutes a different tariff is applied.

KEEPING THE POWER LOAD OFF THE PEAK

Seattle Company Has Secured the Co-operation of Large Consumers in Conserving Station Capacity by Changing Diversity

The Puget Sound Traction, Light & Power Company every year faces the problem of a daily peak which recurs every day for about a month in the latter part of the year and exceeds all other peaks by so much that it becomes the governing factor in determining capacities of generating stations.

This year the problem has become unusually acute because new industries, engendered by the remarkable growth of steel and wood shipbuilding in Seattle and the Puget Sound district, have absorbed the greater part of the surplus power, and plants, such as foundries, machine shops, engine and boiler factories and the steel plants that before the war operated only one shift, working eight hours and shutting down about 4.30 p. m., now operate two, and in some instances three, shifts in order to turn out ships for Uncle Sam. The demands of these plants when under one shift operation did not affect the peak, but the introduction of the second shift has made them a factor to be reckoned with.

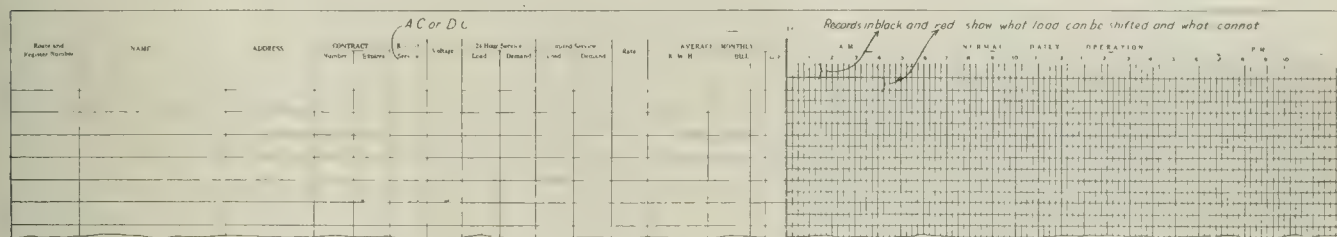
Accordingly Sales Manager H. J. Gille has made a

study of how to relieve peak conditions, and the salesmen have undertaken to interview all power consumers using over 50 hp. in an endeavor to secure their co-operation in smoothing out the load curve during the critical month.

The peaks during this period establish themselves, and the load comes on and approaches its maximum with remarkable regularity. The hours of 4.30 and 7 p. m. mark the limits of the critical interval. The

course, does not include plants connected with the ship-building industry. It is planned always to give consumers at least twenty-four hours' notice on a new schedule of working hours which it is desired to have them observe, thus affording leeway for arranging with workmen.

Another reason which contributes to this effort to obtain conservation and maximum use of generating capacity is the situation that central stations all over



LOAD SHEET USED BY PUGET SOUND TRACTION, LIGHT & POWER COMPANY

peak is caused by the overlapping of the lighting and industrial power loads on the electric railway evening rush-hour demand. The reason assigned for this overlapping just at this time is that, owing to the number of cloudy days and the consequent shortening of the daylight period, the commercial and residence lighting consumers turn on their lights before the one-shift power load goes off. Power consumers also use lights in their plants which at other times in the year they would not require. The street railway evening rush is the same throughout the year and reaches its maximum at about 5.30 p. m. This peak load cannot be shifted, nor can the residence and commercial lighting loads be limited.

Calls on power users, however, produced prompt response. Out of the first 266 consumers visited, only two were not able to co-operate to the extent of shifting their load a little. By arranging an earlier closing hour with some twenty-four consumers 2600 kw. was taken off the peak. By consultation with other large wholesale mercantile and manufacturing concerns having large numbers of employees plans were worked out whereby, instead of all the employees leaving the plants at the same time, different portions of them went off shift at half-hour intervals. This scheme, in addition to relieving street car congestion, assisted in smoothing out the street railway power curve as well as the industrial load curve.

Having thus eliminated the more readily recognized overlapping, a systematic study was begun to find just what changes would be most advantageous. Each power consumer's load with its characteristics was plotted and listed on a large sheet to facilitate careful comparison. Preliminary examination of this collection of data indicates that it may be more desirable to allow certain power users having unrestricted service contracts to operate on the peak than to ask them to shut down just before that time, because the large number of factory employees who use the street cars may make an increase in the street railway load greater than the factory load cut off.

By asking certain consumers to shut off a part of their load a few minutes early, and by asking certain others who could just as well do so to shut down entirely a half hour or an hour earlier, it is believed that the desired peak conditions can be obtained. This, of

the country are facing, namely, the inability to obtain additional generating apparatus until after the war is over, so that the necessity of using the present equipment to the best possible advantage is only too apparent.

The load sheet here reproduced lists, besides the power customer's name and address, the following information regarding the service: Data regarding contract; whether the service is on alternating or direct current and whether one, two or three phase; the voltage; the load and demand on twenty-four-hour service and also on limited service; the rate; the average monthly consumption, bill and load factor, and a normal daily load curve in black showing old conditions and in red showing new conditions of changed peak.

SMALL-TOWN COMMERCIAL PRACTICE AND RESULTS

Data on Development of Service—Town of 1000 Where in Less than Two Years After Construction of Plant Additional Units Had to Be Provided

The extent to which electrical development may be carried in towns of less than 1000 population is a question to which time has yet to give a complete answer. Occasionally, however, data come to light which seem to indicate that the opportunities in these small communities are not so mean as they may appear to the casual estimator. An example of such data is given in the accompanying article. The town in question is Laurel, Neb., which has a population of 800. It lies in the northeast corner of the State, about 40 miles (64.37 km.) directly west of Sioux City, Iowa. It was too far removed from a large community to get transmission-line service and has put in a municipally owned electric plant consisting of a 70-hp. De La Vergne and an 80-hp. Giant oil engine each driving a three-phase, 60-cycle, 2300-volt alternator. Service was delivered for the first time on April 18, 1916.

The distribution system consists of a three-phase, 2200-volt primary system serving a 220-110-volt three-wire secondary. The primary lines are built of No. 6 TB-WP copper, and the secondary lines are of No. 4 TB-WP copper wire and No. 6 TB-WP copper wire. The distribution system is laid out so that there is one

transformer for every four blocks served, the transformer being placed at the street intersection which marks the center of the four blocks. Electric range customers are served by a three-wire tap consisting of either two No. 6 stranded wires and one No. 8 wire or two No. 4 and one No. 6, depending on the location of the customer with reference to the line. The street-lighting system is of the 6.6-amp. incandescent series type.

L. C. Walling, who is superintendent of the city's electrical department, has had charge of the construction and operation of the plant since it has been placed in service and has kept a complete record not only of customers but of each electrical appliance sold in the city. The plant at present has 227 meters and has the following connected load in motors and appliances in addition to the lighting equipment: 28 motors aggre-

from customers' meters during the last five months was: May, 6391 kw.-hr.; June, 6204 kw.-hr.; July, 7084 kw.-hr.; August, 7065 kw.-hr.; September, 8174 kw.-hr. This does not represent the output of the plant because it does not include distribution losses or energy used for street lamps, of which there are twenty-four 100-cp., twelve 400-cp. and nine 600-cp., all of the 6.6-amp. incandescent series type.

The cost of the distribution line and the power house, including the first unit, amounted to \$15,000. The later addition of the 80-hp. unit cost \$4,041, making the total cost of the plant \$19,041. The collections for the sale of electrical energy, including street lamps for the last six months, have averaged \$774.52 per month, or about 9.1 cents per kilowatt-hour sold. The average monthly operating account over the same period was \$455.32 per month, or 5.4 cents per kilowatt-hour sold.

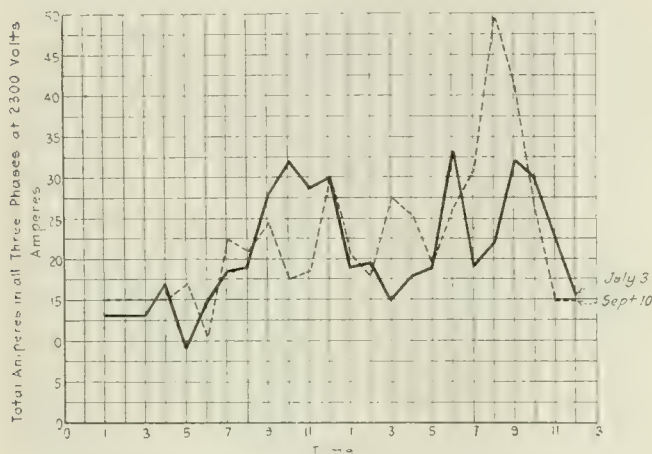
Throughout the life of the plant the rates have been as follows: Light, 15 cents for the first 20 kw.-hr., 10 cents for all in excess of that amount; power, 7 cents for the first 100 kw.-hr., 5 cents for all additional; heating, 2 cents per kilowatt-hour straight.

According to Mr. Walling, the building up of the plant's present load is the result of a great deal of patient and painstaking sales effort. When the plant started operation in April, 1916, there were fifty-four meters connected to the lines. The fact that the City Council did not expect much more business than this is evident from the fact that the first unit purchased was rated at only 37.5 kw., which rating it was believed would be as much as the town would require for ten years. Nevertheless, by the first of August this unit was so well loaded that it was necessary for the city to go without street lighting on account of the power shortage which existed.

No small part of the commercial growth may be attributed to the fact that Mr. Walling established a free trial proposition on electric ranges, agreeing to install a range and permit the customer to use it for thirty days and then to remove it without cost if it proved unsatisfactory. All of the twenty-seven stoves which have been sold on this plan have stayed sold. Mr. Walling personally reads all meters and in this way gets in touch with each customer at least once a month. As he reads the meters Mr. Walling makes notes of customers' remarks as to what appliances they need or might use, and on his return to the office he places them on a mailing list to receive once a week manufacturers' bulletins telling about this particular device. By the time he gets around to that customer's premises a month later the customer is usually ripe for a sale. This accounts for the majority of appliances on the company's lines with the exception of the 112 flatirons. These were purchased by the city and are loaned to the customers who desire them as long as they continue in use.

Electromagnetic Hoist Saves Time and Labor

Under the above caption the ELECTRICAL WORLD published on page 913 in the issue for Nov. 10 an article descriptive of an electric hoist used in a Holyoke (Mass.) hydrant factory. It has since been brought to our attention that a Crocker-Wheeler motor is used on this hoist, and not a Sprague motor, as reported.



LOAD CURVES, SHOWING EFFECT OF RANGE LOAD

gating 97.5 hp., 112 electric irons, 6 percolators, 39 toasters, 16 vacuum cleaners, 41 electric washing machines, 14 air heaters, 6 electric water heaters, 4 curling iron heaters, 52 electric fans, 4 electric soldering irons, 27 electric ranges. The motors range in size from $\frac{1}{2}$ hp. to 15 hp., there being one 15-hp. and nine $\frac{1}{2}$ -hp. units. This power load is carried on a separate three-phase, 220-volt circuit so that it will not interfere with the regulation of the circuits belonging to the lighting system.

An idea of the character of the plant load with these devices in service can be gained from the load curve shown herewith. One curve was taken on July 3, 1917, and the other on Sept. 10, 1917. The effect of operating the street-lighting system on an all-night schedule may be observed in the steady characteristics of the curve in the early hours of the morning. The effect of the cooking load which comes on heavy in the forenoon, owing to the fact that the principal meal of the day is at noon, may be observed between 9 and 12 o'clock on the curve. Again in the late afternoon the effect of the combination range and lighting load may be observed. The readings on the curve, which are given in amperes, represent the aggregate of the current values in the three phases of the 2300-volt, three-phase generator, it being impossible to secure kilowatt-readings owing to the fact that the plant has not a complete complement of instruments. A more accurate idea of the output from the plant may perhaps be gained from the fact that a total of the readings taken

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Commutation of Large Continuous-Current Generators and Rotary Converters Under Heavy Overload Conditions.—H. G. BELL.—The author describes a device enabling a continuous-current generator or rotary converter having commutating poles to be heavily overloaded without sparking. The commutating poles do not require to be carefully adjusted as in an ordinary machine, and on overload the commutating pole is automatically strengthened to the requisite extent.—*London Electrician*, Oct. 5, 1917.

Lamps and Lighting

Some Experiments on the Eye with Pendent Opaque Reflectors Differing in Lining, Dimensions and Design.—C. E. FEREE and GERTRUDE RAND.—The investigation of pendent reflectors is continued. Seven opaque reflectors differing in lining, dimensions and design are employed. In case of three of these reflectors modifications have been made to reduce the brilliancy of the opening. By means of one of these modifications a field of view was obtained presenting the lowest maximum of brilliancy that it has yet been able to obtain in an actual lighting situation. A marked characteristic of the effects produced by the dense and completely opaque reflectors was the low illumination of the ceiling and the upper part of the room and the high and in some cases almost glaring illumination of the floor and objects in the working plane. So far as effects on the eye of the kind registered are concerned, however, these irregularities of illumination and of the low surface brightnesses extraneous to the lamp and reflector seem to be of comparatively little consequence so long as the higher brilliancies of lamp and reflector are themselves properly taken care of. In this series of experiments including the translucent reflectors quite wide variations in the distribution of illumination were observed, ranging from well-illuminated ceilings and comparatively evenly illuminated walls and working plane for the reflectors of medium density to the dark ceilings and upper parts of the room and highly illuminated lower half of the room in case of the opaque reflectors. The greatest amount of light was noticed first in the upper half of the room, then in the lower, and within limits lanes of light have been produced.—Paper issued by the Illuminating Engineering Society.

Specification for Metal-Filament Glow Lamps.—This article summarizes the technical conditions proposed by the Swiss Union of Electricity Works relating to the sale of electric glow lamps. It includes specifications for metal-filament vacuum lamps and gas-filled metal-filament lamps and directions for measuring the candle-power of lamps.—*London Electrician*, Oct. 26, 1917.

The Visibility of Radiation.—PRENTICE REEVES.—A review of the early literature of this subject is given. The writer presents further data obtained by a method

similar to that used by Nutting and Ives but by using different apparatus.—Paper issued by the Illuminating Engineering Society.

Generation, Transmission and Distribution

Effect of Storage Upon the Properties of Coal.—S. W. PARR.—From data collected by the author and presented in this paper it is concluded that bituminous coal can be stocked without appreciable loss of heat value, provided that the temperature is not allowed to rise above 180 deg. Fahr. In fact, there is no appreciable evolution of CO₂ temperatures below 260 deg. Fahr. The actual loss of heat value resulting from storage is small, the indicated loss being due more to an increase in weight of a unit mass of coal resulting from the absorption of oxygen than to an actual deterioration or loss in the heat unit. Freshly mined coal has a large capacity for absorbing oxygen, which combines chemically with both the organic combustibles and the iron pyrites. The combination of oxygen with coal at ordinary temperature generates a small increment of heat. The rapidity with which oxygen is absorbed depends upon the temperature of the mass and the extent of the superficial area exposed; that is, the fineness of division of the coal. If heat is generated by this slow process of oxidation more rapidly than it is lost by radiation, the acceleration of the reaction causes a rise in temperature which quickly brings the mass up to a dangerous point. A temperature of 180 deg. Fahr. is the danger point, for at this temperature practically all of the free moisture is vaporized and a further rise in temperature will be very rapid. Any method of storage to be successful must either check or prevent the absorption of oxygen to such an extent that the generation of heat shall not proceed so rapidly as to exceed natural heat losses due to radiation. Underwater storage prevents loss of heat value and is not accompanied by deterioration in physical properties such as slacking. Dry storage is far more safely undertaken if the fine material is screened out at the storage yard and the lumps carefully sized and stocked.—*University of Illinois Bulletin No. 97*.

Traction

Electrically Generated Steam for Locomotives as an Emergency Measure.—With coal at \$16 per ton in Switzerland and scarce at that, and with a possibility of its reaching \$20 in the near future, the railway authorities have been forced to consider plans for reducing coal consumption on the locomotives of the country. Water power is cheap, but electrification cannot be pushed rapidly on account of the cost and scarcity of materials needed for electric locomotives. One scheme considered is the use of electric heat under the boilers of the present steam locomotives. With electrical energy at 0.3 cent per kilowatt-hour and coal at \$20 per ton, the electrically produced heat is said to be as economical

as that produced from coal, omitting the cost of fitting up the existing furnaces of the locomotives. This conclusion is based on the following data:

Coal Consumption (Kg. per Ton-km.)	Steam Consumption— (Kg. per Ton-km.)	
	Saturated	Superheated
Rhaetische Railroad...	0.100	0.700
Gotthard Railroad.....	0.080	0.560
S. S. B. Kreise.....	0.075	0.525
		0.600
		0.480
		0.450

The price of a complete installation for carrying current to the engines is figured at from 0.0086 cent per ton-kilometer (0.014 cent per ton-mile) to 0.011 cent per ton-kilometer (0.018 cent per ton-mile), while the rebuilding of present engines would cost 0.003 cent per ton-kilometer (0.0048 cent per ton-mile). While this temporary expedient would be justified only under extreme conditions, it may be the only solution of the Swiss transportation problem if the coal supply from Germany is shut off.—*Teknisk Tidskrift*, September, 1917.

New Split-Phase Locomotive of the Pennsylvania Railroad.—A. J. HALL.—The control equipment of this locomotive, which utilizes single-phase energy from an overhead trolley and transforms it into three-phase energy through the medium of a rotating type of phase converter to supply power to three-phase induction motors, is described in this article. Owing to the inherent characteristics of the induction motor no extra control equipment is required for regenerative braking.—*Electric Journal*, October, 1917.

Direct-Current Aluminum Lightning Arresters.—V. E. GOODWIN.—This type of arrester, it is pointed out, finds its principal application in the protection of street railway equipment. While it was not uncommon some years ago to find from 5 per cent to 10 per cent of a railway company's cars out of commission after a severe electrical storm, the table given shows that since the introduction of the direct-current lightning arrester only a very small percentage of motors protected by this device are damaged.—*General Electric Review*, November, 1917.

Installations, Systems and Appliances

Metal Cutting with the Electric Arc.—GRAHAM KEARNEY.—This article is based on observations made by the author and contains some recommendations respecting the best arrangements of electrode holder, size and shape of carbon, and methods of securing contact for the positive terminal to the material being worked on. A table is included which is an exact copy of notes taken in the course of an afternoon's work on 9/16-in. (14.3-mm.) steel plate. The records show that the cost per ton by the oxy-acetylene method was approximately \$11 as compared with \$2.40 for the electric arc method. Besides this economy, the author points out that the electric arc is much safer, for during the time that the oxy-acetylene apparatus was used two explosions of gas tanks occurred.—*General Electric Review*, November, 1917.

Electric Winding.—D. BURNS.—This paper is concerned with discussing the problem of electric shaft winding, and is illustrated by examples. It is pointed out that it is necessary to fix the following preliminary details in working out the problem: (1) the quantity of coal to be raised, the cage load, the number of winds per day or per hour, the time per wind with the average speed; (2) the strength, weight and size of the

winding rope to be used; (3) the diameter of the drum and sheaves to be used; (4) the inertia, acceleration and retardation of the moving masses; (5) the determination of the speed, torque and power diagrams from the foregoing data, and (6) the determination of the horsepower of the motor from the torque diagram.—*London Electrician*, Oct. 12, 1917.

Construction of Large High-Tension Transformer Stations.—MAURICE KOEHLIN.—Interruptions to service due to defects in transformer stations might be made less numerous, in the author's opinion, were experience gained in one station put to use more generally in others and greater unification thus brought about. In studying this matter three principles should be kept in mind—security of service, rapidity of operation, and economy. A simple scheme, judicious choice and disposition of apparatus, sufficient space between busbars and machines and well-thought-out signals are requisites of security. Rapidity should be sought by uniting at one spot the control of all interrupters and measuring instruments. Economy may be obtained, not by diminishing the equipment, but by so arranging it as to reduce the space occupied by connections, and thus the dimensions of the station.—*Revue Gén. de l'Elec.*, Oct. 20, 1917.

Wires, Wiring and Conduits

Phantom-Circuit Remote-Control System.—H. H. REEVES.—The system dealt with in this article was designed to provide a simple, reliable and economical means for controlling groups of street incandescent lamps which are installed at a distance from the central station and are fed by local transformers. The author describes the theory and operation of the system and the various component pieces of apparatus, and analyzes the system's merits.—*General Electric Review*, November, 1917.

Electrophysics and Magnetism

Relations of Magnetism to Molecular Structure.—A. P. WILLS.—A brief discussion of the works of investigators like Langevin, Weiss, Barnett, Einstein and de Hass to point out how well each of their theories explains the relations between magnetism and molecular structure.—*Science*, Oct. 12, 1917.

Units, Measurements and Instruments

Squirrel-Cage Speed Indicator.—E. B. BROWN.—The indicator described in this article depends for its action upon the modification of the main field by the cross-magnetization of a rotating armature in a small generator.—*London Electrician*, Oct. 26, 1917.

An Approximate Method of Checking the Accuracy of a Direct-Reading Insulation Testing Set.—G. W. STUBBINGS.—The article suggests a method of checking the accuracy of direct-reading testing sets by using a moderately high resistance in series with an emf. opposed to that of the magneto-generator.—*Electrical Review*, Oct. 5, 1917.

Apparatus for Measuring Very Strong or Very Weak Alternating Currents, with Adjustable Field Magnet.—PESTARINI.—The arrangement described comprises a special galvanometer and a static phase transformer fed from an alternating auxiliary source. The galvanometer comprises two coils, one fixed and the other movable. If the current to be measured is weak, it is

passed through the moving coil and the phase transformer feeds the fixed coil. If the current to be measured is large, it is sent through the fixed coil and the moving coil is fed by the phase transformer. The theory of the apparatus is the same in both cases, and consequently the author takes up only the case for weak current.—*London Electrician*, Nov. 2, 1917.

High-Temperature Thermostat.—J. L. HAUGHTON and D. HANSON.—The object of this paper is to describe certain alterations which have been made in the apparatus to render it suitable for much higher temperatures. The instrument consists of a double-walled vessel, similar in shape to a Bunsen ice calorimeter, which is made into a furnace by winding it with nichrome wire. This vessel acts as a gas thermometer, and the variations in the pressure of the air contained in it are used to operate a contact breaker, which increases or decreases current supplied to the furnace, according as the temperatures fall below or rise above the desired value.—*London Electrician*, Oct. 9, 1917.

Telegraphy, Telephony and Signals

Telephone Interference from Induction.—E. W. KELLOGG.—The author takes up the general principles of circuit balance, method of checking circuits for mutual balance, the development of system for prevention of cross-talk, the balancing against foreign circuits, and reducing disturbing influences.—*Telephony*, Nov. 10, 1917.

Elimination of Radio Strays.—CORNELIUS J. DE GROOT.—Continuation of an article on an investigation under the auspices of the Dutch East India Department of Telegraphs. The article includes a classification of strays as to electrical nature and source, tests for the separation of different types of strays, and proof that the lightning type of strays is not the most general type and that the difference between day and night strays is not due to differences of absorption between the lightning center and the receiving station.—*Wireless World*, November, 1917.

Wave-Lengths of Antennas with Flywheel Coupling and a Second Approximation for the Time Period of a Wavemeter.—BALTH. VAN DER POL.—Assuming that the self-inductance and capacity of the vertical part of the aerial are equally distributed over the length of it, the author shows that the problem of finding the natural wave-lengths can be solved with the aid of elementary mathematics. As a result of this solution he shows some interesting peculiarities of the fundamental and higher harmonics of an antenna with flywheel coupling, peculiarities that are usually not considered in leading textbooks on wireless telegraphy. The solution is given in full in the article.—*Wireless World*, November, 1917.

The Duplex Balance.—JAMES FRASER.—The author discusses a method of balancing underground duplex circuits.—*Post Office Electrical Engineers' Journal*, October, 1917.

Miscellaneous

Mineral Resources of the United States.—This report, which is presented in two volumes and represents findings of the United States Geological Survey, covers metallic and non-metallic substances. Among subjects treated in this report that are of interest to the readers of the ELECTRICAL WORLD are fuel briquetting, asbestos, slate, graphite, mica, production of coal, distribu-

tion and consumption of coal, coke, petroleum and natural gas.—Bulletin issued by the United States Geological Survey, Department of the Interior, Washington, D. C.

Working Costs of the Principal Prime Movers.—OSWALD WANS.—Data are given that should be of service in estimating capital expenditures and working costs and in establishing the relative commercial values of the principal prime movers. For this purpose typical examples of the following prime movers are considered: Suction-gas engines and plants burning anthracite, coke and wood refuse; gas engines using town gas; oil engines of the solid-injection, high-compression type; Diesel engines, and steam engines. The scope of the paper includes units up to a working load of 500 brake-hp., a power range embracing the engines for which there is by far the greatest demand. The author divides the items constituting total working costs into two parts—capital charges and running charges. Under the first part are included depreciation, insurance and interest upon capital expenditure. Under the second part are included the cost of fuel, lubricating oil, water supply, sundry stores, labor and repairs.—*London Electrical Review*, Oct. 26, 1917.

High-Economy Oil Engine.—Recently there has been developed in Skien, Sweden, an internal-combustion engine which is said to use only 116.2 grams of fuel oil per horsepower-hour. As the best recorded performance of a Diesel-type engine heretofore has been about 170 grams per horsepower-hour, the new engine represents a considerable step in advance. Although detailed description of the construction is at present not available, it is stated that a compression of between 60 and 70 atmospheres is used, resulting in a temperature of nearly 500 deg. C.—*Teknisk Uteblad*, September, 1917.

The Future of Electricity in Russia.—This article, which supplements one on the present state of electrical distribution in the vast Russian territory, takes up the power resources of the new republic. Under combustibles are included peat deposits covering 38,000,000 hectares (93,000,000 acres) in European Russia exclusive of Finland, which has 7,400,000 hectares (1,828,000 acres) more. Russia is also rich in coal deposits, and petrol is employed in some regions for heating boilers. The product of the turf pits is estimated at 96,000,000,000 tons, or the equivalent of 48,000,000,000 tons of coal. Of coal itself it is estimated that Russia possesses 75,000,000,000 tons. The water power capable of development in Finland, the Ural and the Caucasus is estimated at 15,400,000 hp. Of this only 250,000 hp. was utilized in 1910, and since then development has not been rapid. While awaiting capital for hydroelectric exploitation, Russia has depended on coal, of which she imported annually, principally from England and Germany, before the war, from 7,000,000 tons to 8,000,000 tons, the factories of Petrograd, Libau, Riga and other places finding it cheaper to import their coal from Yorkshire and Cardiff than to haul it from the Russian mines. The future of Russia, concludes the writer, depends on the realization of great projects for transmitting electricity, and unless the industries of the country are to continue under German domination to a degree even greater than in the past, capital for their development must come from other countries—England or France, the United States or Japan.—*L'Industrie Elec.*, Oct. 10, 1917.

Book Reviews

ELECTRICAL MEASUREMENTS. By Frank A. Laws. New York: McGraw-Hill Book Company, Inc. 720 pages, 442 illustrations. Price, \$5.

This is an excellent textbook on electrical measurements for the classroom and technical laboratory. The illustrations are abundant and excellently prepared. The diagrams of connections and vector relations are simple and easy to apprehend. The book has been prepared after long experience with the difficulties which students of electrical engineering encounter in their testing laboratory work. It embodies a large amount not only of compilation but also of individual effort and investigation. The chapters relate to the following topics: The measurement of current, the ballistic galvanometer, resistance devices, the measurement of resistance, the measurement of potential difference and electromotive force, power measurement, measurement of inductance and capacity, induction instruments, electricity meters, phase meters, curve-drawing meters, instrument transformers, the calibration of instruments, determination of wave form, cable testing, and legal definitions of the electrical units. A good index of subject matters concludes the book. The treatment is both descriptive and analytical. The mathematical demonstration is adapted to the acquirements of engineering students who are familiar with the fundamental principles of the direct-current and alternating-current circuits and who can employ the calculus. The book will be of value not only as a textbook for college students but also as a reference volume for all electrical engineers employing modern measuring apparatus.

THE RANGE OF ELECTRIC SEARCHLIGHT PROJECTORS. By Jean Rey. Translated by J. H. Johnson. New York: D. Van Nostrand Company. 152 pages, illustrated. Price, \$4.50.

This account of searchlights and their practical properties is particularly to the point at the present moment, the more so as the data are from recent practical investigations conducted on modern types of searchlights actually used in war. It brings together the theory of the production and distribution of light in the searchlamp and the practical facts regarding the utilization of the flux generated in a concentrated beam for military purposes. Save for the recent papers of Professor Blondel, fortunately utilized in the preparation of this work, there has been very little exact information regarding the performance of the searchlight. One can approach the theory of the searchlight from many standpoints, the final and crucial questions being the total luminous flux of the source, the proportion of this which gets out of the searchlight in the direct beam, and the actual spread of this beam. As a matter of fact, for recent military searchlights the form has settled down into fairly definite proportions, so that the ratio of total to effective flux can be rather certainly reckoned with. Lamps and mirrors have settled toward standard design, and with the mirror and lamp determined the spread of beam is also settled within moderate limits. One can therefore arrive at certain useful generalizations regarding the result in illumination to be expected from the apparatus at hand. He can even, employing standard military forms, base the result on the energy in the arc. For instance, the

table on page 60 of the book before us shows that one will not go far wrong if he counts on attaining at a distance of 1000 meters an illumination of 6.5 lux per kilowatt in the arc. Improvements in the theory and practice of the apparatus are in the direction of concentrating more energy into a smaller arc and hence obtaining more luminous flux and more precise focusing. Starting from the properties of the searchlamp, the author in the second part of the book takes up the problems which are of immediate importance in the practice of war, the amount of illumination necessary for distinguishing the objects customarily sought at various distances, the effect of varying conditions of atmosphere on these results, and the probable range of action of searchlights of various sizes. The information given on these points, and especially the data bearing on changes of visibility due to atmosphere, are exceedingly important, and their value to the artillery officer can scarcely be overestimated. The book will not be found particularly easy for the untechnical reader, but the charts and tables are of exceptional value, although their use is not always quite obvious without pretty careful study of the text. It would have been well had the translator taken the opportunity to set out the terminology employed in such plain terms, and in a position so accessible to tables and charts, that even a careless reader could not fail to interpret the data correctly. The volume is certainly a most timely one and should prove invaluable to students of artillery practice.

THE APPLICATION OF HYPERBOLIC FUNCTIONS TO ELECTRICAL ENGINEERING PROBLEMS. By A. E. Kennelly. New York: The McGraw-Hill Book Company, Inc. 302 pages, illustrated. Price, \$2.50.

The first edition of this book, published five years ago, was based on a series of lectures which the author delivered before the University of London. This, the second edition, differs from the first only in that two new appendices have been added. Few books have been so fruitful in their results as this one on "The Application of Hyperbolic Functions to Electrical Engineering Problems." A working knowledge of these functions is now a necessary part of the equipment of those who would study problems in alternating-current transmission. The methods of the author have been freely used by other writers, and the accuracy of his results have been checked on the many artificial transmission lines that have recently been constructed. The book is not an elementary text on the subject, and those who have not a sound knowledge of algebra and of calculus are not likely to read beyond the first few pages. The bulk of the book is devoted to the application of hyperbolic functions to the solution of problems on alternating-current power lines and on wire telegraphy and telephony.

Books Received

PRACTICAL ELECTRIC ILLUMINATION. By Terrell Croft. New York: McGraw-Hill Book Company, Inc. 226 pages, 166 illustrations. Price, \$2.

THE THEORY OF THE SUBMARINE TELEGRAPH AND TELEPHONE CABLE. By H. W. Malcolm. London, England: "The Electrician" Printing & Publishing Company, Ltd. 566 pages, 198 illustrations. Price, 18s.

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

ELECTRICAL DIVISION OF WAR INDUSTRIES BOARD

War Service Committee of Electrical Manufacturers Asked to Meet in Washington—War Problems and Government Needs

A bulletin issued by the electrical division of the War Industries Board of the Council of National Defense follows:

The war service committee has been asked to convene in Washington at the earliest convenient date for the purpose of discussing a number of problems, among them means of distributing in an equitable manner the needs of the government in lines which have been standardized by the Electric Power Club.

The government is in need of many devices for the manufacture of which electrical plants are entirely competent. It is, however, the policy not to request diversion to new classes of work so long as the needs for electrical equipment are unsatisfied. The proposed conference with the war service committee will undoubtedly develop whatever excess capacity there may be, if any, which can be diverted to the manufacture of mechanical parts for other requirements.

The Signal Corps needs small gasoline generating sets which can be readily transported on trucks. It may need additional searchlights. Those companies which have developed such direct-connected sets are requested to send a list of the sizes, accompanied by some general statement as to the delivery that could be made on each size.

The engineers, ordnance and others, and also private companies attempting to extend their plants for the manufacture of equipment needed are in turn in need of prime generating equipments, principally of the turbine type, the available supply being less than the immediate requirements. For the same departments deliveries are unsatisfactory for motors of 150-hp. capacity and larger. If the orders already placed and to be placed for the smaller sizes can be properly distributed so as to take advantage of the facilities of all companies, immediate needs in this respect, both for the government directly and indirectly for those who will supply the government, can be satisfactorily met.

The electrical division is fairly conversant with the limitations of the abilities as to sizes in the standard lines, but is not fully conversant with individual specialties that you may have developed. If you publish a stock bulletin and list thereon all of the specialties which you make and will indicate thereon something as to the delivery you are in a position to make as per former requests, that will be satisfactory. Please be sure that any type designations used in these lists are explained so that we can understand the exact nature of the apparatus listed. If you do not publish a stock bulletin, will you write us in general terms as to your delivery situation? It will not be necessary immediately to ask you to perform any unnecessary labor to prepare definite tabulations.

The functions of the electrical division may be in part described as follows:

First. A statistical department as to sources of supply for electrical apparatus. Electro-medical apparatus is handled entirely by the medical corps. Small electric tools, electric drills, etc., are handled by the small tool division. Wire is handled by the wire committee. Undoubtedly provision will shortly be made for handling of classes other than apparatus.

Second. Engaging engineers to all departments with a view to standardizing requisitions and preventing unnecessary hardships, which will in turn facilitate production.

Third. Assisting buying commissions of foreign governments both as to their inquiries and advising as to the desirability or acceptability of proposals which may be received.

Fourth. Canvassing the departments as to their future needs in general, with a view to advising the manufacturers that they may in turn somewhat anticipate and prepare for such requirements.

Fifth. Advising with private companies as to sources of supply for early delivery to enable them in turn to start their production at the earliest possible dates.

WAR SERVICE COMMITTEE OF MANUFACTURERS MEETS

Organization of Representatives of Associated Manufacturers, Electric Power Club and Electrical Manufacturers' Club

In accordance with the resolution of the Electrical Manufacturers' Council calling for an organization meeting of the war service committee of electrical manufacturers, the representatives of the different organizations assembled at the Bankers' Club, New York, on Nov. 28. In the unavoidable absence of D. H. Murphy, secretary of the Electrical Manufacturers' Council, the meeting was called by S. L. Nicholson, chairman of the council.

As stated in last week's issue of the ELECTRICAL WORLD, R. K. Sheppard, Simplex Wire & Cable Company, and J. R. McKee, General Electric Company, are the representatives of the Associated Manufacturers of Electrical Supplies on the war service committee thus outlined. C. A. Terry, Westinghouse Electric & Manufacturing Company, and W. W. Nichols, Allis-Chalmers Company, represent the Electrical Manufacturers' Club. C. L. Collens II and J. C. Hobart represent the Electric Power Club.

SECTION MEETINGS OF THE ASSOCIATED MANUFACTURERS

Molded or Formed Insulation Section, Insulating Materials Section and Line Material Section to Meet Next Week

The Molded or Formed Insulation Section of the Associated Manufacturers of Electrical Supplies will meet on Wednesday, Dec. 5, at 2 p. m., at the association offices, New York. A number of important matters are scheduled for consideration and an interesting meeting is anticipated.

The Line Material Section of the Associated Manufacturers of Electrical Supplies will meet on Tuesday, Dec. 4, at 2 p. m., at the association offices, New York.

The Insulating Materials Section will meet at 10 a. m. on Dec. 6 at the association offices, New York. Committees are to be appointed and other important work transacted.

NEW ENGLAND COMPANIES ARE UNEASY ABOUT FUEL OUTLOOK

With Estimated Shortage of 6,000,000 Tons During the Coming Winter, Curtailment Is Urged as Conservation Move

According to a report of the sub-committee on coal conservation of the Boston Chamber of Commerce, New England is likely to run about 6,000,000 tons short of its coal supply in the coming winter, and out of the reduced amount available must come all the coal needed to carry on the many war industries of that section. This condition will prevail, it is said, even with full use of the ocean-carrying facilities now at the disposal of the Northeastern seaboard States. Fuel Administrator J. J. Storrow of New England says that New England is already short of soft coal by several million tons, and that while the hard coal supply was reasonably satisfactory two months ago, not enough is coming forward now to meet the increased needs.

Every effort is being made by the Fuel Administrator to facilitate shipments and secure economical utilization of the coal received. Many relatively unnecessary uses have been curtailed or eliminated. The market for cordwood is most promising, and plans are under way to utilize the native supply of this fuel to a larger extent.

In the campaign for coal conservation, merchants are being urged to darken show windows or to reduce total wattage of lamps or hours of burning in each installation; to enlist co-operation of employees in turning off as many inside lamps as possible on sunny days; so far as possible to carry on work near windows which otherwise would require interior lamps for longer periods; to clean shop by day instead of during the evening; to dress certain windows by day when feasible; cut down idle use of lamps over desks in customers' rooms of banks, and to reduce hours of showcase illumination. Elevator service is being curtailed in many office buildings and substantial curtailment of electric signs continues under discussion.

Recent inquiries by the ELECTRICAL WORLD as to the coal situation among New England central stations indicate that at present the larger companies are in pretty good shape with respect to fuel on hand, and among these the situation has not yet reached an alarming stage. Among smaller and medium-sized companies there is more anxiety as to prospects of obtaining satisfactory deliveries during the next few months. It is felt that, in view of the large amount of munitions plant service on central station circuits and the recognized public necessity of street and even private lighting, central stations stand an excellent chance of being supplied preferentially when necessary. Some companies have been obliged to refuse lucrative power business on account of lack of capacity or uncertain fuel prospects; in others a vigorous and successful campaign against isolated plants is being made and business secured which might long have been withheld under normal conditions.

Within their capacity the large New England hydro-electric systems are performing service of utmost value in critical times. An official of one of the largest companies informed the ELECTRICAL WORLD that on account of the money market it will be impossible for the present to undertake comprehensive extensions of his hydro-electric system planned last spring, although energy is

in great demand. According to the New England point of view here is a field for governmental co-operation, in view of the threatened power shortage due to the uncertain fuel situation this year and next.

PRICE-FIXING, TAXATION AND OUR WAR-TIME NEEDS

Report to the President and Congress by the Foreign Trade Council—"Production a Question of Profit"

A report to the President and Congress, made by the National Foreign Trade Council, of which James A. Farrell is chairman, discusses principles underlying the co-ordination of price-fixing, taxation and foreign trade. Among the points which it makes are:

It is a natural, economic law that whenever the government requires the total possible production of any article, whether for war or peace, it must pay such price for that article as will return a fair profit to the producer otherwise, and if that producer cannot secure a fair return or profit upon his labor and investment he will not labor or invest, and production is necessarily curtailed.

In the arbitrary fixing of prices by the government profits should be estimated upon the highest normal cost of production instead of upon some lower cost made possible by larger investment, broader experience, superior methods or any other cause tending to improve the efficiency of production.

Naturally this method will result in conferring the advantage of higher profits upon the concern producing most cheaply, but this advantage can be effectively neutralized by the application of an intelligent plan of profit taxation.

In an ideal plan for price fixing and profit taxing by the government high production and not low prices should be the controlling consideration. If the final determination of the war is to be measured to any considerable extent by the relative economic power of the belligerents—and, of course, it will be so measured—the existence of the things which money can buy will be of far greater importance than the possession of money itself. The undesirable effect of unreasonably high prices even would be only temporary, as, when the emergency arises, the government, through profit taxation, will be able to recover for war purposes the greater portion of the unduly high profits.

The practical separation of the question of production from that of profit is not possible. Production essentially is a question of profit. Without profit production ceases. The times when production occurs at a loss are incidental always either to temporarily adverse conditions or to the deliberate purpose of concerns, usually of great size, to undertake development work at an immediate loss for the purpose of ultimate profit. In any of these cases production is a matter of profit, a fundamental fact which the government must recognize in the performance of its duty of price fixing and taxation.

In considering the purposes of war we should not lose sight of the fact that in war, as in other things, there can be a class of economy which kills. A recent writer, speaking of the war, has said: "It does not matter to the gunner whether the shell which he is firing costs half as much or twice as much as it would have cost in 1913. What does matter is that he should have the shell."

Next after production, and scarcely less important in its bearing upon the purposes of war, comes conservation. This should not be confined to the elimination of luxuries and unnecessary things, nor to what might be referred to as conscious and intentional waste, but applies to every activity of the individual, the concern and the nation which in its operation uses men or materials in excess of what actually would be required in the production of satisfactory results, assuming proper methods.

We are not attempting to find fault with or criticize the government—we are desirous only of helping in every possible way to win this war, because if we do not win it it

will not matter particularly what else happens to us, and we firmly believe that it is only by careful and faithful application of sound fundamental economic principles that we can carry through successfully the enormous burden laid upon us.

Closer co-ordination of the government's buying activities is also recommended.

**HASTENING MOVEMENT OF
COAL CARS IN INDIANA**

Improvement in Unloading Results from Careful Attention to Practices of Dealers—Providing for the Consumers

In relieving shortage of domestic coal in Indiana, the Federal Fuel Administration for Indiana has had occasion to attempt to hasten car movements and has tried to impress upon dealers that it is necessary to get cars unloaded quickly.

When information is received from operators that shipment has been made on one of the requests there

The man in the trenches works overtime and Sundays. This country is short of coal cars. Help this country and get this car unloaded quickly no matter what hours you work.
Federal Fuel Administrator for Indiana

PART OF TELLING POSTAL CARD ISSUED BY THE INDIANA FUEL ADMINISTRATION

is mailed to the dealer a double postal card with a sticker on it. Parts of these are indicated in the accompanying illustrations, together with another postal, which is sent if the return postal card shows that the dealer took more than thirty-six hours to unload.

Alexander R. Holliday, Assistant Fuel Administrator for Indiana, is president of the Noblesville Heat, Light & Power Company and treasurer of the Indiana

Federal Fuel Administrator for Indiana
227 Federal Building
INDIANAPOLIS, INDIANA

_____ has notified us that
car _____ No. _____ has been shipped to
you on _____ to apply on your order No. _____

Please report its arrival and return of car to the railroad on the form below.

PLEASE

SELL ONLY ONE TON TO EACH CUSTOMER.
DO NOT ALLOW PEOPLE TO STOCK COAL

POSTAL-CARD NOTICES DESIGNED TO EXPEDITE MOVEMENT OF COAL CARS

Railway & Light Company. At present the Fuel Administration for Indiana is attending only to domestic requirements and a very few emergency requests of public utilities.

**HOPE OF COAL SUPPLY
NOW IN THE RAILWAY POOL**

Washington Information on the Coal Situation Looks to the Pooling of Yards, Trackage and Equipment

Analysis of the coal situation by the Washington representative of the ELECTRICAL WORLD, based on information at the Capitol, shows that considerable hope is pinned to the railroad pooling arrangement for relief from what is now undoubtedly a coal famine.

Washington is beginning to understand, according to the information, that coal buyers and users have been so befogged by conflicting statements from the railroads, the railroad war board, the priority-in-transportation agency, the Council of National Defense, the National Coal Association and the Fuel Administration, to say nothing of price fixing and the alteration of prices, that it has been difficult for them to plan for the future.

Now, the long-talked-of famine is here in some districts. Coal operators who have established national headquarters in Washington say that they are anxious and willing to correct the situation if they can, because their selfish interests will not allow them to shut down, but that they cannot get cars. In the Pittsburgh district coal output has been cut 60,000 tons a day because of lack of cars. Railroads still claim that they have cars but not enough power, and on the other hand stories are pouring into Washington from all sections reporting that both loaded and unloaded cars are being stacked on sidings, creating congestion which halts not only coal but other commodities.

The normal movement of cars to the mine, at the mine, to the consumer and back to the mine, empty, takes ten days. Last month this movement required, according to figures in Washington, from fifteen to forty days, with an average of twenty.

In these circumstances, the railroad arrangement to pool yards, trackage and equipment is looked forward to eagerly, and December is expected to tell the story of what industry will face. Comparatively mild weather, usual during that month, will give mine operators opportunity to do their best. The labor situation is said by operators to be satisfactory. If railroads do not move cars in sufficient quantity during that

N 2
FEDERAL FUEL ADMINISTRATOR FOR INDIANA.
227 Federal Building,
INDIANAPOLIS, INDIANA.

The man in the trenches works overtime and Sundays.
Your return card shows you took a pretty long time to get your car of coal unloaded.
The car supply must be helped.
Answer your conscience: - Don't write to me about it.
Were you a Slicker in getting the car unloaded?

month, operators expect a long, hard pull in the effort to catch up, and say frankly that they need to get a good start to aid industry in storing some reserve for the winter.

THE ELECTRICAL WORLD STREET-LIGHTING TABLES FOR 1918

Following its practice for twenty-nine consecutive years, the ELECTRICAL WORLD has prepared tables showing the proper time for lighting and extinguishing street lamps. The 1918 tables will be ready on Dec. 15, and a copy will be sent free to any reader upon request to the ELECTRICAL WORLD, Tenth Avenue and Thirty-sixth Street, New York. For more than one copy a charge of 10 cents per copy is made.

NEW SECURITIES ISSUED BY GENERAL ELECTRIC COMPANY

Issues of \$10,000,000 of Two-Year 6 Per Cent Notes and \$10,000,000 in Stock—Special Stock Dividend of 2 Per Cent

The General Electric Company has sold \$10,000,000 of 6 per cent two-year notes, dated Dec. 1, to J. P. Morgan & Company and Lee, Higginson & Company. They were heavily oversubscribed. The notes were sold to the public to yield 6½ per cent income. It is reported that the net cost to the company was a little more than 7 per cent. This issue follows \$15,000,000 of 6 per cent three-year notes, sold in July, at a net cost to the company reported at about 6½ per cent. The new notes, put out by the bankers at 98¾, sold early this week at 99¼.

Directors of the company have also voted to issue \$10,000,000 new stock to shareholders at par. A meeting of stockholders will be held in Schenectady on Jan. 3 to vote on increasing the authorized amount from \$105,000,000 to \$125,000,000.

In addition to the regular quarterly cash dividend of 2 per cent, the directors declared a special semi-annual dividend of 2 per cent payable in stock at par on Jan. 15.

The total amount of new capital provided by the two note issues and the proposed new stock issue is \$35,000,000. The company states:

The proceeds of the \$15,000,000 three-year notes issued by the company in July, 1917, and of the \$10,000,000 two-year notes which have just been sold are for temporary use made necessary by the increase in orders received by the company from \$98,000,000 in the year 1915 and \$167,000,000 in 1916 to \$230,000,000 estimated for the year 1917.

This large increase has required extensions to manufacturing facilities which, from Jan. 1, 1916, to date, have amounted to \$36,000,000, completed and in process of erection. The increase in inventories and in customers' notes and accounts in the same period is about \$70,000,000.

As normal business conditions are restored, it is expected that sufficient capital will be released by the reduction of inventories and notes and accounts receivable to meet the \$25,000,000 notes at their maturity.

	1917 (Partly estimated)	1916	1915
Orders received	\$230,000,000	\$169,582,058	\$133,363,891
Sales billed	192,000,000	132,242,290	85,522,070
Net income (after all taxes) applicable to interest and dividends	27,000,000	19,160,973	12,307,995
Surplus at close of fiscal period, after paying interest and dividends	50,000,000	34,361,000	25,682,000

The \$10,000,000 capital stock which it is now proposed to offer to the stockholders at par will supply all the perma-

nent capital which it seems necessary to provide at present.

The directors have preferred to adopt the policy of paying semi-annual stock dividends at the rate of 4 per cent per annum in addition to the regular 8 per cent cash dividends, rather than to increase the rate of dividends or to distribute a larger stock dividend payable at one time. The decision to distribute stock dividends semi-annually in addition to the regular cash dividends has been reached in view of the large surplus account of the company, representing earnings invested in additional manufacturing facilities and working capital.

COURT DECISION IN THE FLEXIBLE CONDUIT CASE

Tubular Woven Fabric Company Upheld by United Circuit Court of Appeals in Long-Standing Litigation

A decision has been rendered by the United States Circuit Court of Appeals for the First Circuit in the patent suit between the National Metal Molding Company and the Tubular Woven Fabric Company. In the long-standing litigation involved, the Tubular Woven Fabric Company won the first case in the district court, in which the important feature was a paper-twine helical member of the tubing. That company lost on the appeal to the Circuit Court of Appeals. It therefore adopted a tube made with a cotton-yarn helical member. The National Metal Molding Company brought suit again. In the district court decision the Tubular Woven Fabric Company was upheld, and that finding was indorsed by the Circuit Court of Appeals on Nov. 14. The Osborn patent, which entered prominently into the case, expired on July 3 of this year.

The decision of Nov. 14 says in part:

The question whether the defendant's completed conduit involves two or three steps or elements is quite immaterial, if it results that its means of manufacture and its means of properly stiffening are substantially different from the means described and employed by Osborn.

We think the defendant produced its new conduit by combining elements old in the art under conditions which differ substantially from Osborn's conception, and by employing means which are quite independent of the means and combination which Osborn described. Osborn was not a pioneer inventor, and we do not think his claims should be so broadly construed as to include the defendant's new conduit.

ELECTRICALLY CONTROLLED RAIDERS MADE IN GERMANY

Interest in the New German "Electrically Controlled" Warships, but Disposition to Regard Them as "Philosophical Toys"

Navy Department officials in Washington expressed themselves as much interested in cable dispatches describing the so-called "electrically controlled" sea raiders which the British government reports were in operation off the Belgian coast.

The German ships, however, are regarded in high quarters in Washington, at least at this advance stage of their use, as merely "a very interesting philosophical toy." Government officials do not care to be quoted in regard to the German experiments. They, however, point to the fact that recent news dispatches from abroad are conflicting in that one says the German ships, several of which have been destroyed by the British, are controlled by wireless and another says they are controlled by a land wire.

POWER RATES TO MUNICIPALITY ARE INCLUDED IN FRANCHISE

New England Hydroelectric System Sells Energy for Railway with Possibility of Serving Municipality Also

Following protracted negotiations, the Turners Falls Power & Electric Company, one of the largest hydroelectric systems of New England, has been granted a franchise by the town of Westfield, Mass., to supply electrical energy to the Springfield Street Railway within the municipality and to build and operate a high-tension transmission line for this service. On account of the intense local interest in the municipal plant at Westfield the franchise does not permit the company to sell energy in competition with the town station, but provision is made in the agreement for rates in case of future purchases of electricity by the town from the transmission system. The franchise requires that power shall be furnished only to the railway company, and in the event of this provision being violated the location for the transmission line becomes void unless the town shall vote within two years to purchase power for municipal use from the Turners Falls company.

In case of such a vote power could be taken under two plans designated as "A" and "B." Prices under these plans would be as follows: First 1,000,000 kw.-hr., \$0.012; second 1,000,000 kw.-hr., \$0.011; all over 3,000,000 kw.-hr., \$0.009. Both plans contain a coal clause which would vary these prices in case the cost of coal on the power company's siding at its Chicopee Junction turbine plant is in excess of \$4.50 per ton. In case the plans defined in the agreement are not acceptable, the price to be paid by the town is to be fixed by the Massachusetts Gas and Electric Light Commission.

LOCAL SECURITY SELLING FOR BYLLESBY FINANCING

O. E. Osthoff Says that Problems Now Being Worked Out Are No More Difficult than Those of Past

O. E. Osthoff, vice-president of H. M. Byllesby & Company, says in a statement regarding war and construction conditions and financing by the sale of securities of local operating companies in home territory:

At most properties extraordinary demands for power service, and at certain properties the requirements of army training camps, necessitate additional investment. Additions and extensions now in hand and planned for the next fourteen months will be financed partly by the sale of the individual companies' securities in their local territories. Our plan of local security selling has met with a gratifying measure of success. Northern States Power Company, Western States Gas & Electric Company, San Diego Consolidated Gas & Electric Company, Ottumwa Railway & Light Company, Oklahoma Gas & Electric Company and Arkansas Valley Railway, Light & Power Company all have large and growing lists of home stock and bondholders.

Public utilities are vital to industrial and social welfare as well as to war production. Our power companies are helping to build ships, extract ingredients for explosives from kelp, operate flour mills, mine ore, run munition and agricultural implement factories, and are assisting hundreds of establishments to increase the output of necessary articles. Every industrial plant connected to our lines is saving fuel compared with the consumption of isolated power plants. Besides this, 45 per cent of all power supplied by Byllesby companies is generated by water power. We have three

army training camps at our properties—at Louisville, San Diego and Tacoma.

Increased operating expenses at some utilities have brought about a condition whereby the utilities are entitled to higher rates for service. The public and the utility commissions are recognizing the justice of increased compensation. We have found a spirit of fairness on the part of the public wherever these questions have been raised. One of our companies has obtained the consent of large power users to accept temporary advances in service rates by simply presenting the facts.

The Louisville Gas & Electric Company is now mining its own coal and shipping it in its own steel cars, with a marked saving under current market prices, and the assurance of a plentiful supply. A new 15,000-kw. turbine recently placed in operation is expected to achieve still further economies. At Minneapolis a new 33,000-hp. steam turbine is being installed which will still further increase both the efficiency and capacity of this steam auxiliary station.

The problems now being worked out by public utilities are no more difficult than many which have been solved in the past and those met with in any business. Intrinsic values of securities based on these properties are as sound as they always have been.

REASONS FOR PRACTICAL ELECTRICAL CHRISTMAS

James M. Wakeman Says that the Industry Is Doing a Public Service in Urging Sensible Gifts for the War Christmas

James M. Wakeman, general manager Society for Electrical Development, New York, makes the following statement to the ELECTRICAL WORLD of reasons why Christmas gifts this year should be of practical electrical value:

1. It should be recognized that the buying needs of the public for the Christmas of 1917 are changed by the fact of war.
2. Business is going on far more actively than ever before, but it is not confined in the same channels as in past



CHRISTMAS LITERATURE OF ELECTRICAL DEVELOPMENT SOCIETY

years. It is necessary that the electrical industry shall adapt itself to the new requirements of the public. It is doing so in urging that Christmas be made practical and electrical.

3. When labor is saved by the more intensive use of electricity it is a real economy. It is true conservation. The industry is doing a public service in urging sensible gifts for the Christmas season.

CAPITALIZATION OF CONSERVATION COSTS

Expenditures for the Conservation of Water and Industrial Real Estate Development Considered by Massachusetts Commission

Two interesting problems bearing upon capitalization were features of a recent stock hearing given to the Turners Falls Power & Electric Company by the Massachusetts Gas and Electric Light Commission. Lately the company has made considerable expenditures in the acquisition of land and flowage rights and in the investigation and development of storage at the sources of the Connecticut River and its tributaries for the purpose of conserving its flow. An investment has been made in this connection of \$51,000 in 60 per cent of the capital stock of the Connecticut River Conservation Company, which was organized recently by the Turners Falls and New England Power companies with a view to co-operating in a plan for impounding the spring floods in the Connecticut River. Regarding the permanent financing of this expenditure the commission said in its decision:

No question arises as to the propriety or value to the company and the public of this expenditure, but the method in which it is to be handled and shared with the other owners of the water privileges on the river, while of the utmost importance, is complicated by the relation of this stream to four states and in its navigable reaches to the federal government. The necessity of co-operation in some plan of legislation to control and equalize the stream flow by utilizing the spring floods is manifest. The expenditures so far incurred do not need to be considered in connection with this petition, and before its permanent financing is undertaken the solution of the problem can be more fully studied and considered.

The extent of the work of these two hydroelectric companies in the Connecticut River Conservation Company, as described by President Philip Cabot of the Turners Falls company, is material. Although the permanent financing of the cost of such conservation remains to be accomplished and approved by the board, its recognition of the propriety of the expenditures already incurred in conservation by mutual arrangement and co-ordinated investigations deserves emphasis.

The other issue dealt with the expenditure by the Turners Falls company of about \$16,700 in the erection of a building on land adjoining its canal for lease to a manufacturer, and at the hearing President Cabot pointed out that if the company had not made this expenditure, the manufacturer might not have located in Turners Falls. This raised the question as to whether the board shall approve new securities for an expenditure of this character where the real estate is to be occupied by a prospective user of electric power.

"It is part of our business," said he, "to attract manufacturers to Turners Falls and take care of them to some extent when they get there. In this case the company built a cutlery factory for the Hinckley Manufacturing Company and leased it to that company for a term of years on the basis of 6 per cent net on the cost of the land and buildings." President Cabot pointed out that as a result of the hydroelectric company's co-operation experienced cutlers previously unable to find work in Turners Falls returned from less profitable tasks in a near-by town.

The commission did not allow the above outlay to be capitalized in the case before it, but did not discuss the

policy in any extended way. At the hearing there was a disposition on the part of the board to recognize the company's public spirit, subject to financing outside capitalization.

EXEMPTION OF EMPLOYEES FOR INDUSTRIAL REASONS

Relation of Georgia Railway & Power Company to Maintenance of Military Establishment, the Military Forces and National Interest

A memorandum on the subject of exemption from military service for industrial reasons was prepared recently by the Georgia Railway & Power Company for the information of the district board of the northern district of Georgia. This was done in order that the board might have data before it in determining the relation of the company to the maintenance of the military establishment, the effective operation of the military forces and the maintenance of the national interest during the emergency.

The company shows that its transmission and distributing lines now aggregate over 500 miles (800 km.) in length and traverse twenty-one counties of northern



LIGHTNING ARRESTERS AND DISCONNECTING SWITCHES

Georgia with a population of over 700,000. The company is generating and distributing approximately 22,500,000 kw.-hr. of hydroelectric energy per month. It serves forty-three towns and municipalities with electrical energy for lighting and power purposes.

In the conduct of its business in furnishing transportation facilities and light and power service in the territory served, the adequate and effective operation of the Georgia Railway & Power Company is, the company says, "necessary to the maintenance of the military establishment, necessary to the effective operation of the military forces, and necessary to the national interest during the war."

As indicating the relation of the company to the military establishment the memorandum states:

The Georgia Railway & Power Company furnishes the electrical energy with which the Officers' Reserve training camp at Fort McPherson is lighted and also with which the fort proper is lighted. It furnishes the most frequent and reliable means of passenger transportation between the training camp and the fort and the city of Atlanta.

It is preparing to furnish the energy for lighting the grounds, the streets and the buildings at Camp Gordon; also the power for pumping water throughout the camp community, as well as pumping it to the camp site.

It supplies the energy for operating the signal system controlling all the trains operating on the Southern Rail-

way by and to and from the camp and hauling the material to and carrying the workmen to and from the camp site. The adequate and effective operation of this signal system is necessary to the adequate, efficient and safe operation of this division of the road.

It has in course of construction a railway line to the camp site for use in furnishing passenger transportation facilities between this camp and the city of Atlanta, the agreement to furnish these transportation facilities and service being a condition precedent to locating the camp on the site selected.

The service to be furnished by this company is necessary to the maintenance of Camp Gordon and to the continued occupancy of Fort McPherson and is therefore necessary to the maintenance of the military establishment.

Many of the industries shown on a list attached to the memorandum are making war materials and supplies which are essential to the effective operation of the military forces. In most cases these industries are solely dependent on electrical energy supplied by the



TYING IN A STORM-GUYED STRAIN CORNER IN CONSTRUCTION FOR CANTONMENT

Georgia Railway & Power Company. Quotations from replies received from some of these industries show their dependence on the company for power.

Setting forth the relation of the company to the national interest during the war, it is stated:

The forty-three cities and towns served by the Georgia Railway & Power Company, including the city of Atlanta, are dependent upon the company for electric light and power service, including the power for operating their respective waterworks systems.

In the city of Atlanta the company supplies from its hydroelectric plants the energy for street lighting, residence lighting, for lighting business houses and office buildings, churches and theaters, and the power for propelling the street cars within the city and on the suburban and inter-urban lines; power for lifting elevators, for pumping water at the Atlanta waterworks and for operating various and numerous light manufacturing establishments. The adequate and effective operation of the company's power plants and transmission and distributing systems is of supreme national interest in the territory served. It is the backbone of the commercial activity of the northern section of

the State. If the hydroelectric plants of the company were interrupted for any length of time, the entire business activity of this section of the State would cease, the forty-three cities and towns served would be without water and lights, transportation facilities within the city of Atlanta and suburbs would stop, factories would cease to operate, and upward of 15,000 people would be thrown out of industrial employment.

A great majority of the industries served have no other source of power, and even though they had steam plants available, under present conditions it would be practically impossible to secure the coal necessary to generate steam power and also impossible to secure the men necessary to operate individual steam plants. With the present high price of coal, the scarcity of labor and the shortage of coal cars it is a great economic loss and an inexcusable national waste to generate steam power when hydroelectric power is available.

The generation and transmission of electric energy from our water powers consume no materials, require a minimum of men, draw no supplies from outside the territory, and appropriate no part of the country's railroad facilities.

The use of this hydroelectric energy in furnishing the power for and running the factories and industries of the territory releases the coal, materials, transportation facilities, engineers, mechanics and laborers which would otherwise be required by the isolated steam-power plants it displaces.

In view of the extent and character of the services performed by it we can conceive of no particular industry the adequate and effective operation of which is more essential to the national interest at the present time than the Georgia Railway & Power Company.

The company has in its employ over 2200 persons. Many of these are subject to military service in the National Army. The policy of the company has been to encourage those who could be spared from the organization to enlist in the service of the country. There are a number of technically trained and experienced men in the organization whose services are necessary to the adequate and effective operation of the company and who could not be replaced by other persons without direct, substantial, material loss and detriment to the company's service. In such cases, where the men are called, we will be under the necessity of requesting that they be exempted for the reasons stated.

WORKING AGAINST THE SUBMARINE DANGER

Important Progress Announced in Washington on
Inventions to Combat the German U-Boat
Menace—40,000 Suggestions Made

Secretary Daniels announced in Washington that "important progress" has been made by inventors who are working with the Naval Consulting Board. Thomas A. Edison, chairman of the board, is now residing in Washington, occupying the old room of the late Admiral Dewey in the offices of the general board of the navy, and is giving all his time to the government in connection with inventions for the prosecution of the war.

One of the most skilled technical inventors in the naval service, it is announced, is perfecting, with the co-operation of Mr. Edison, Capt. Williams Strother Smith, U. S. N., and specialists assigned by Mr. Daniels, a device in the direction of detection and destruction of submarines. Necessarily secrecy is thrown over what is being done, and plants where experiments and other work is being done are under extra guard.

Secretary Daniels says that more than 40,000 separate suggestions have reached the Naval Consulting Board, that all have received attention, and that some have been of sufficient importance to assist in collateral plans to cripple submarines.

CHANGES IN PERSONNEL OF ENGINEERING FACULTIES

Further Listing of Resignations, Leaves of Absence, Promotions and Appointments in the Electrical Teaching Body of the United States

Following is the third installment of the record of resignations, leaves of absence, promotions and appointments in the electrical engineering faculties of the various colleges and universities of the United States. Previous articles were published in the issues of Nov. 3, page 878, and Nov. 24, page 1022.

State College of Washington, Pullman, Wash.—The only change which has taken place in the teaching staff of the electrical engineering department is the promotion of Prof. H. V. Carpenter from head of the department of mechanical and electrical engineering to that of dean of the College of Mechanical Arts and Engineering.

Stevens Institute of Technology, Hoboken, N. J.—Prof. L. A. Hazeltine has succeeded the late Professor Ganz as acting professor of electrical engineering in charge of the department. Professor Hazeltine had been in the department for the last ten years. Frank C. Stockwell has been advanced from instructor to assistant professor of electrical engineering, and F. S. Cummings has been advanced from assistant to instructor in the same department.

Syracuse University, Syracuse, N. Y.—Rich D. Whitney has been advanced from the grade of assistant professor to that of associate professor of electrical engineering. C. W. Henderson has been added to the teaching staff as instructor in electrical engineering. He comes from Denison University, where he has been an instructor in physics.

Union College, Schenectady, N. Y.—W. B. Kirke, who last year was instructor in electrical engineering, is at the present time connected with the research department of the General Electric Company, and his position has been filled by M. K. Ts'en. Mr. Ts'en was graduated from Cornell University three years ago and did one year and a half of graduate work at Union College, receiving his master's degree in electrical engineering. During the last year Mr. Ts'en was engaged in engineering work in China.

University of Arkansas, Fayetteville, Ark.—Adjunct Prof. W. B. Stelzner is on leave of absence pursuing post-graduate work in the University of Ohio. Hugh A. Brown, assistant in electrical engineering, is on leave of absence in the service of the government, giving instruction in wireless telegraphy at the aviation camp at Urbana, Ill. Prof. W. H. Wadleigh, A. B. and M. S., from the University of Michigan, succeeds Mr. Stelzner. Professor Wadleigh was in the department of physics and electrical engineering of Fairmount College, Wichita, Kan. H. F. Lickey was appointed assistant in electrical engineering, to take the work formerly done by Mr. Brown. Mr. Lickey is a graduate of the 1913 class of Purdue University in electrical engineering and since graduation has spent most of his time with the Westinghouse Electric & Manufacturing Company at Pittsburgh, Pa. Mr. Lickey is giving special instruction in sending and receiving wireless messages, to prepare men for the army and for the Aviation Corps.

University of Cincinnati, Cincinnati, Ohio.—C. R. Wylie has resigned as assistant professor of electrical engineering. V. T. Mavity has accepted an instructorship in the department. Mr. Mavity is a graduate of Purdue, 1913, and has spent three years in Central America in electrical engineering work. L. M. Alexander has also accepted a position as instructor in the electrical engineering department. Mr. Alexander is a graduate of the university's co-operative course, and in addition to the practical experience connected with the co-operative course has been doing practical work for two years since graduation.

University of Illinois, Urbana, Ill.—J. W. Davis, instructor in electrical engineering, has entered the aviation corps of the United States government. P. J. Nilsen, instructor in electrical engineering, has accepted a position with Arthur Young & Company, Chicago. R. S. Quick, research fellow in electrical engineering, has entered military service. E. A. Reid, formerly instructor in electrical engineering at the University of Minnesota, has been ap-

pointed instructor in electrical engineering. W. R. Lyon, who was graduated from the Worcester Polytechnic Institute, June, 1917, has been appointed research fellow in electrical engineering.

University of Kansas, Lawrence, Kan.—S. S. Schooley has been appointed as instructor in electrical engineering to take the place of E. E. Hartman, resigned. Mr. Schooley is a graduate of the University of Kansas in 1913 and comes to the electrical engineering department from the engineering department of the Bowersock Milling & Power Company of Lawrence, Kan.

SURVEY RICHMOND (VA.)

MUNICIPAL UTILITIES

Hagenah & Erickson Recommend Adoption of Office Methods and Policies More Nearly Akin to Those of Private Utility Corporations

A survey of all departments of the city government of Richmond, Va., including the municipally owned gas, water and electric plants, has just been completed. The survey, except the work pertaining to the utilities, was made by the Bureau of Municipal Research, New York, the utility investigation being made by Hagenah & Erickson, consulting engineers, Chicago.

The utilities section of the work embraced a study of office methods pursued by the city in administration of these properties, the accounting systems in use and practices under such systems, and analysis of the rate schedules. The report of the engineers criticises some of the methods now in use and recommends the adoption of office methods and policies more nearly akin to those followed by private utility corporations, in so far as the nature of municipal ownership will permit. Many recommendations are made with respect to the accounting systems now in use, which are criticised, especially the accounting systems of the water and electric departments. The engineers recommend that separate classifications of accounts, such as are now generally prescribed by public utilities commissions, be adopted by each of the three utility departments to the end that the operations of such departments may be shown independently, charges being made for service supplied to the city or to another municipal utility in the same manner that charges would be made for such service if rendered to individuals, and that proper credit be given by each utility for the benefit it receives from expenditures made on its account by some other city department, or for the personal services, in whole or in part, of any individual who is not employed by the utility itself. It is stated that only through the adoption of and strict adherence to such a classification of accounts is it possible to determine whether the utility departments are being operated at a profit or a loss.

Extended analyses were made of the financial operating records of the gas and water departments and of the records of consumers in these departments in order to ascertain the extent of the service development and the proper application of the particular rate schedules now in force to the service conditions as disclosed. Recommendations are made suggesting the advisability of radical changes in the schedule for water service, and changes of a lesser degree are recommended with respect to the gas rate schedule. The electric utility is operated solely in the service of the city, no commercial service being supplied.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Abandonment of Unprofitable Line.—The Utah Public Utilities Commission holds in a case affecting the Emigration Canyon Railroad Company that a railroad company makes out a case for the abandonment of its road where it is shown that the purpose for which it was built has ceased to exist, that the road is operated at a loss, that there is no prospect for any change in the situation, and where it appears that there is no question as to connection with other railroads or any charter or other obligations to estop it. The mere fact that numerous persons have purchased lands and made improvements thereon in the belief that a railroad will be operated is not, as a matter of law, a sufficient reason to require its continuance.

Recognizing the Economic Changes.—The Washington Public Service Commission, in authorizing the Puget Sound Railway, Light & Power Company to discontinue a low ticket rate of fare on its cars, says: "This commission would be remiss in its duty if it failed to recognize the economic changes which have taken place and are still taking place and the unbalancing of activities. We are passing from a peace to a war footing. Under these conditions few, if any, of the old relationships can continue to exist. If we have any power to aid in the readjustment of matters that new conditions may be met, we should be fair enough to exercise it. Every article which the company must purchase to maintain its properties is abnormally high."

Construction Order Modified Because of Abnormal Costs.—On account of abnormal costs, the Maine Public Utilities Commission has modified an order requiring the Grand Trunk Railway Company to install block signals. Its decision says: "Serious as business conditions were when the original report in this case was made, it is well known that they have since become very much more serious. Present cost of labor and materials and the difficulty in procuring either, more especially the latter, make extensive construction practically out of the question. In addition to these considerations, governmental authorities generally have expressed the wish that transportation lines be hindered as little as possible in the immediate carriage of freight. We shall therefore not now insist upon present compliance with the full recommendation as originally made. We shall order a substantial beginning through the more congested part of respondent's lines within the State and suspend further action until the subject may again be properly considered."

Rate Advance to Cover Increased Cost.—The Illinois Public Utilities Commission, having denied the utility companies' applications for permission to insert a coal clause in their rate schedules in the two Rockford cases, has taken the stand in the case of the Warren Light & Power Company that rates may be advanced to meet increased operating expenses due to higher wages, cost of material, supplies and coal, the coal increase being estimated on the price fixed by the federal government. The commission permitted the advance on a showing of efficiency and management, though the risks of the undertaking appeared to be normal and the existing rates would yield a return of approximately 7 per cent upon the tentative valuation of the property.

Unremunerative Service Not Required.—A ruling of the Washington Public Service Commission in the case of George F. Yantis against the Olympia Light & Power Company holds that, although a person lives within the corporate limits of a city, that does not justify him in demanding service from a public service corporation if the income in sight would require ten years to reimburse the company for the expense of installation, without anything for upkeep, service or depreciation. Mr. Yantis lives within the corporate limits of Olympia, and he wanted lighting service. The company found that the cost would be excessive, and refused to install service unless Mr. Yantis would buy two shares of capital stock to provide the money. This he declined to do, and appeared before the commission, which found that his demand was not a reasonable one.

Present Valuation and Higher Rates.—The Massachusetts Board of Gas and Electric Light Commissioners in allowing the Newburyport Gas & Electric Company to increase gas rates for the duration of the war says: "The board has not felt that it is in the public interest to attempt to determine in any final way the fair and reasonable price of gas in Newburyport or elsewhere at a time when the cost of every item entering into the construction, operation and financing of gas plants has reached exceptional and unprecedented levels. It may be confidently hoped that this abnormal situation will not outlast the war. When normal conditions are restored it will then be possible to reach just conclusions, resting on reasonable and stable grounds. Meantime some relief should be granted, although both consumer and stockholder must realize that in a time of great stress and in meeting conditions for which neither is responsible there must be sacrifice and self-denial on both sides. In the opinion of the board the price hereinafter named will give the company a reasonable measure of relief which, in conjunction with all the business of the company, will tide it over the present emergency. Should experience demonstrate that a higher or a lower price is called for to discharge the natural obligations of the consumers, a modification of this order will be made."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Regulation of Rates.—Under the code, which authorizes cities to regulate and fix the rents of electric light or power, etc., and to fix the charges for meters, where a franchise to sell and distribute electricity fixed maximum prices per kilowatt, without fixing or authorizing any charge for meters, the maximum price could not be increased through the addition of a meter rental or other device or subterfuge for increasing the stipulated compensation, the Supreme Court of Iowa held in Iowa Railway & Light Company versus Jones Auto Company (164 N.W. 780). The power to fix rates in this case is a continuing power, and rates may not be fixed permanently or for any specified time by ordinance or resolution or through any contract. Under the code, which further provides that franchises shall not be granted, renewed or extended for the use of the streets, etc., unless a majority of the legal electors vote in favor thereof, the rates specified in a franchise granted by the city to construct and operate a heating plant system for supplying heat to the city and its citizens were subject to subsequent adjustments, as might be deemed expedient or necessary by the City Council, though the franchise was granted with the approval of the electors. Under the sections providing that articles of incorporation, etc., of corporations shall be subject to legislative control, and may be altered, abridged or set aside, and that every franchise obtained, used or enjoyed by any such corporation may be regulated, withheld or subjected to conditions, where a city council changed the rates specified in a franchise to construct and maintain a heating plant, there was no impairment of the obligation of the so-called contract. A city council's authority to regulate and fix rates charged by a company granted a franchise to construct and maintain a heating plant system for supplying heat was not limited to reducing the rates specified in the franchise, but included the power to increase them, and it was not essential that the change of rates should rest on a new consideration. An increase by a city council of the rates specified in a franchise to construct and maintain a heating-plant system was not invalid, though at the time the code contained no provision for the amendment of the franchise, as, in view of a supplement to the code, which must be read into the franchise, this did not amend the franchise but carried out its terms, and it was immaterial that the fixing of the rate was accomplished by an ordinance amending the section of the franchise specifying its rates.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 1086 of this number.

Worcester Branch of the A. I. E. E.—Carlyle A. Atherton addressed the second regular meeting of the Worcester Polytechnic Institute branch of the American Institute of Electrical Engineers on Nov. 16 on the subject of "An Electrical Engineer in Germany and in England Under War Conditions."

Relation of Science and Engineering to War.—Major R. A. Millikan, vice-chairman and executive officer of the National Research Council, Washington, D. C., addressed a joint luncheon meeting of the Electric Club-Jovian League and the Chicago Section, A. I. E. E., at Chicago, Nov. 27. Major Millikan was formerly connected with the physics department of the Chicago University.

Toronto Section, A. I. E. E.—Three papers were read and discussed at the Nov. 16 meeting of the Toronto Section of the A. I. E. E. The papers and authors were as follows: "A Commercial Method of Taking the Ratio of Current Transformers," by Harry S. Baker, Ontario Power Company; "Demand Meters," by Perry A. Borden, Hydro-Electric Power Commission; "Relays," by C. W. Baker, Canadian Westinghouse Company.

"Hooverizing Electricity."—A special meeting of the Jovian League of San Francisco was called for Nov. 19 to listen to a discussion and suggestions on the subject of "Hooverizing Electricity." The subject was presented by Max Thelen, president of the California Railroad Commission, with the support of Messrs. Loveland, Gordan, Edgerton and Devlin, who are the other members of the commission, and F. Emerson Hoar, the commission's electrical engineer. Albert H. Elliot, secretary of the Pacific Coast Electrical Jobbers' Supply Association, was named as chairman of the day to introduce the speakers.

Empire State Gas and Electric Association.—At a recent executive committee meeting of the Empire State Gas and Electric Association the following plan for the appointment of various committees was approved: (1) The executive committee would authorize the following committees or sections: Commercial committee, gas production committee, gas distribution committee, electrical production committee, electrical distribution committee, electrical meter committee. (2) Each member company would be asked to name, on form provided, representatives to be the official members of these committees or sections. All notices of meetings of these committees or sections would then be sent to the persons thus named. (3) At the first meeting of each section the members would elect from the official

company representatives a chairman, a vice-chairman and a secretary, who would act as an executive committee of such section. These persons would hold office for one year from the date of their election.

Production of Steam from Coal.—Alex Dow, president and general manager of the Detroit Edison Company, addressed a meeting of the Schenectady Section of the American Institute of Electrical Engineers on Nov. 23 on the subject of "Production of Steam from Coal." On Nov. 13 G. H. Stickney, president of the Illuminating Engineering Society, outlined the general problems of the illuminating engineer, and Dr. Clayton H. Sharp, technical director of the Electrical Testing Laboratories of New York, addressed the meeting on the "Terminology and Measurements of Illuminating Engineering."

Meeting of Middle West Credit Men at Chicago.—The twenty-second annual meeting of the Electrical Credit Association of Chicago was held at the Hotel La Salle on Nov. 15 and 16. Membership has increased to 293 members, including 38 enrolled during the last year. One day was given to papers and discussions. The topic taking the greatest time and which was the most discussed was, "Trade Acceptances, Merits and Faults." The discussion was led by W. J. Burton. A resolution was passed in effect favoring the adoption and use of trade acceptances as rapidly as members individually deem it expedient to change from the open-account method.

New York Electrical Society Receives Handsome Donation.—A handsome donation has just been made to the New York Electrical Society by Willard E. Case of Auburn, N. Y. While the amount of the gift has not yet been made public—at the desire of Mr. Case—it is sufficient to defray all the liabilities of the society and leave a substantial sum for the carrying on of its special work. George E. Guy, who is secretary, also announces that the membership committee, of which Walter Neumuller is chairman, is engaged on an active and far-reaching campaign and that the society looks for the largest accession to its membership in its history this season.

Work of American Association of Engineers.—A letter written by the committee on ethics and co-operation of the American Association of Engineers, Chicago, has been sent by President Edmund T. Perkins of that organization to the presidents of the various engineering societies in the United States. The letter says, in part: "Our association is not endeavoring to rival but rather supplement existing activities and to do those things which many of the older established bodies have considered to be beyond their functions and yet which from the standpoint of the engineer as a man and a citizen should have careful consideration. It is our desire not to interfere in any way with the established customs of existing societies, but rather to co-operate and to a certain extent incite effort in the fields which so far have been hardly touched."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Central Station Organ Reviews Technical Articles for Operators.—The Consumers' Power Company, Jackson, Mich., through its official organ, the *Ausable News*, is calling the attention of its operators to articles which they should read in various technical papers. In this way subjects of special importance in the company's mind can be emphasized when they might go unnoticed by the operators.

Complication Over Increase in Rates in Kentucky.—An application for an increase in rates has been withdrawn by the Kentucky Public Service Company at Bowling Green, Ky., where it was discovered that the question could not be settled by ordinance. The company announces that it will continue at a financial sacrifice in the hope that supplies will become less costly, or until it becomes necessary to ask for an altered franchise.

Threshing by Electric Light.—The *West Penn Bulletin*, published by the West Penn Power Company and West Penn Railways Company, Pittsburgh, reports an instance of threshing by electric light. Owing to labor shortage it was impossible to get men to do the threshing on the farm by daylight. A canvass for men who work in shops in the daytime was made, and enough were secured to do the work. Lamps were placed in the barn.

Control of Spokane Company.—Field, Richards & Company, Cincinnati, have bought the interests of Harry A. Flood, president of the Spokane (Wash.) Heat, Light & Power Company. Mr. Flood has resigned and will be succeeded by Ludwig Kemper, representative of Field, Richards & Company in Spokane. The holding company will be discontinued as a medium for controlling the operating company, the stock of which will be distributed share for share among shareholders in the holding company.

Data on Commonwealth Edison Income and Expenses.—In a report of Samuel Insull's speech before employees of the Commonwealth Edison Company in Chicago on Oct. 25, reported in the Nov. 3 issue of the *ELECTRICAL WORLD*, errors were made in publishing the table of data. The annual report of the Commonwealth Edison Company for the year Dec. 31 shows that the taxes and municipal compensation for this year were \$1,835,912. This item was given in the table as "taxes and insurance." The item "bonded indebtedness" should have read "bond interest." The printed table contained two items listed "depreciation"; the second one should have been designated "dividends."

E. H. Davis of Houston has been appointed manager of the Texas Gas & Electric Company at Center, Tex., to succeed **E. A. Davidson**, who has resigned.

J. R. Baldwin has been promoted in the transmission division of the engineering department of the Georgia Railway & Power Company to be engineer of design.

W. R. Smith, formerly division foreman for the Public Service Electric Company, Newark, N. J., has been transferred to the position of field engineer, engineering department.

Frank R. Bacon, president of the Cutler-Hammer Manufacturing Company, has been commissioned a major in the Officers' Reserve and is now stationed at New Haven, Conn., with the Quartermaster's Corps.

William G. Martin, who for the last twelve years has been auditor for the Danville (Ill.) Street Railway & Light Company, resigned Oct. 1. Mr. Martin is taking a well-deserved rest before forming new connections.

J. F. Sells of the engineering staff of the National X-Ray Reflector Company has been appointed consulting illuminating engineer for the new-business departments of the Henry L. Doherty Company central stations. Mr. Sells is at present at Mansfield, Ohio, where the Doherty company operates the Mansfield Electric Light & Power Company.

D. C. Durland, works manager of the Sprague Electric Works of the General Electric Company, with which he has been connected for the last twenty-three years, has resigned to become president of the Mitchell Motor Car Company on Jan. 1. Mr. Durland was a member of the board of governors of the Associated Manufacturers of Electrical Supplies.

James H. Ellis, research associate in physical chemistry at Throop College of Technology, Pasadena, Cal., has become a member of the physics department of the college as instructor in electrical measurements. Mr. Ellis was graduated from the Massachusetts Institute of Technology in 1912 with the degree of bachelor of science and in 1916 with the degree of doctor of philosophy. He was assistant in the electrical laboratory of the Massachusetts Institute of Technology in 1913-14 and research associate in physical chemistry at the same institution from 1914 to 1916.

R. B. Howland, until recently assistant general superintendent of the Mississippi River Power Company, Keokuk, Iowa, is now in Philadelphia in the service of the American International Corporation, which is organized to promote foreign trade. Mr. Howland was graduated from Drury College in 1906 and took the degree of B.S. in electrical engineering from Purdue University in 1910. After work on the Pacific Coast, he went to Keokuk, where he held successively the positions of construction foreman, system operator, substation superintendent and assistant general superintendent.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

John B. Pennington, who was connected with the municipal waterworks of Gloucester City, N. J., as chief engineer, has resigned.

William Insull, who recently was appointed district manager of the Kentucky Utilities Company at Elizabethtown, Ky., has been commissioned first lieutenant in the Signal Corps.

Thomas N. McCarter, president of the Public Service Corporation of New Jersey, Newark, N. J., has been elected chairman of the war board of the American Electric Railway Association.

P. H. Adams, heretofore field engineer for the Public Service Electric Company, Newark, N. J., has been transferred to the position of assistant engineer, engineering department.

W. H. Leighliter has been transferred from the post of operating engineer at the main power plant of the West Penn Power Company to be superintendent of the Butler power station. Mr. Leighliter formerly held a similar position at the Creighton power station.

John M. Rodger, who has been manager of the Cleveland office of the ELECTRICAL WORLD and *Electrical Merchandising*, has been made Western manager of these two papers with headquarters at Chicago, succeeding Sam A. Hobson, resigned. Mr. Rodger was formerly in the Chicago territory as assistant to Mr. Hobson and prior to that time was sales representative in the Central Western territory for the Duplex Metals Company and other electrical concerns.

John Hunter, chief engineer of power plants of the Union Electric Light & Power Company, St. Louis, Mo., has been commissioned to supervise the construction of a large number of freighters and transports at the Passaic River (N. J.) shipyards. Mr. Hunter has had considerable experience in the building of ships for transatlantic service. He was chief engineer of the liner St. Paul during the Spanish-American war. He went to St. Louis as chief engineer for the Union company in 1905.

E. M. Walker, who resigned as general manager of the Dubuque Electric Company early in September, has been appointed general manager of the Terre Haute division of the Terre Haute, Indianapolis & Eastern Traction Company. In this capacity Mr. Walker will have full charge of the electric lighting and power work in the city of Terre Haute and a number of surrounding suburban towns, the city street railway system in Terre Haute and the interurban division radiating from Terre Haute.

H. M. Byllesby, president of H. M. Byllesby & Company, Chicago, has been made a major in the aviation division of the Signal Corps of the United States Army.

Fred M. Rosseland has resigned as safety inspector for the Chicago Telephone Company to become safety engineer for the National Safety Council, Chicago.

T. K. Jackson, manager of the Mobile Electric Company, has been appointed a member of the State Central Committee, having in charge fuel distribution in the State of Alabama.

J. E. Fitzgerald, formerly of the purchasing department, has succeeded T. P. Kindig as assistant to the general commercial manager of the United Gas & Electric Engineering Corporation.

C. B. Borden has been appointed superintendent of the Westboro (Mass.) Gas & Electric Company to succeed H. F. Hemenway, who resigned to take a position at the Springfield Arsenal.

J. F. McGuire, manager of the Minot (N. D.) division of the Northern States Power Company, has been appointed on the committee in charge of the United States Signal Service Corps School, opened at Minot on Nov. 15.

Albert V. Miller of the Metropolitan Edison Company, Reading, Pa., has resigned to become superintendent at the plant of the Lebanon Steam Heating Company, Lebanon, succeeding George Krall, who resigned because of ill health.

R. B. MacDonald, formerly general manager of the Fort Dodge (Iowa) Gas & Electric Company, has been appointed general manager of the People's Power Company, which operates in Moline, Rock Island and other surrounding Illinois towns, succeeding the late Dugald Porter.

Charles W. Mullen, formerly a member of the Maine Public Utilities Commission, is now in control of the newly incorporated Great Eastern Paper Company of Bangor, Me., which holds the development rights of 27,000 hp. on the Madeline River watershed in the Province of Quebec, Canada.

F. A. C. Tocque, until recently commercial manager of the Fort Smith (Ark.) Electric Light, Power & Traction Company, has sailed for England, where he will enter the British army. Mr. Tocque, who is an Englishman, was formerly district salesman of the Louisville Gas & Electric Company.

T. P. Kindig, for the last four years assistant to the general commercial manager of the United Gas & Electric Engineering Corporation, has left the organization to enter the war, having obtained an appointment to the United States Army Aviation Corps. Mr. Kindig joined the organization some eight years ago as a salesman in Colorado Springs and was promoted to be commercial manager of the Leavenworth (Kan.) Light, Heat & Power Company, from where he was called to assist the general commercial manager at the New York office.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

TRADE ACCEPTANCES

MEET WITH MORE FAVOR

Electrical Jobbing Industry Taking Steps to Make Assets More Liquid Through Use of This Form of Credit Extension

A very definite movement is on foot throughout the country toward a general adoption of the trade acceptance. Ever since the Federal Reserve banking system was inaugurated early in the first Wilson administration the use of the trade acceptance form of extending credit in place of the customary open-account scheme has been urged by the Treasury Department through the principal reserve banks. While new in name only, trade acceptances have not been widely used. There seemed to be little desire to change over from the open-account system owing largely to a lack of understanding in the many trades of the trade acceptance plan, its use and value.

In this connection it is interesting to note the tendency of the electrical industry, particularly the supply jobbers, to make an extensive use of the new plan. On the Pacific Coast the use of trade acceptances by electrical jobbers is fast supplanting the open-account system. At the fall meeting of the Atlantic division of the Electrical Supply Jobbers' Association a resolution was adopted recommending that all members put trade acceptances into use with their customers, beginning the first of November. Already a majority have done something toward introducing trade acceptances, and more are planning to do so shortly.

The next step was taken at the meeting of the association at Cincinnati a couple of weeks ago, when the members voiced their approval of the use of trade acceptances.

Added impetus is being given to this movement by the Trade Acceptance Council, which was formed to further the use of acceptances through education and publicity. Local committees, acting under the guidance of the council, will be formed in all of the important trade centers.

As a war measure to strengthen the credit resources of the nation as well as the industry, the use of trade acceptances is being urged. It is now well recognized as a means of making liquid, as and when desired, the non-frozen assets represented by open accounts.

FIGURING DISCOUNTS

FROM DATE OF INVOICE

Backbone and Real Nerve on the Part of the Seller Are All That Are Required to Enforce This Policy

Some companies buying goods insist, after the purchase has been made, that they should be allowed to take their discount for payment within ten days after the goods are delivered, even though the seller's purchase terms specifically include the statement, "Discount ten days from date of invoice." When the check from the purchaser reaches the seller within ten days from the date of arrival of the goods, but on account on the delivery situation many days after the date of the invoice, minus the 2 per cent or whatever the discount may be, the seller must decide what he will do with the check. It has been noticed that large corporations, and especially those in the automobile trade, seem to be the worst offenders along this line. That such is the case, it has been brought out repeatedly by credit men, is not because the corporations determine that they shall pursue that policy, but because the man who handles that sort of work is usually so far behind that he actually cannot get

his work out in the specified discount time, and he likes to keep his own shortcomings covered up.

The only real solution for this trouble, as stated by a number of representative manufacturers and jobbers, is for the seller to display his courage and return the check, pointing out to the customer that purchase terms carry very definitely the understanding that discount will only be allowed if payment is made within ten days from the date of the invoice. The customer, of course, may consider this unfair because he does not care to pay for goods before he has seen that they are in accordance with specifications. Some purchasers, however, have met the situation by using a rubber stamp which says "Payment will be made within ten days subject to corrections upon receipt of goods." Some companies which have had trouble with purchasers taking time in this manner keep a card record of the regular offenders and treat them as such.

EXPEDITING ALL ORDERS

OF A "WAR" CHARACTER

Manufacturers Everywhere Give Priority to Work in Which the Government Is Interested—Method of Procedure

A few companies have formally notified the trade that if shipments of material are directly or indirectly entering into the manufacture of munitions and other necessary supplies for the war the orders will be expedited in every possible way. In these commitments it is specified that the destination and how the merchandise is to be employed must be stated. It appears, in this particular connection, that advantage is taken of current conditions by some buyers—none too scrupulous, reports say, when it comes to gaining an advantage for themselves, or maybe a customer in dire need of equipment or supplies which ordinarily would be "held up."

One of the representative distributors, in referring to this matter, said that while no notice had been given the trade, nevertheless all orders requesting priority of shipment on government claims were subject to the most careful scrutiny. The War Department, for example, in making an inquiry for prices or in placing an order, used a definite number on all of its transactions. Consequently, if a customer stated that the material or accessories purchased were to be part of or wholly devoted to the purpose of the government, the official number was requested and must be "proved up" before preference was accorded the shipment.

Other prominent concerns follow the same procedure, even if buyers have not been cautioned in advance. A certificate from the Priority Board is frequently insisted upon before the order obtains immediate attention and delivery is hastened. As an example, something was recently called for to be used at a nearby camp, the producer being in Trenton, N. J. When a jobber, acting as the buyer for a contractor, asked when delivery could be made he was told that the merchandise in question could not be had under ninety days. Thereupon the manufacturer was promptly informed that the material was for the aviation camp at Mineola, N. Y. This altered the situation entirely. The order was filled at once and shipped the same day, reaching its destination in record time. In addition to priority of execution, the best prices are quoted on every description of government orders, and such delays as occur in their completion and delivery are charged up to interferences caused by labor agitations along obstructive lines.

Shipments of war material going abroad, to the British government, for instance, must arrange for cargo space

through the Minister of Munitions. When the goods arranged for are ready for delivery to an "Atlantic port," a cable advises the English official to this effect, a priority order for quick transportation is forthcoming through the War Industries Board to the railroads, and the entire shipment, whatever it may be, is aboard the outgoing vessel without a hitch from the factory to the sea.

SCANDINAVIA A MARKET FOR ELECTRIC RANGES

High Cost of Domestic Fuels Leads Northern European Nations to Make Inquiries Concerning American-Made Products

Recently there have come to this country a number of inquiries from Scandinavian countries regarding electric ranges. The scarcity of domestic fuels of all kinds has led these nations to look seriously to electricity as the most economical means for cooking. Already the electric furnace for industrial processes has there made great strides, and there seems every reason to believe that the domestic range will be very popular, provided that a supply can be obtained.

Because of large hydroelectric developments energy for this load can be had at a small expense. Once cultivated, this market will undoubtedly prove to be of considerable size to the American manufacturers of electric ranges, but the electric range industry in the United States is in such a condition at the present time that it hardly seems possible that much can be done in this direction. The demand in the United States for electric ranges in the past few years has grown very rapidly, and manufacturers now find difficulty in keeping up with the domestic demands. Besides, the supply of raw materials is in a very unsatisfactory position. Sheets are hard to obtain because of the government's need for sheet and for rolling mills to make tin plate.

METAL MARKET SITUATION

The Government Announces Resale Price on Copper —Tin High and Scarce

Arrangements have finally been completed whereby the wholesaler is permitted to resell such copper as he may desire, in less than carload lots only, to the consumer at a charge of not over 5 per cent of his original purchase price. This concession has been made by the War Industries Board, through the usual trade channels. As to its exact meaning the usual difference of opinion exists. This action was taken in recognition of the inability of small manufacturers to order in carload lots or more, which is the necessary condition for shipments to producers. On the basis of the new regulation, therefore, the small manufacturer can obtain his requirements in such quantities as may be necessary quickly, but at a slightly higher price than that of the larger manufacturers.

Tin is not only high, but scarce. One jobber in the market last week for 10,000 lb. was unable to find a seller. Lead is lower and brass higher; otherwise no changes have occurred either in the new or secondary metal markets.

NEW YORK METAL MARKET PRICES

	Nov. 19			Nov. 26		
	l	s	d	l	s	d
Copper:						
London, standard spot.....	110	0	0	110	0	0
Prime Lake	Govt. price	23.50		Govt. price	23.50	
Electrolytic	Govt. price	23.50		Govt. price	23.50	
Casting	Govt. price	23.50		Govt. price	23.50	
Wire base	30.00	to	31.00*	28.00	to	30.00*
Lead, trust price		6.25			6.25	
Nickel ingot		50.00			50.00	
Sheet zinc, f.o.b. smelter....		19.00			19.00	
Spelter, spot	7.97½	to	8.05	7.87½	to	7.97½
Tin, Straits		75.00			80.00	
Aluminum, 98 to 99 per cent.	34.00	to	36.00	34.00	to	36.00

OLD METALS

Heavy copper and wire.....	22.50	to	23.00	22.50	to	23.00
Brass, heavy	14.50	to	16.00	14.50	to	16.50
Brass, light	10.50	to	11.50	10.50	to	11.50
Lead, heavy	5.25	to	5.75	5.50	to	5.87½
Zinc, old scrap	5.00	to	5.50	5.00	to	5.50

*Nominal.

THE WEEK IN TRADE

SALES of electrical merchandise, with a few exceptions in staples, represent, in all parts of the country, satisfactory totals. Some grave shortages in flashlight batteries, large-size motors, rubber-covered wire and conduit, with stocks heavily drawn upon, are reported in the Far West and elsewhere. Lamps continue in short supply pretty nearly everywhere, with indications of relief possibly after the first of the year. The bulk of trade, however, is in all household appliances, and this promises to increase, with stocks in fair condition. Price changes in nearly every line are not conspicuous.

With few exceptions collections are reported in a healthy state, with manufacturers and jobbers insisting on prompt settlements. Credits are held firm, and contractors of a speculative reputation are held to a strict accountability.

NEW YORK

Notwithstanding the drawbacks incident to the freight embargo in the New York territory, where it is making itself felt keenly on a number of electrical commodities, manufacturers, jobbers, distributors and dealers report satisfactory business. Of course, on seasonable goods this is more active than in the staple lines, wherein stocks are by no means so strong as could be wished. Deliveries continue uncertain and will in all probability remain so for weeks ahead. Prices and discounts vary slightly.

Collections are reported as very satisfactory, the trade in all its branches having evidently accepted the current high standard of liquidating indebtedness. Credits are firm, with the credit men holding a tight rein upon accommodations.

TURBINES, GENERATORS.—Up to the medium sizes turbines are on eight to twelve months' delivery. Prices are on the high level they have been for some time, with a bare possibility of a reduction, but no dating accompanies the prediction. Generators are likewise classified. The large-size deliveries are far distant—1920 and even later. Labor troubles at the factories have been adjusted and no further disturbances are anticipated.

HEATING APPLIANCES, UTENSILS, ETC.—Outside of heaters, of which jobbers and distributors do not always carry complete stocks, on account of the range of voltages and different demands, heating appliances, flatirons, toasters, grills, pads, etc., are in strong supply. Stocks of sewing machines are especially satisfactory, and orders are being filled on about an 80 per cent basis, which is reported as excellent, all things considered. As a jobber stated it, the manufacturers of all household and energy-consuming devices are sufficiently numerous to meet every reasonable demand by the trade, and therefore no uneasiness may be entertained in this territory on the score of shortage. Deliveries locally are hampered by truckage limitations. Shipments originating in the West are causing anxiety, and the seriousness of the situation is increasing rather than diminishing, with no relief in sight. In fact, deliveries are not expected to improve between now and the holidays. No price changes are looked for until the new year.

OUTLET BOXES.—Discounts on black boxes on orders under \$10 list were advanced from 20 per cent to 25 per cent, and on orders running from \$25 to \$50 list from 30 per cent to 42 per cent. On galvanized, below \$10 list, the discount was lowered from 25 to 20 per cent. The \$25 to \$50 list changed from 20 to 37 per cent.

PORCELAIN KNOBS, CLEATS.—Prices on porcelain knobs were advanced, with a marked shortage in the supply. This applies also to cleats, which have gone up, on the lowest range of prices that has been quoted, \$4 and \$5 per 1000.

ARMORED AND FLEXIBLE CONDUIT.—On account of the stagnation in building operations armored and flexible conduit is slow in moving. Stocks are strong; in fact, in most instances too strong.

SOCKETS.—There is no complaint of any curtailment of socket stocks as was intimated a few weeks ago. Jobbers' reports are to the effect that they are filling orders, perhaps not 100 per cent, but satisfactorily.

LAMPS.—On all sizes lamps are still reported as short. A leading middleman very frankly expressed the opinion that the supply from the factories was wholly inadequate.

COLLECTIONS AND CREDITS.—Collections remain in good shape, and dealers are meeting bills promptly. The tightening of credits has had a wholesome effect. This has been going on for some time, owing to abnormal conditions in selling and buying.

CHICAGO

With the contractors in the smaller cities in the territory business is spotty. Some have been resourceful enough to secure business out of the regular channels. They saw the decline in speculative building and took up factory work and farm lighting to fill in. The farm lighting is paying well where it is pushed because the high prices of farm produce have made the farmer spend freely. The factory work just now is largely reconstruction and rearrangement of equipment to permit handling government work. There is no doubt that the movement of goods is continuing more and more to incline toward consumption of a greater percentage for government work. The Christmas season is expected to reflect this situation in part.

CONDUIT.—Conditions in conduit delivery are getting worse in some quarters. Shipments in carload lots are especially hard to get. Smaller shipments, however, are being made from stock. Sizes of $\frac{3}{4}$ in. and larger appear to be giving the most trouble.

COPPER WIRE.—The prices on copper wire have not changed materially, although there has been some fluctuation up and down. Rubber-covered wire is still on a 34-cent to 35-cent base.

SOCKETS.—The report of shortage of sockets in the East has had no effect on Middle Western territory, and it is reported that there seems to be more likelihood of a shortage of socket orders than a shortage of sockets.

APPLIANCES.—A falling off in the purchase of percolators and toasters is noted by some electric-shop keepers. This is attributed to the fact that these devices are to some extent in the class of luxuries. Washing machines and vacuum cleaners, on the other hand, are reported to be going better than ever because of the fact that the labor-saving element enters more strongly into these devices.

INDUSTRIAL LIGHTING.—It is stated that prices of industrial lighting reflectors are hardly high enough to give a fair profit. These goods are moving well in spite of the fact that this time is somewhat between seasons.

CHRISTMAS TRADE.—The staple goods which constitute Christmas gifts are moving in good shape. Christmas-tree outfits have not commenced to move, but are expected to take on increased activity.

GLASSWARE.—Prices on all sorts of glassware, including glass insulators, seem to have an upward tendency, which has been somewhat accelerated by talk about the government commandeering the supply of natural gas in Ohio. Glassware is hard to get at present.

STORAGE BATTERIES.—It is understood that the decrease in the price of storage batteries about which rumors have been current in the trade in Chicago amounts to some $3\frac{1}{2}$ to 5 per cent. One large user of vehicle batteries recently picked up 30,000 plates at a remarkably low figure.

SECOND-HAND MACHINERY.—One big manufacturer has announced that, owing to present abnormal conditions, the factory stock of induction motors is negligible and detail sheets showing the stocks will be dropped until their replacement is warranted. Second-hand machinery concerns are on this account getting orders from dealers for motors in large lots, showing that the need of the larger sizes of motors is great and price a secondary consideration, especially if immediate delivery can be given. On the smaller sizes of motors carried by second-hand dealers—that is, motors between 1 hp. and 5 hp.—prices have been somewhat reduced.

BOSTON

Intense activity continues in the electrical trade, government work underlying the market and profoundly influencing deliveries. It is understood that some orders still are to be placed for equipment for the great destroyer plant at Squantum, Mass., and also for the Watertown Arsenal, where guns are to be rushed to completion for General Pershing's army. The Squantum plant has been one-third completed, after only seven weeks' work, and the electrical trade deserves no little credit for its co-operation toward this achievement.

Collections are fairly good, but some complaint is heard regarding the slowness of contractors in meeting obligations. Labor troubles are on the whole less threatening than a week ago. The Western Electric Company's strike at Boston remains unsettled, but conferences are in progress with a view toward reaching a basis of agreement before a sympathetic strike of New England telephone operators and workers is declared.

Service flag stars are multiplying, and not a few contractors and jobbers are feeling the effects of the call to arms. Special emphasis is being laid upon the vital importance of the shipbuilding program in New England at this time, and in the supply of both labor and material the electrical industry in this section is doing much toward meeting the calls upon it in this respect. It is rumored that an increase in the price of porcelain will take effect in the early future. Railroad conditions are very unsatisfactory and are almost certain to be much worse with the first heavy snowfall. The trunk lines are choked with traffic, and embargoes are frequent enough to introduce serious time lags in many cases between factory and consignee.

RETAIL BUSINESS.—Dealers report great activity in small electrical commodities, over-the-counter sales being on a very healthy basis.

FIXTURES.—The annual spurt in fixture sales is under way, but the volume of trade is hardly up to last year's record as yet. Price conditions do not appear to be affecting this business as much as the absence of new building on a comprehensive scale.

LAMPS.—Miniature lamps are scarce and are likely to be until next June, when the effect of improved factory facilities will be felt. On standard tungsten lamps the shortage is reported to be somewhat abated, and some deliveries from stock are being made in moderate quantities. Large orders are not at present acceptable if they require special lamps or early deliveries in bulk. The market is in a better condition as regards deliveries than a year ago, and prices remain unchanged.

WIRE AND CABLE.—The government was in the New England market for 50,000 ft. of armored cable a few days ago. Jobbers are overstocked on BX and circular loom, and there appears not to be much of a market for this class of material, even in munitions work, at present. It would seem that emergency requirements in the construction field would be well met by calling upon existing large stocks instead of waiting for conduit. Smaller sizes of wire are showing improved deliveries, and some observers of the market look for a further reduction in prices early in 1918.

WIRING MATERIAL.—The market is very active here, and an advance in porcelain is said to be in contemplation, though representative dealers have received no formal advices so far as can be learned. Some outside construction will result from plans now under way for the better protection of the Boston waterfront.

FLOODLIGHTS.—These are moving fairly well, and Boston Harbor protective measures will soon lead to sales hitherto held in abeyance.

LABOR CONDITIONS.—Demands on the industrial labor market are very far-reaching here. In the near future there will be 20,000 men at work in the Boston district on the shipbuilding program. Difficulties at the Fore River plant will probably be settled this week. Thirty-five destroyers, costing about \$1,500,000 each, are to be built in sixteen months at Squantum, and a large boiler plant for these craft is being erected near Providence, R. I. This work is of the first order of importance in the successful conduct of the war, and it naturally disturbs the labor supply in the electrical field. Readjustments are being made, however.

ATLANTA

Buying in almost all lines of the electrical field continues strong. Government buying makes for a very large volume of business. The stream of business in ordinary channels runs quite freely, considering that the government has preference in the matter of deliveries, but there is more or less uncertainty respecting the future trend of prices. Outlying districts that have been favored with good crops, zones in which cantonments have been established, shipbuilding centers and the Southeast in general continue to purchase in a way that suggests they are little affected by political or other factors that cause concern in the principal centers, and from these sections come reports of filling-in orders and fairly substantial buying for future delivery. Complaints regarding scarcity of labor, shortage of cars and paucity of materials are widespread.

LAMPS.—Estimates place sales in the South to date 40 per cent above last year, and the demand continues very strong. A great portion of this business is accredited to cantonments and shipbuilding plants, but, on the other hand, the call from industrial sources has also been very large. A number of textile mills are operating double shifts, and other industrial plants are running night and day. The government has practically standardized on the 25-watt and 40-watt sizes. The demand for carbon lamps shows a notable falling off, as industrial plants are also using more of the 40-watt type. This section is also developing into a good market for the "blue or daylight lamp," and a large number have been sold lately. There is a steadily growing demand for the 18-cp. automobile lamp. Shipments are coming in better now, and local stocks are in very good shape, considering the pressure, being 40 to 50 per cent of normal. A general lamp shortage is expected, owing to the abnormal demand and the inability of the manufacturers to cope with the situation. It is rumored that prices will be advanced about Jan. 1.

RECTIFIERS.—A strong demand exists, and comparatively good delivery is promised. Some substantial orders were placed this week.

CABINETS.—Reports from one manufacturer indicate a price advance of 5 per cent to take effect immediately.

STEEL PRODUCTS.—Information secured from an authentic source shows a slight shading in price, to the extent of 10 per cent, covering rigid conduit, stamped boxes and flexible armored cables, two-wire, No. 14, in the face of longer deliveries.

SEATTLE

Northwest dealers, in Seattle particularly, report business continuing good, with little or no changes over last week. Demands along several lines are still increasing, especially household appliances. Early holiday buying brings reports of satisfactory increases in trade, both wholesale and retail. Government buying for cantonment and navy yard work continues brisk. New cantonment contracts, in both Washington and Oregon, are swelling the volume of business and benefiting local dealers materially. Tacoma electrical dealers report very brisk business during the past month in sales to shipyards, industrial plants and for new buildings. Sales to shipyards and mills of electrical equipment in the Seattle territory are very satisfactory, although there has been no noticeable increase. No change in prices along any line the past week is noted.

The shortage of lamps still prevails and is becoming worse daily. There is also an extreme shortage in flashlight batteries, which is very unfortunate, as the demand is heavy. The shortage of motors of large-size, rubber-covered wire and conduit has not been lessened. The demand for wire and conduit is increasing. The demand for motors is light as compared with several months past. Shipments on the above-named goods are exceptionally hard to get.

Reports from various parts of the Northwest indicate an extreme shortage of labor in all lines of industry, the shortage being particularly exaggerated in the lumber mills and logging camps. A shortage of poles and cross-arms and of men to cut, prepare and handle them is causing inconvenience.

The transportation situation is becoming the subject of growing uneasiness and agitation. The number of unfilled requisitions for freight cars, after heavy declines between May 1 and Sept. 1, shows a large increase in spite of the vast augmentation of traffic. Local manufacturers believe the time may be almost here when it will be necessary to distinguish in railway transportation between things that are essential and those that are not essential. The expiration of government licenses for exporting merchandise has caused such a congestion of cars on Puget Sound that the railroads will be compelled to issue a general embargo unless relief can be had from some other direction.

Hopes of an immediate ending of the telephone strike in the Northwest vanished Nov. 25 when the Seattle strikers voted practically unanimously to reject the offer of settlement submitted by the federal mediation commission.

Projectors are moving well, although spasmodically. The new shipbuilding plants and industrial enterprises are making installations. The demand for projectors for advertising purposes shows a decrease, and stocks are ample. The demand for meters from Seattle and contiguous territory continues light. Tacoma reports a slight increase, deliveries are comparatively prompt and stocks are well filled. Fixtures are moving slowly, except in Tacoma, where there is considerable apartment house and residence building.

SAN FRANCISCO

A canvass of the electrical jobbers in the San Francisco territory fails to develop any complaints of delivery delays caused by the freight car shortage, and shows few in which the arrival was delayed by the generally congested freight situation or the priority of other freight. Prices have not fluctuated recently, and here and there is found a frank expression of the belief that prices have reached the top. This is not an altogether desirable condition, particularly as the prospects for the holiday trade are not now so bright as formerly. Retail stores are reporting a notable trend toward conservation and buying that is limited to necessities. Retailers are consequently not stocking far ahead.

Construction work on industrial plants engaged on government war orders continues to be prominent. The absence of building activity in the larger cities is now offset somewhat by the building in the country towns.

CREDITS AND COLLECTIONS.—Collections are a little harder than last month, as is usual in November, and credits are beginning to tighten. The prediction is that there will be a careful scrutiny of credits this winter. However, there have been no failures, and contractors and dealers particularly are paying up satisfactorily.

STORAGE BATTERIES AND FLASHLIGHTS.—This Christmas a holiday trade in flashlights easily 100 per cent above last year is expected. This is largely on account of supplies for the soldiers. Orders are coming from various cantonment supply centers in proportion to the number of men quartered there. The storage-battery demand is likewise very heavy. One San Francisco house has 800 battery orders pending the arrival of four carloads en route.

WEATHERPROOF AND RUBBER-COVERED WIRE.—The weatherproof wire situation is still uncertain. The price is lowering. Deliveries are slower, if anything. Stocks are very low. Rubber-covered wire stocks are in bad shape and deliveries are slow. Prices remain firm.

CONDUIT.—Conduit prices remain unchanged. Deliveries are slow and uncertain and stocks have been drawn down extremely low. This refers to galvanized conduit, which, on account of its resistance to salt-air conditions, is used almost to the exclusion of black conduit on this coast.

MOTORS.—Deliveries have improved slightly and one manufacturer has added sizes between 10 hp. and 15 hp. to the Coast stock, so that in these sizes immediate delivery is quoted. From 15 hp. upward deliveries vary from three or four weeks on orders which carry first priority certificates to five or six months on orders without certificates.

LAMPS.—Small retailers are now getting lamps for stocks of a week or ten days ahead. Hotels accustomed to buying a supply of 300 to 400 to keep on hand are now allowed about 100 at a time.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor

No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single Conductor

Less than coil.....	No. 14 Solid List to +10%
Coil to 1000 ft.....	10% to \$59.17
Less than coil.....	No. 12 Solid List to +10%
Coil to 1000 ft.....	10% to \$59.17

Twin-Conductor

Less than coil.....	No. 14 Solid List net to \$105.00
Coil to 1000 ft.....	\$70.00 to 10%
Less than coil.....	No. 12 Solid List net to \$135.00
Coil to 1000 ft.....	—10% to \$130.95

DISCOUNT—CHICAGO

Single-Conductor

Less than coil.....	No. 14 Solid List to +10%
Coil to 1000 ft.....	List to —10%
Less than coil.....	No. 12 Solid List to +10%
Coil to 1000 ft.....	—10%

Twin-Conductor

Less than coil.....	No. 14 Solid List to +10%
Coil to 1000 ft.....	List to —10%
Less than coil.....	No. 12 Solid List to +10%
Coil to 1000 ft.....	—10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10% to list net
1/5 to std. pkg.....	15% to 20%
Std. pkg.....	28% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+20% to 12%
1/5 to std. pkg.....	List to 20%
Std. pkg.....	30% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31 to .3175	.32 to .3275
Barrel lots.....	.28 to .2875	.29 to .2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, Per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp. \$75.00	\$63.75 to \$69.75
3/8-in. d. stp. 75.00 to 82.50	68.25 to 75.50
1/2-in. s. stp. 100.00	85.00 to 93.00
1/2-in. d. stp. 100.00 to 110.50	91.00 to 100.00

NET PER 1000 FT.—CHICAGO

Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip.... \$75.00	\$63.75
3/8-in. double strip.... 78.75	71.25-71.75
1/2-in. single strip.... 100.00	85.00
1/2-in. double strip.... 105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
5/8.....	.15	2.....	.55
3/4.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.— \$25.00-\$55.00	\$20.50-\$24.75	\$20.00-\$22.00
1/4-in.— \$28.00-\$60.00	\$22.50-\$27.00	\$22.00-\$24.00

NET PRICE 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.— \$36.67-\$55.00	\$27.50	\$24.75
1/4-in.— \$10.00-\$60.00	\$30.00	\$27.00

CONDUIT, COUPLINGS AND ELBOWS RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4.....	\$0.03 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List Elbows, List

1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.60
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

Less than 2500 lb..	1/4 in. to 1/2 in. 4% to 6%	3/4 in. to 3 in. 7% to 9%
2500 to 5000 lb..	6% to 9%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

Less than 2500 lb..	1/4 in. to 1/2 in. 3.7%	3/4 in. to 3 in. 6.7%
2500-5000 lb..	5.7%	8.7%

(For galvanized deduct six points from above discounts.)

FLAT IRONS

NEW YORK

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

CHICAGO

List.....	\$5.00 to \$6.00
Discount.....	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50

600-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.00 to \$5.75
1/5 to std. pkg.	4.50
Standard package, 500. List. each.	\$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500. List. each.	\$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg	List, Each
Regular, clear:		
10 to 40-watt-B	100	\$0.27
60-watt-B	100	.36
100-watt-B	24	.65
75-watt-C	50	.65
100-watt-C	24	1.00
200-watt-C	24	2.00
300-watt-C	24	3.00
Round bulbs, 3 1/2 in., frosted:		
15-watt-G 25	50	.50
25-watt-G 25	50	.50
40-watt-G 25	50	.50
Round bulbs, 3 1/2 in., frosted:		
60-watt-G 30	24	.72
Round bulbs, 4 1/2 in., frosted:		
100-watt-G 35	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 13

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$30.00 to \$33.98
Coil to 1000 ft.	25.50 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$36.56
Coil to 1000 ft.	27.42

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	\$20.00 to \$29.00
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CHICAGO

Net per 100	\$19.25 to \$25.75
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OUTLET BOXES

No.	List, per 100
101—A, A 1 1/2, 4 S.C., 6200, 320	\$30.00
102—B.A., 6200 S.E., 300, A.X., 1 1/2, 4 S	30.00
103—C.A., 9, 4R, B 1 1/2	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list.	25% to 37%	20% to 32%
\$10.00 to \$50.00 list.	42% to 45%	37% to 40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list.	40%	35%
\$10.00 to \$50.00 list.	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80 to \$38.00
1/5 to std. pkg.	14.80 to 19.00
Standard package, 2200. List per 1000.	\$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80 to \$20.54
1/5 to std. pkg.	14.80 to 19.24
Standard package, 2200. List per 1000.	\$20.

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net	Std. Pkg.	3500 Std. Pkg.	4000 5 1/2 N.C.—Solid Nail-it—N.C.
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Less than 1/5 std. pkg.	\$27.50 to \$29.00	\$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

Per 1000 Net Std. Pkg. 3500 Std. Pkg. 4000		
5 1/2 N.C.—Solid Nail-it—N.C.		
Less than 1/5 std. pkg.	\$11.85	\$30.75
1/5 to std. pkg.	11.10 to 11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg	List
1/2-in. cap key and push sockets	500	\$0.33
1/2-in. cap keyless socket	500	.30
1/2-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List to net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List to net
1/5 to std. pkg.	List to —15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	\$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00

Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than \$10 list.	List net to +5%
\$10 to \$25 list.	11%
\$25 to \$50 list.	14% to 15%
	Low Grade
Less than \$10 list.	5% to 10%
\$10 to \$25 list.	16%
\$25 to \$50 list.	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than \$10 list.	List to +5%
\$10 to \$25 list.	List to —11%
\$25 to \$50 list.	List to —14%
	Low Grade
Less than \$10 list.	List to —5%
\$10 to \$25 list.	List to —16%
\$25 to \$50 list.	List to —24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp. 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to —15%
Std. pkg.	List to —30%

SWITCH BOXES, SECTIONAL CONDUIT

	Union and Similar—	List Each
No. 155		\$0.34
No. 160		.66

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list.	List	List to +10%
\$2.00 to \$10.00 list.	10% to 20%	5% to 10%
\$10.00 to \$50.00 list.	20% to 30%	15% to 20%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list.	25% to 50%	20% to 40%
\$2.00 to \$10.00 list.	25% to 50%	20% to 40%
\$10.00 to \$50.00 list.	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	\$5.00 to \$7.50
Discount	25% to 30%

CHICAGO

List price	\$5.00 to \$6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools.	\$0.44 1/4 to \$0.63
No. 18, full spools.	0.43 1/4 to 0.51

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	\$0.57 1/4 to \$0.61
No. 18, full spools.	0.50 1/2 to 0.51

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No.	500 Ft.	1000 Ft.	5000 Ft.
11	\$15.00-\$18.00	\$13.00-\$14.00	\$11.25-\$12.00
12	23.25-27.09	21.30-23.22	19.35-20.81
10	32.40-37.80	29.70-32.40	27.00-29.25
8	45.70-53.34	41.90-45.73	38.00-41.38
6	72.40-84.42	66.35-72.35	60.30-65.50

CHICAGO

	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No.	500 Ft.	1000 Ft.	5000 Ft.
14	\$18.00	\$13.50	\$12.00
12	27.36-27.37	23.41-27.37	21.83-23.46
10	38.15-38.25	32.40-32.72	29.97-30.60
8	53.83-54.27	46.14-46.43	42.29-43.42
6	72.40-84.42	66.35-72.40	60.30-65.50

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 1 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$35.25 to \$40.00
25 to 50 lb.	35.25 to 39.00
50 to 100 lb.	34.25 to 38.00

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	\$40.00 to \$40.50
25 to 50 lb.	39.00 to 39.50
50 to 100 lb.	38.00 to 38.50

NEW APPARATUS AND APPLIANCES

*A Record of Latest Developments and Improvements in Manufacturers' Products
Used in the Electrical Field*

Electrical Precipitation of Fine Particles

The Cottrell process, which, as is generally known, is an electrostatic method of precipitating the fine dust carried by gases, is being successfully used for smoke prevention, for sup-

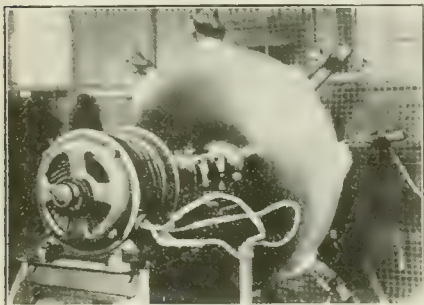


FIG. 1—TYPE OF GENERATOR USED

pressing the dust from cement mills, blast furnaces, converters and ore roasters, and for many similar purposes. Not only does it save the neighborhood of the plant in which it is used from the soot and dust nuisance, but it generally more than pays for its cost by the valuable materials that it reclaims.

In operation the gases are passed through tubes or pipes, in the centers of which fine wires or chains are suspended. Between each tube and its central conductor a high static difference of potential is maintained by means of a unidirectional current of from 40,000 volts to 100,000 volts. Solid or liquid particles in the gases passing through these tubes receive a static charge of the same polarity as the central conductor, because the surface of the central conductor is much smaller than that of the tube and far greater ionization occurs at this point. The particles, therefore, are projected against the inner surface of the tube and are dislodged into hoppers below by jarring the tubes.

The high-voltage current for charging the treaters is derived from alternating current and is then rectified into unidirectional current by means of mechanical rectifiers or commutators. As the voltage at which the best results are obtained varies with the velocity, temperature and consistency of the gases and with the barometric pressure, arrangements must be made to vary this voltage by changing the low-voltage taps on the transformers for the coarse steps and by varying the voltage of the incoming alternating current for the intermediate steps. The alternating current may be supplied from a power line or separately.

Standard apparatus has been developed by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., and is shown in the accompanying illustrations.

The unit generators are usually driven by motors so that motor-generator sets are generally supplied. The current generated is 60-cycle, single-phase and can be adjusted from 110 volts to 250 volts by means of a field rheostat. Standard capacities are 15, 25, 40 and 75 kva.

From the generators the current passes to the transformers. These are made in standard sizes of 15, 25, 40 and 75 kva. for 60 cycles and 10 kva. and 20 kva. for 25 cycles. Standard high-tension voltages are 40,000, 60,000 and 100,000. Each transformer has five



FIG. 2—15-KVA. TRANSFORMER 8 FT. HIGH

standard low-voltage taps, giving 50, 62½, 75, 87½ and 100 per cent of full voltage respectively. Full rated capacity is obtainable on each tap. Careful protection against static surges has to be provided. Each of these transformers has a small oil-immersed choke coil mounted within the case between the end turns and the high-voltage windings, and transformers for over 50,000 volts have in addition choke coils mounted outside the case on each of the high-tension terminals. Condenser-type terminals are also used on transformers for 50,000 volts and over.

Red, White and Blue Lamp

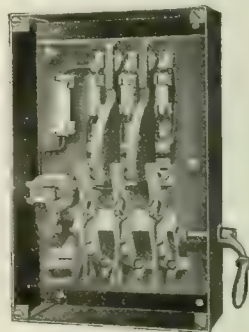
A Christmas-tree lamp which is tinted in the national colors is being manufactured by the Vacu-Rite Lamp Company, 361 West Superior Street, Chicago. The highest quality tungsten, the maker states, is used in its construction. The lamps have a 14-volt rating, eight of them being wired in series for use on 110-volt circuits.

Inclosed Starting Switch for Squirrel-Cage Motors

Inclosed starting switches that provide motors with protection against overload and against unexpected restarting after there has been an interruption in the circuit or failure of voltage have been developed by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis. They also insure safety to the operator under all conditions, because, as the manufacturer points out, he cannot touch a live part while operating the switch or when inspecting or renewing fuses. The sliding panel, which incloses the contacts and fuses, interlocks with the mechanism so that the switch cannot be closed, and the fuses are always dead when the sliding panel assumes the lowered position.

The fuses are not in circuit when starting, but are automatically included in the motor circuit when the starting handle reaches the running position. The fuses can, therefore, be of sufficiently low capacity to give proper protection to the motor windings. Failure of voltage causes the switch to open. Unexpected restarting, with the resultant possibility of injury to operator or machine driven, does not occur because the starting lever must be manipulated in order to put the motor into operation again.

The interior parts consist of three moving-contact fingers, which when the starting lever is moved to the extreme upward position make contact with three stationary contacts, connecting the motor directly to the line. After the motor is up to speed the hand is removed from the handle and the con-



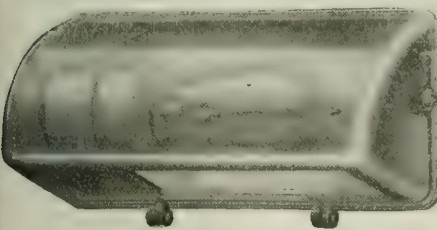
STARTING SWITCH WITH INCLOSED PANEL
LOWERED

tact fingers slide into engagement with the running contacts, the change being made without opening the motor circuit.

The rated capacity of this standard switch is 3-hp., 110 volts, or 5-hp., 220 volts.

Aisle Lighting Fixtures for Theaters

A special lighting fixture for illuminating theater aisles is one of the latest developments of the Brookins Company, Euclid Avenue and East Eighteenth Street, Cleveland, Ohio. A strong metal case is provided, which can be finished



as desired. The interior of the case is finished in pure white for purposes of efficient reflection. A porcelain receptacle is used to carry the 10-watt tungsten lamp. The window is of double-strength ground glass, making the fixture dust-proof. With these fixtures installed in a motion-picture house all other lights may be extinguished.

Electric Refrigerating Machine

The "Williams" electric refrigerating equipment is designed primarily for household service and may be readily attached to any of the standard types of refrigerator. Provision is made for the production of a small amount of ice for the table and other uses. The cost per unit of refrigeration, the manufacturer points out, is considerably less than for an equivalent of ice. The machines, which are being made by the Electrical Refrigerating Company, Woolworth Building, New York City, are supplied in the following sizes: ¼ hp., ½ hp. and 1 hp. These sizes produce refrigerating effects equivalent to 150, 300 and 600 lb. (68.0, 136.1 and 272.2 kg.) of ice per day, respectively.

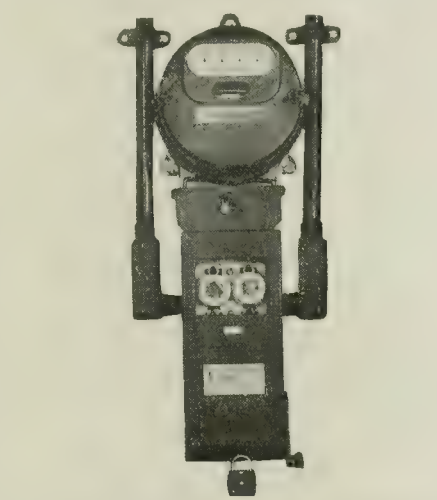
Magnetic Trouble Lamp

An electric lamp which operates from a 6-volt battery and embodies an electromagnet in the base, controlled by a switch which permits the lamp to be fastened to any iron or steel member of an automobile or support around a garage, is made by William J. Koenig of Brooklyn, N. Y. The device consists of a lamp socket with bulb incased in a nickel-plated holder and reflector and an electromagnet, incased in a steel shell, energized by the battery through the same connecting cable that feeds the bulb. A switch connected to the magnet permits the use or non-use of the magnet as desired. The lamp is operated in the same way as every other trouble lamp. A plug is provided at one end of 10 ft. (3 m.) of connecting cable so that a connection can be made in the dashboard of an automobile or any lamp socket of an automobile, motorcycle or motorboat. When

used about a car, the lamp can be fastened to any convenient metal part and furnishes a steady light shielded by the reflector so as to throw the light where it is desired.

Fuse Protector and Service Switch

Externally operated switches are now being made by the Wadsworth Electric Manufacturing Company of Covington, Ky., that embody unique construction features. The inclosing box is made in parts which interlace in such a manner that when the cover is placed in position these parts are firmly locked without the aid of rivets or screws. The bottom and sides are formed in one continuous piece, while both ends, fuse holder, lid and meter adapter are detachable. This construction, the maker points out, permits the meter adapter to be placed either at the top or the bottom of the switch and so arranged that these adapters can be applied to any standard meter. This, it is claimed,



is an advantage in this particular construction which makes for convenience of installation. To illustrate this, the maker cites the installation of three meters banked. In this case the bodies of the switch box are placed in position with conduit connections made from box to box, after which wiring is installed with uninterrupted access to wire gutter and terminal screws. Then the fuse holder is set in position at the top end of the box and the ends, meter adapter and lid are placed in position. The switch employed is a standard single-knife design, operated from a handle on the outside. The handle is connected to a crank shaft with bearings on both sides of the box and connected to the switch by a cam on the bar. The lid is provided with a sliding shutter with brackets extending down to engage the switch-closing means in such a manner that closing the switch closes the fuse opening completely before contact is made by the switch to close the circuit. By this arrangement the fuses are accessible at all times and cannot be put in a position to expose a live connection.

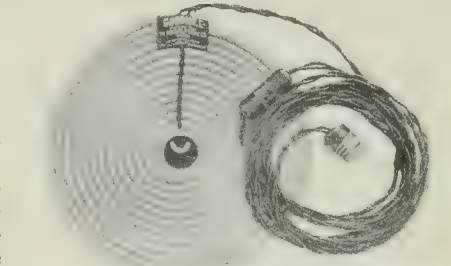
Sharpening Machine

The Henderson Machine Company of Cincinnati, Ohio, has developed the "Youngs" automatic razor-blade-sharpening machine, which is motor-operated. Dull blades of any make are put into the machine at one side by hand, the only manual operation, all others being automatic and dependent on a fractional-horsepower motor manufactured by the General Electric Company. The blades are conveyed across the machine during the honing and finishing processes, so that they receive the diagonal or barber's stroke at the rate of 60 to 120 edges per hour. Oilless bearings are used, and the drive is noiseless with self-adjusting friction drive. By means of a conveyor the need for an attendant is eliminated. The device is suitable for a window display.

Electric Heating Pad

The Goodwill Electric Company, 59 East Van Buren Street, Chicago, is offering an electric heating pad to the trade. This pad was originally designed for hospital service. The new pad for general use is a slight modification of one the company developed for the hospital field, though the principle of its construction is the same. The thermostat is mounted in the center of the pad and is contained in a sealed box 1.125 in. (3.2 cm.) in diameter and 0.25 in. (0.6 cm.) deep. It is composed of two U-shaped arms of half-hard brass and tempered steel, both of which are wound with a continuation of the German silver wire which forms the main heating element. Hence it is not dependent for its temperature on radiation, but heats up with the pad, both being always at the same temperature. The thermostat is adjusted through a slot in its container and has a range covering all points between 100 deg. Fahr. and 180 deg. Fahr. (37.8 deg. C. and 82.2 deg. C.).

Being designed to withstand hospital service, the pad is durable, but at the same time unusually light and flexible. Tendency to short-circuit is overcome by the helical construction, and the manufacturers claim that the current may be turned on when the pad is wet



without damage. It is made of two sizes, 10 in. (25.4 cm.) and 6 in. (15.24 cm.) in diameter. Both are equipped with cloth and rubber covers and 12 ft. (3.65 m.) of attachment cord with a separable connector near the pad to relieve possible strain.

Trade Notes

THE SPRAGUE ELECTRIC WORKS. Bloomfield, N. J., are planning for the construction of a large addition to their plant.

THE WESTON ELECTRICAL INSTRUMENT COMPANY. Newark, N. J., has increased its capital stock, by the issue of 5000 new shares of common stock, to \$1,500,000.

THE MULTI REFILLABLE FUSE COMPANY. Chicago, has removed its office and salesrooms to 803 West Madison Street, where larger and more convenient quarters are secured.

THE STANDARD ELECTRIC TIME COMPANY. Springfield, Mass., will build a new three-story addition to its plant, about 35 ft. by 105 ft., to cost \$25,000. The contract for erection has been awarded.

WILLIAM S. BOYD, formerly assistant in the purchasing department of the Crucible Steel Company of America, Pittsburgh, Pa., is now purchasing agent of the Page Steel & Wire Company, Monessen, Pa.

THE AUSTIN COMPANY. Cleveland, Ohio, in order to centralize its business in the East, has removed the office at Bridgeport, Conn., to 217 Broadway, New York City. L. D. Stauffer will be in charge of sales, H. G. Phillips of engineering, and K. A. Pritchard of construction.

THE DEPARTMENT OF COMMERCE. Washington, D. C., has published "Customs Tariff of Chile" as No. 36 of the Tariff Series, compiled by L. Domeratzky. The chief difference between the new law and that of 1897, previously in force, is one of form, and the change is largely from the ad valorem to the specific system.

THE BLAKE ELECTRIC MANUFACTURING COMPANY. Boston, Mass., has enlarged its plant, following a reorganization of its business. A special department for winding and repairing alternating-current motors has been established apart from the direct-current service department, and the company's electrical construction department now occupies an entire floor at 1 Rowe's Wharf, Boston.

THE EDISON STORAGE BATTERY COMPANY'S New England sales office, of which George W. Holden is district manager, will shortly be moved from 236 State Street to 702 Beacon Street, Boston. The company will establish a service station about 100 ft. long by 35 ft. wide at its new location, including quarters for its sales staff. The company expects to be at its new address in about a week.

THE CONNECTICUT BRASS & MANUFACTURING CORPORATION. Waterbury, Conn., has been organized to acquire and consolidate the business of the Connecticut Brass Corporation of West Cheshire and the Pilling Brass Company, Waterbury. It will be the largest concern of its kind in the country. The production of the constituent companies in twelve months has increased 1000 per cent. The prospectus of the new corporation has just been distributed.

THE PHILADELPHIA STORAGE BATTERY COMPANY. Philadelphia, has opened a branch office and depot at 37 Spear Street, San Francisco, Cal. The company's first Pacific Coast branch was opened in Los Angeles a year ago. Arthur Affeld will have charge of the Los Angeles office and A. P. Clark will operate the San Francisco office. C. L. McWhorter, manager of the Pacific Coast division, will make his headquarters at the San Francisco office.

WILLIAM CRAMP & SONS SHIP & ENGINE COMPANY. Philadelphia, has purchased for \$1,500,000 the property of the De La Vergne Machine Company, covering five and one-half acres in New York City. The plant is to construct marine steam engines and other work now being executed by the Cramp company for the United States government. No change will be made in the De La Vergne organization with the exception of a new board of directors.

CONDENSITE PATENT RECOGNITION.—Pending litigation between the Condensite Company of America and the General Bakelite Company has been terminated, and as a result of the settlement the General Bakelite Company agrees to recognize the validity of the Condensite (Aylsworth) patents, No. 1,065,495, dated June 24, 1913, and No. 1,137,374, dated April 27, 1915, and to pay substantial royalties thereunder. This recognition of the force and validity of the Condensite company's varnish patents by the General Bakelite Company is a confirmation of the Condensite company's claims for the broad scope and pioneer character of these patents. The Condensite company is advised that any phenolic condensation

varnish, enamel, lacquer or cement making use of a double solvent falling within either description given below will be an infringement of one or other of the said patents, and the company intends to prosecute vigorously any and all infringements thereof. Users of phenolic varnishes, enamels, lacquers and cements are particularly cautioned not to deal in or make use of infringing products. These products are largely used in the electrical industry. The patents cover broadly varnishes, lacquers, enamels and cements in which a phenolic condensation product (such as condensite or bakelite) is combined with a double solvent of either of the following types: First, a readily volatile organic liquid and another organic liquid immiscible with and of a higher boiling point than water; second, a liquid oxygen compound of the aliphatic series and a compound of the benzene series soluble therein or a cyclic hydrocarbon.

New Incorporations

THE ROARING SPRING (PA.) LIGHT, HEAT & POWER COMPANY has been incorporated by I. E. Garver, A. L. Garver and E. G. Robb of Roaring Spring. The company is capitalized at \$50,000.

THE UNIVERSAL SIGNAL COMPANY of St. Louis, Mo., has been incorporated by George A. Czubulka, A. C. Wirth and others to manufacture automobile signals. The company is capitalized at \$27,000.

THE ECONOMY ELECTRIC COMPANY of Norfolk, Va., has been incorporated by Charles A. and E. R. Page of Norfolk and others. The company is capitalized at \$50,000 and proposes to manufacture electrical supplies.

THE MONTGOMERY TRANSIT & LIGHT COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$1,000,000. The incorporators are: J. J. Jolls, M. L. Harty and K. E. Langfield of Wilmington, Del.

THE BEAVER RIVER POWER & LIGHT COMPANY of Wilmington, Del., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$400,000, to generate and distribute electricity for lamps and motors.

L. ADLER & COMPANY of New Brunswick, N. J., have been incorporated by Louis P. Ruck, Robert Rosen of New Brunswick; Louis Adler and Annie Adler of Bound Brook, N. J. The company is capitalized at \$25,000 and proposes to manufacture electrical fixtures.

THE NEWTON (IND.) ELECTRIC LIGHT COMPANY has been incorporated with a capital stock of \$10,000, to install and operate an electric light and power plant in Newton. The incorporators are: James R. Campbell, Thomas Schultz and George F. Chamberlain.

THE KANT-MIS SPARK PLUG COMPANY of Green Bay, Wis., has been chartered with a capital stock of \$10,000 to manufacture spark plugs and other gas-engine and automobile devices and accessories. The incorporators are: William C. Haslem, Beal E. Calburn and J. Gilleaume.

THE RAILWAY & POWER ENGINEERING CORPORATION of Toronto, Ont., has been chartered by Theodore Malm, 55 Kingswood Road; Gerard Ruel, 127 Isabella Street; Frederick C. Allen and others. The company is capitalized at \$50,000 and proposes to manufacture machinery, tools, etc.

THE ALPHA ELECTRIC & MANUFACTURING COMPANY of Warsaw, Ind., has been incorporated by Walter H. Stanley, Angus C. McDonald, George W. Polk, John William Scott and Bertram Shane. The company is capitalized at \$50,000 and proposes to manufacture electrical and mechanical devices.

THE SNOWFLAKE & TAYLOR MILL COMPANY of Snowflake, Ariz., has been incorporated by A. Z. Palmer and J. J. Shumway of Taylor; Walter H. Denham of Shumway; John A. Freeman, Samuel F. Smith, Joseph W. Smith and W. H. Shumway of Snowflake. The company is capitalized at \$50,000 and proposes to supply electricity in Snowflake, Taylor Mill and vicinity.

THE RURAL SERVICE COMPANY of Philadelphia, Pa., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$500,000 to install and operate heating and lighting systems in many of the smaller towns in Delaware and Maryland. The incorporators are: Francis S. Brown of Philadelphia, Pa.; William G. Taylor, Townsend W. Miller, Robert Penington of Wilmington, Del., and Joseph P. Bryan of Dover, Del.

Trade Publications

RANGES.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has prepared its catalog 8-D, descriptive of its automatic electric ranges.

FLASHERS.—The Reynolds Electric Company of Chicago is sending out a mailer entitled "How to Save Coal." This mailer describes the sign flasher made by this company.

CONNECTORS.—The Diamond Expansion Bolt Company of New York City has prepared a leaflet descriptive of its Diamond-strand connectors used with specially heavy three-bolt guy clamps.

FILM SERVICE.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has prepared a booklet descriptive of its motion-picture, lantern-slide and lecture-bureau service.

INDUSTRIAL PRODUCTS.—The Nuttall Company of Pittsburgh, Pa., has prepared an illustrated bulletin descriptive of its industrial products. This book includes information on gears, expansion joints, flexible couplings and trolleys.

ELECTRICAL HOLIDAY SUGGESTIONS.—Julius Andrae & Sons Company of Milwaukee, Wis., has issued bulletin No. 90, in which are listed many electrical holiday suggestions for Christmas, 1917. A dealers' price list is also included.

PUMPS AND RECEIVERS.—The Worthington Pump & Machinery Corporation, 115 Broadway, New York City, has prepared a bulletin descriptive of its Deane automatic pumps and receivers, steam, electric, single, duplex and triplex types.

ENGINEERING DATA BOOK.—Ophüls-Hill & McCreery, Inc., 112 West Forty-second Street, New York City, has issued a data book for securing all data pertaining to plants and the operating conditions to make estimates on contemplated improvements.

WINDING MACHINES.—Ampudia & Cahill, Candler Building, New York City, have prepared an illustrated leaflet descriptive of a cable-winding machine. This machine does the winding on the ends of cables in the form required by both United States standards and foreign standards for aeroplane work.

LAMPS.—"How to Sell Mazda C-2 Lamps" is the title of a bulletin prepared by the National Lamp Works of General Electric Company of Cleveland, Ohio. The purpose of this book is to present clearly and concisely the important facts necessary to the successful merchandising of Mazda C-2 lamps, with examples of their application, supplying conclusive evidence of the reliability of claims for them.

TOOLS.—The Borden Company of Warren, Ohio, has just issued its 1918 catalog of "Beaver" die stocks and square-end pipe cutters. This catalog is said to be the finest tool catalog ever issued, and its attractive appearance indicates that no expense has been spared in securing the services of the best artists and printers. Several new "Beaver" tools are shown for the first time in this catalog—one of the most popular of these being the No. 3 "Beaver" junior ratchet die stock, which is built on the unit plan to thread pipe from 1½ in. to 1 in., inclusive.

OUTDOOR CABLE TERMINALS.—A revised bulletin on type D. O. A. outdoor cable terminals has just been issued by the Standard Underground Cable Company of Pittsburgh, Pa., in which several new types of terminals are described and listed. Among these are the protected disconnection terminal, pipe-top terminal and bore-hole terminal. The bulletin gives tables of working voltages and sizes of conductors for which terminals of certain dimensions and weights are required; also instructions for ordering, installing, etc. A copy will be sent on request.

MOTOR TRUCKS OF AMERICA.—Announcement is made that the 1918 edition of "Motor Trucks of America," of which S. V. Norton, manager of truck tire sales of the B. F. Goodrich Rubber Company, is the author, will be ready for distribution on Jan. 1. The book, consisting of 200 pages of reading matter, illustrations and specifications, is the sixth to be issued in as many years. It is hand-sewn and of heavy binding. Complete specifications of nearly 150 of the leading gas-driven and electrically driven motor trucks are contained in the volume. These details are absolutely dependable as the approval of each truck manufacturer is obtained before specifications of his model are inserted.

New England States

BURLINGTON, VT.—The Winooski Valley Power Company has petitioned the Public Service Commission for permission to increase its bonded indebtedness to more than a million dollars, the proceeds to be used for further extensions. The present capacity of the plant at Essex Junction is 10,000 hp., which is leased to the Burlington Light & Power Company.

NEWPORT, R. I.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 10, for construction of a garage, including plumbing, lighting and heating systems at the naval training station at Newport, R. I. Drawings and specifications (No. 2688) may be obtained upon application to the above bureau or to the commandant of the naval station named.

NEW LONDON, CONN.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 10, for furnishing and installing on the runway railways one 5-ton, three-motor bridge crane, one 2-ton hand-operated bridge crane and one 1-ton hand-operated bridge crane in the machine shop at the submarine base at New London, Conn. Drawings and specifications (No. 2701) may be obtained on application to the bureau or to the commandant of the naval station named.

Middle Atlantic States

ASTORIA, N. Y.—The Astoria Heat, Light & Power Company is contemplating the erection of a grinding mill at its plant along the river at Casino Beach, to cost about \$25,000.

ASTORIA, N. Y.—The Astoria Consumers' Ice Company is planning to erect an ice plant, 90 ft. by 200 ft., on Seventeenth Avenue, south of Flushing Avenue, to cost about \$60,000.

AUBURN, N. Y.—The special committee appointed to investigate the feasibility of establishing a municipal electric-light plant has recommended that steps be taken at once for the project and that the engineer who made a survey of the lighting proposition a year ago be engaged to prepare plans for the proposed new plant.

CLYMER, N. Y.—The Public Service Commission has granted the town of Clymer permission to establish and operate a municipal electric-light plant.

COBLESKILL, N. Y.—The installation of a municipal electric-light plant in Cobleskill is reported to be under consideration.

NEW PALTZ, N. Y.—Bids will be received by Dr. Thomas E. Finegan, deputy commissioner of education, Education Building, Albany, N. Y., until Dec. 17, for construction, including heating, sanitary and electric work, of addition to the State Normal School at New Paltz. Drawings and specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany. Drawings and specifications may be consulted at the State Normal School, New Paltz, and at the New York office of the Department of Architecture, Room 1224, Woolworth Building, New York City.

TROY, N. Y.—Plans are being considered for the erection of an addition to the laboratory of the Rensselaer Polytechnic Institute, Troy, to cost about \$100,000.

WALDEN, N. Y.—The capital stock of the Walkill Valley Electric Light & Power Company has been increased from \$16,000 to \$30,000, the proceeds to be used for extensions.

ASBURY PARK, N. J.—Bids will be received by the Board of Commissioners of the city of Asbury Park until Dec. 10 for electric work in connection with alterations to the Municipal Building, at the corner of Bond Street and Mattison Avenue. Plans and specifications may be obtained from Ernest A. Arend, architect, Kinmouth Building, Asbury Park, or 105 West Fortieth Street, New York, N. Y. Harry B. White is city clerk.

BORDENTOWN, N. J.—Plans have been prepared for improvements to the electric street-lighting system. It is proposed to use lamps of greater candlepower and install larger units in the business section of the city.

EAST ORANGE, N. J.—The Sprague Electric Company is planning to build a power plant at its works, to cost about \$20,000. The company manufactures motors.

ELIZABETH, N. J.—Owing to conditions brought about by the war the Board of Public Works has sanctioned an agreement with the Public Service Corporation and the United Electric Company of New Jersey which will release them from the necessity of expending \$25,000 this year for underground work in Elizabeth.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

JERSEY CITY, N. J.—The capital stock of the Municipal Light & Power Company has been increased from \$200,000 to \$4,000,000.

NEWARK, N. J.—Plans are being prepared by the Rubber & Celluloid Products Company for improvements in its boiler house on Irving Place.

WESTFIELD, N. J.—Plans are being considered by the Park Commission for the installation of an electric-lighting system through Lake Park. Ornamental standards will be used.

EASTON, PA.—Arrangements are being made by the Pennsylvania Utilities Company to provide for an electric railway connection from its Dock Street plant to the coal-storage and ash-dumping grounds. The company has recently completed the installation of a new ash and coal-handling equipment.

HAZLETON, PA.—Plans are being considered for the installation of a new type of electric lamp for the West Diamond Avenue Parkway.

LANCASTER, PA.—The Conestoga Traction Company is contemplating extensions and improvements to its Engle-side power plant, to cost about \$100,000. The plans provide for the installation of considerable electrical equipment.

PHILADELPHIA, PA.—The American Railways Company has been compelled to again place in operation the old electric plants in both Salem and Bridgeton, owing to the failure of securing sufficient energy from the plant at Wilmington, across the Delaware River.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 10, for furnishing and installing on the runway rails two 6-ton, two-trolley, five-motor bridge traveling cranes and one 3-ton swinging jib crane in the new galvanizing plant at the United States Navy Yard, Philadelphia, Pa. Drawings and specifications (No. 2699) may be obtained on application to the above bureau or to the commandant of the navy yard named.

PHILADELPHIA, PA.—Bids will be received by the Department of City Transit until Dec. 4 for the following work appurtenant to the Frankford Elevated Railway: Contract (No. 539), plumbing installation on station buildings at Orthodox-Margaret Streets and at Ruan-Church Streets; Contract (No. 540), electrical installations in station buildings at Orthodox-Margaret Streets and at Ruan-Church Streets. Copies of plans and specifications may be obtained upon deposit of \$10, to be refunded upon return of plans.

PITTSBURGH, PA.—The City Council has adopted an ordinance authorizing a contract with the Duquesne Light Company to light the first twenty wards of the city with electricity for a period of ten years.

PITTSBURGH, PA.—Owing to the great demand for electric power service the West Penn Power Company has been compelled to refuse to connect new power consumers. Many of the regular consumers have arranged to use power at night. The breakdown of the large new plant at Windsor, W. Va., has handicapped the company. Repairs cannot be completed for several weeks.

READING, PA.—Work has begun on the construction of a large addition to the West Reading plant of the Metropolitan Edison Electric Company, which will double the output of the plant. Contracts have been placed by the company for a new 25,000-kw. turbine and two 1000-hp. boilers.

SUNBURY, PA.—The Borough Council has appropriated \$600 to be used to secure estimates of the probable cost of establishing a municipal electric-light plant in Sunbury. Electrical service is now furnished by the Northumberland County Gas & Electric Company of Sunbury.

WILKES-BARRE, PA.—The Lehigh & Wilkes-Barre Coal Company is building a new power house at the Green Mountain colliery.

BALTIMORE, MD.—Preparations are being made by the Reus Brothers Company, 146 West Mount Royal Avenue, to enlarge its plant. The company has acquired a site in the rear of its present building on which it will erect a machine shop. It is now erecting a special ignition laboratory for repair and maintenance of electrical equipment for automobiles and rebuilding

and recharging of storage batteries. The proposed improvements will add 10,000 sq. ft. to the machine and ignition department.

GLENARM, MD.—The machine shop, boiler shop, and office building of the F. X. Hooper Company of Glenarm was recently destroyed by fire.

CHARLESTON, W. VA.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the installation of an electric power distribution system at the naval projectile plant, at \$13,500.

HUNTINGDON, W. VA.—Plans are being considered for a complete lighting system for the parkway.

LEWISBURG, W. VA.—A company has been organized by local interests to take over the property of the old Lewisburg & Ronceverte Electric Railway Company and complete the railway into Lewisburg.

North Central States

DETROIT, MICH.—The County Commissioners of Wayne County are considering the installation of electric elevators to replace the steam-driven lifts now in use. The installation of an independent light and power plant to supply electricity for lamps and motors for the county building is also under consideration.

EATON RAPIDS, MICH.—At an election to be held Dec. 3 the proposal to issue \$30,000 in bonds, the proceeds to be used for the purchase of water powers at Eaton Rapids and Smithville, on the Grand River, 2 miles distant, will be submitted to the voters.

AKRON, OHIO.—Bids will be received at the office of C. F. Beck, director of public service, Akron, Ohio, until Dec. 6 for furnishing motor-driven centrifugal pumps as follows: (1) Two horizontal centrifugal pumps, normal capacity 1000 gal. per minute against 100 ft. total head, directly connected to motor; (2) one horizontal centrifugal pump, normal capacity 1000 gal. per minute against 50 ft. total head, directly connected to electric motor. Specifications may be seen at the office of the director or copies may be obtained from the Engineering Department, Water Works Office, 102 East Mill Street, Akron. G. G. Dixon is engineer.

CLEVELAND, OHIO.—The Public Utilities Commission of Ohio has given its approval to the application of the American Gas & Electric Company and the Lake Shore Electric Railway Company to purchase the hydroelectric plant of the Ohio State Power Company, located on the Sandusky River, for \$120,000. The plant is to be used owing to the shortage of coal.

DE GRAFF, OHIO.—At an election held recently the proposal to sell the municipal electric-light plant was carried.

EAST LIVERPOOL, OHIO.—The City Council has decided to postpone the installation of the new street-lighting system for another year at least, and has authorized a continuance of the present lighting system with the Ohio River Power Company for a period of one year.

MANSFIELD, OHIO.—The property of the Mansfield Electric Railway, Light & Power Company has been taken over by the Mansfield Electric Light & Power Company, a subsidiary of the Cities Service Company. The power plant of the former company will be closed down and energy for operating line will be obtained from the Melco plant (recently completed) of the latter company.

PORTSMOUTH, OHIO.—The general plan of the Portsmouth Street Railroad & Light Company for extending its line to Nauvoo, West Side, has been approved by the directors of the Board of Trade of Portsmouth.

LOUISVILLE, KY.—Contract has been awarded by the government for the construction of a power house at Lock No. 41, Ohio River, to the National Concrete Construction Company of Louisville, at \$7,691.

GARY, IND.—The substation of the Gary & Interurban Railroad Company in West Gary was recently destroyed by fire, causing a loss of about \$35,000.

NEWTON, IND.—The Newton Electric Light Company, recently incorporated with a capital stock of \$10,000, is contemplating installing an electric-light and power plant. James R. Campbell, Thomas Schultz and George F. Chamberlain are directors.

BLOOMINGTON, ILL.—The Bloomington & Normal Railway & Light Company has applied to the Illinois Public Utilities Commission for permission to issue \$53,000 in capital stock.

CHICAGO, ILL.—The Apex Electric Manufacturing Company, Fifty-ninth Street,

Chicago, manufacturer of electrical supplies, is contemplating building an addition to its plant, about 25 ft. by 50 ft., one story.

APPLETON, WIS.—The trustees of Lawrence College are considering the purchase of two or three large boilers for the college heating plant.

CLINTONVILLE, WIS.—The Topp-Stewart Tractor Company is considering the construction of a new hydroelectric power plant near Clintonville. As yet nothing definite has been decided upon. A. H. Mayhew is secretary.

MILWAUKEE, WIS.—The Pawling & Harnischfeger Company, Thirty-eighth and National Avenues, is building a large power house, to cost about \$25,000. The company manufactures traveling and other hoisting cranes.

SUPERIOR, WIS.—The Globe Shipbuilding Company, which is adding an area of 400 ft. by 1500 ft., to its yards, is planning to install three electrically operated traveling cranes.

SIOUX CITY, IOWA.—The contract for lighting fixtures for the new county court house has been awarded to the McGraw Company, at \$16,000.

OZARK, MO.—Steps have been taken by residents of Ozark to prevent the sale of the local electric-light plant, which will soon take place. It is proposed to organize a company to take over the property. John W. Robertson, president of the Business Men's League, is interested.

ST. CHARLES, MO.—The installation of an ornamental lighting system in St. Charles is under consideration. Three ornamental, single lamp, standards have been erected in different parts of the city by the American Light & Power Company for experimental purposes.

SOUTHWEST, MO.—Steps have been taken to organize a company to establish a municipal electric-light plant in Southwest.

PENDER, NEB.—The contract for improvements to the municipal electric-light plant has been awarded to the Wright Electrical Construction Company of Fremont.

AGENDA, KAN.—At an election held recently bonds for the installation of an electric-light plant in Agenda were authorized.

CHANUTE, KAN.—Improvements including the installation of new boilers are being made to the municipal electric-lighting plant. The cost is estimated at about \$20,000.

CUBA, KAN.—At an election held recently the proposal to issue bonds for the installation of an electric-lighting system in Cuba was carried.

ELLSWORTH, KAN.—Work has begun on the construction of a new building for the local electric-light plant. New equipment, including generating machinery, will be installed.

INDEPENDENCE, KAN.—All bids for the installation of the proposed ornamental lighting system have been rejected by the City Commissioners. It is expected that new bids will be asked for.

JENNINGS, KAN.—The local electric light plant, it is reported, has been sold to T. A. Vonada.

LURAY, KAN.—At an election to be held Dec. 14 the proposal to purchase the local electric-light plant, owned by M. L. Britton, to be owned and operated by the municipality will be submitted to the voters.

MERRIAM, KAN.—The power house of the Hocker interurban railway at Merriam was recently destroyed by fire, caused by an explosion. Arrangements have been made with the Kansas City Railways Company to furnish electricity to operate the line.

NEWTON, KAN.—The installation of an ornamental lighting system, covering twelve blocks, is under consideration. The Kansas Gas & Electric Company of Wichita furnishes electrical service in Newton.

WICHITA, KAN.—The Wichita Railroad & Light Company will begin work at once on the construction of an extension to the Orient shops.

WICHITA, KAN.—The Public Utilities Commission has granted the Kansas Gas & Electric Company of Wichita permission to sell \$460,000 in bonds, the proceeds to be used for extensions and improvements to its system.

Southern States

BURLINGTON, N. C.—The Piedmont Railway & Electric Company has increased its capital stock to \$1,000,000, and has changed its name to the Piedmont Power & Light Company.

MOBILE, ALA.—Work will begin immediately on the construction of the large shipyard for the United States Steel Corporation on the land recently purchased north of Mobile. Ten shipways will be laid down and wharves of suitable capacity for fitting out the ships will be built. A large power plant, boiler shop, joiner shop, machine shop, steel metal shop, forge shop, storehouse and main office will be erected. Two large villages have been laid out, one for whites, and the other for colored workmen. Electric-lighting and street railway service will be provided. The Mobile company will be known as the Chickasaw Shipbuilding Company. George Gordon Crawford, president of the Tennessee Coal, Iron & Railroad Company, will be president of the Chickasaw company.

ASHDOWN, ARK.—The Ashdown Light & Ice Company, recently incorporated with a capital stock of \$50,000, it is understood, will take over the property of the Ashdown Ice, Light & Power Company, recently purchased by M. B. Morgan of Little Rock. The electric-light plant and ice factory, it is reported, will be enlarged.

KENSETT, ARK.—The City Council has granted a franchise to Dr. E. C. Hardin to furnish electricity for lamps and motors in Kensett for a period of 25 years.

SEMINOLE, OKLA.—At an election to be held Dec. 14 the proposal to issue \$5,000 in bonds for the installation of an electric-light plant will be submitted to the voters.

BEAUMONT, TEX.—Plans are being prepared by the Crystal Ice Company for improvements to its plant, including extensions to the ice-storage house, the installation of ice-manufacturing machinery to increase the output to 120 tons daily; also remodeling the interior of buildings and the installation of equipment to provide three methods of motive power, steam, oil and electricity. The cost of the work is estimated at \$20,000.

DALLAS, TEX.—To insure an adequate supply of power during the peak load the electric transmission lines of the Dallas Power & Light Company and the Texas Power & Light Company will be connected at Norwood and Trinity Heights in Dallas. This arrangement, it is understood, will require the erection of a high-tension transmission line, 7 miles long, costing approximately \$250,000. F. R. Slater is vice-president and general manager of the Texas Power & Light Company.

DALLAS, TEX.—Within five years the Dallas Power & Light Company will expend approximately \$2,834,500 for improvements and extensions to its service. The plans provide for the erection of four substations for the distribution of energy, which will be the first work to be done. The first station will be erected in the downtown section, located near the Interurban Building, at a cost of about \$575,000; a second station to serve Oak Cliff, costing about \$177,400, will be erected near the Oak Cliff car barns; a third station will be erected on Peak Street, probably near the car barns, at a cost of about \$181,300; it is proposed to build another station in East Dallas, the cost of which has not been given out. The underground system calls for an expenditure of about \$918,200. Extensions and improvements to the generating and transmission systems will cost about \$729,000. About \$253,600, it is estimated, will be required for extensions and improvements to the overhead system, including street-lighting.

HOUSTON, TEX.—The Petroleum Refining Company is planning to erect a large machine shop, carpenter shop and to install a steam-driven plant in connection with its new oil refinery in Houston. Electrically operated pumps will be used for pumping oil into the steel tanks.

SAN ANGELO, TEX.—Plans have been approved by the San Angelo Water, Light & Power Company for the construction of a reinforced-concrete dam across the South Concho River, a few miles south of here, for the purpose of increasing the water supply of the city. The dam will be approximately 225 ft. long, 15 ft. high and above low water mark, 10 ft. wide at base and 4 ft. wide at the top. The company will also install additional machinery in its water, light and power plant.

SAN ANTONIO, TEX.—The Missouri, Kansas & Texas Railroad Company, it is reported, is planning to erect an ice and cold storage plant at San Antonio, to cost about \$100,000.

VICTORIA, TEX.—The city of Victoria has engaged A. Garcia of the Independent Electric Light Company to prepare plans for an ornamental-lighting system and underground conduit system in connection with the proposed municipal electric-light plant. Bonds to the amount of \$40,000 have been voted for installation of plant.

WACO, TEX.—Extensive improvements are contemplated by the Big Four Ice Company involving an expenditure of about

\$50,000. The work will include the installation of a 50-ton electrically-driven ice machine, the erection of a 3000-ton ice-storage house, and the installation of an automatic stoker to be used in handling lignite coal. Jacob J. Schrade, chief engineer, will have supervision of the work.

Pacific and Mountain States

CENTRALIA, WASH.—The North Coast Power Company of Portland, Ore., has petitioned the Commissioners of Lewis County for permission to erect and operate electric transmission lines of the roads in Lewis County. A line to Forest over the Pacific Highway is one of the extensions contemplated by the company.

GRAND MOUND, WASH.—The State Board of Control has called for bids for the construction of another cottage and power plant for the State School at Grand Mound. The cost of the cottage is estimated at \$40,000, and the power plant at \$30,000.

SEATTLE, WASH.—Plans have been prepared for the construction of a boiler house, 64 ft. by 160 ft., at the plant of the Seattle Boiler Works, to cost about \$12,000.

SEATTLE, WASH.—Preliminary work is under way for the construction of a shipbuilding plant for the Erickson Engineering Company of Seattle, which has received contracts from the government for ten 9500-ton steel ships, involving an expenditure of \$20,000,000. The plans provide for six shipways, a boiler shop, plate shed, machine and blacksmith shops. C. J. Erickson is president.

SKYKOMISH, WASH.—The Town Council has accepted the bid of the State Board of Finance for the \$7,000 bond issue, the proceeds to be used to establish a municipal electric-light and power plant.

SPOKANE, WASH.—Residents on Post Street have filed a petition with Commissioner Fassett for the installation of an ornamental lighting system on Post Street, extending from the bridge to Third Avenue, similar to that in use on the east and west downtown streets.

STAYTON, ORE.—The City Council has granted a franchise for the construction of a new railway in Stayton. An electric power right for a period of 50 years was also given at the same time. The proposed railway, it is said, will be operated by steam for a time, but later will be equipped for electrical operation. Mr. Lynott is interested in the project.

BISHOP, CAL.—The Railroad Commission has extended the time in which the Bishop Light & Power Company may complete its reconstruction work—one-half to be completed before Dec. 31, 1917, and the entire work before June 30, 1918.

CLOVIS, CAL.—The Fresno Flume & Lumber Company has filed notice of application for 200 cu. ft. per second of the waters of Dinkey Creek, tributary of Kings River, for power purposes. The plans provide for a main ditch, tunnel and pipe line $4\frac{1}{2}$ miles long, and the storage of 25,000 acre feet of water. The company has also filed an application for 400 cu. ft. per second of water in Big Creek, also tributary of Kings River, the water to be used in connection with the above power project. The main ditch and pipe line in the latter is given as 8 miles in length.

HOLTVILLE, CAL.—The Railroad Commission has extended the time in which the Holton Power Company may complete its work. At least half of the reconstruction work must be completed before Dec. 31, 1917, and the entire work before Dec. 31, 1918.

MIDDLETOWN, CAL.—Application has been made to the State Water Commission by Paul J. Stuparich of Middletown for permission to use 8 in. of water from Hickmott Creek in Lake County, to generate electricity for domestic use.

RIVERSIDE, CAL.—The Railroad Commission has extended the time in which the Southern Sierras Power Company may complete its reconstruction work. One third to be completed before Dec. 31, 1917, two-thirds before Dec. 31, 1918, and the entire work before June 30, 1919.

SAN FRANCISCO, CAL.—The Great Western Power Company has filed an amended application with the State Railroad Commission, asking for authority to use \$3,000,000 derived from the sale of \$4,998,000 in capital stock of the City Electric Company for reimbursing in part its treasury for expenditures between June 1, 1915, and Sept. 30, 1917, and for additions and betterments to its system.

TAYLORSVILLE, CAL.—The Great Western Power Company of San Francisco, has been granted a franchise to operate in certain portions of Plumas County. This franchise will allow the company to operate

in the town of Taylorsville, which has requested the company to furnish electrical service.

VALLEJO, CAL.—The Santa Rosa Vallejo Tanning Company has been granted a permit to erect a boiler house at the corner of Sixth and Rice Streets in connection with its proposed new power plant in North Vallejo.

ALBUQUERQUE, N. M.—Plans have been prepared, it is reported, by Trost & Trost of El Paso, for the erection of a hotel, 80 ft. by 150 ft., five stories, for Eduardo Otero of Los Lunas, N. M., to cost about \$175,000. The plans provide for an electric power plant, to cost about \$25,000; electric elevators, refrigerating system, vapor and steam heat, etc. Bids, it is understood, will be opened about Jan. 1.

Canada

LETHBRIDGE, ALTA.—The installation of additional equipment in the municipal electric-light plant, to cost about \$65,000, is under consideration by the City Council.

SOUTH VANCOUVER, B. C.—The City Council is considering the installation of a 75-hp., 2200-volt motor in the city lighting plant.

TORONTO, ONT.—Plans are being prepared by the Hydro-Electric Power Commission of Eugenia for extensions to its power plant, to cost about \$75,000.

TORONTO, ONT.—The Dunlop Tire & Rubber Company, 244 Booth Avenue, Toronto, is contemplating building an addition to its power plant, to cost about \$5,500.

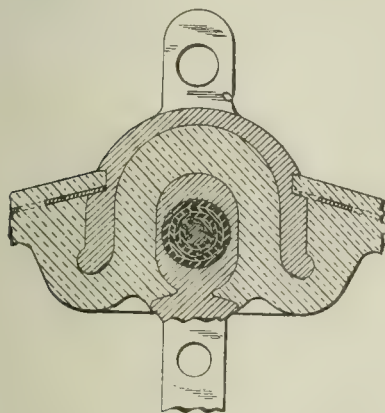
Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing agent, the Panama Canal, Washington, D. C., until Dec. 17, for furnishing steel reinforcing bars, electric cable and wire, transformers, electric meters, panelboards, electric fittings and fixtures, copper bussing, cable grips, cable jacks, ground clamps, fiber rod, fiber sheet, fish paper, rubber sheet, linen tape, insulating compound, mica, wood molding, brass chain, tank indicator, etc. Blank and general information relating to this circular (No. 1188) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York City; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

1,246,831. BRAKE; Frank W. Adsit, Chicago, Ill. App. filed June 17, 1916. Vehicle.

1,246,845. ELECTRIC - CIRCUIT - MAKING DEVICE; Reuben B. Benjamin, Chicago, Ill. App. filed April 19, 1912. Applicable to attachment plugs of the kind generally known as separable.

1,246,846. ELECTRICAL RECEPTACLE; Reuben B. Benjamin, Chicago, Ill. App. filed Jan. 27, 1916. Improved means for retaining a lamp base in place within receptacle.



1,247,343—Condenser Type Suspension Insulator

1,246,853. TAPER-CHARGE CURRENT REGULATOR; William L. Bliss, Niagara Falls, N. Y. App. filed April 6, 1917. Improved regulator for preventing the current delivered by a generator from increasing beyond a predetermined value until the storage battery connected therewith has been charged to a predetermined voltage.

1,246,854. STOP-CHARGE CURRENT REGULATOR; William L. Bliss, Niagara Falls, N. Y. App. filed April 6, 1917. Provides a regulator which will discontinue the battery-charging current after the battery voltage has risen a predetermined amount and which will be sensitive and positive in operation.

1,246,855. BATTERY CHARGING SYSTEM; William L. Bliss, Niagara Falls, N. Y. App. filed April 6, 1917. Provides an improved regulator for controlling the charging rate of storage batteries.

1,246,894. ELEVATOR-CONTROL LOCK; Edward L. Dunn, Worcester, Mass. App. filed Dec. 29, 1915. Improvements.

1,246,895. PHONOGRAPH TRANSMITTER; Henry C. Egerton, Passaic, N. J. App. filed Nov. 25, 1914. For transmitting to a circuit the vibrations of a phonograph record.

1,246,927. THERMO-ELECTRIC REGULATOR; Lee P. Hynes, Chicago, Ill. App. filed June 7, 1915. Regulating the electric heating apparatus of a car.

1,246,964. ELECTRIC CABLE; Charles W. Lowe, Jersey City, N. J. App. filed Feb. 17, 1917. Applies particularly to moisture-proof cases for inclosing electrical apparatus which is adapted to be connected into submarine cables.

1,246,970. CONNECTION SLEEVE FOR CABLES; James T. Madigan, Colorado Springs, Col. App. filed Nov. 29, 1916. Employed in connection with telephones.

1,247,009. RHEOSTAT; Thomas Rhodus, Chicago, Ill. App. filed June 23, 1917. Adjustable.

1,247,022. BATTERY; Frank B. Smith, Malden, Mass. App. filed May 1, 1917. Used by physicians.

1,247,026. INCANDESCENT-LAMP SOCKET; Martin V. Smith, Hartford, Conn. App. filed July 26, 1916. Improvements.

Record of Electrical Patents

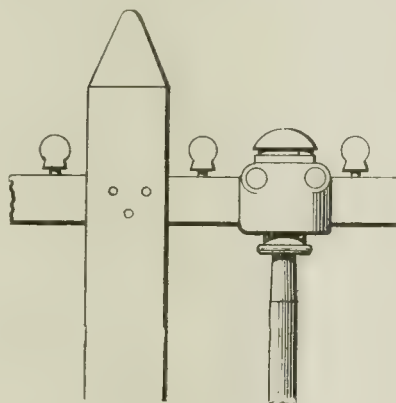
Notes on United States Patents
issued on November 20, 1917

1,247,027. VACUUM REGULATION; Homer C. Snook, Cynwyd, and Edwin W. Kelly, Philadelphia, Pa. App. filed June 11, 1915. Relates to means for regulating the degree of vacuum of an X-ray tube or other vacuum tube.

1,247,041. AUTOMATIC CUT-OUT SWITCH; Edward Waigand and Benjamin Waigand, Nampa, Idaho. App. filed Nov. 9, 1916. Fuse cut-outs used in connection with three-phase circuits.

1,247,042. SUPPORTING FRAME FOR ELECTRIC SWITCHES; Cassius M. Walker, Pueblo, Col. App. filed Feb. 26, 1912. Adapted to contain and retain the several parts thereof in position to be included within a containing box.

1,247,068. FILAMENT; Burnie L. Benbow, Cleveland, Ohio. App. filed Oct. 4, 1913. Tungsten.



1,247,555—Fuse Puller

1,247,123. PLATE GUARD FOR SECONDARY BATTERIES; Joseph O. Luthy, San Antonio, Tex. App. filed April 16, 1917. Relates to guard sheaths or envelopes for secondary battery plates.

1,247,125. ARMORED CONDUCTOR; Charles P. Madsen, Chicago, Ill. App. filed Sept. 6, 1913. Adapted for high-temperature electric heater service.

1,247,127. PROTECTION OF TRANSMISSION SYSTEMS; Richard H. Marvin, Schenectady, N. Y. App. filed April 8, 1914. From arcing or permanent grounds.

1,247,154. ILLUMINATED LEVEL; William H. Robertson, Brewster, N. Y. App. filed May 3, 1917. Improvements.

1,247,180. ELECTRIC-SWITCH GUARD; Samuel S. Thompson and Edmond J. Le Blond, Minneapolis, Minn. App. filed May 15, 1916. Forms the casing so that it is adjustable in length to fit within any service box over any size fuse block.

1,247,210. ELECTRIC HEATER; Horatio A. Black, Topeka, Kan. App. filed June 11, 1917. Portable.

1,247,286. ELECTRICAL HEATING UNION; Frank Kuhn and Jay A. Hand, Detroit, Mich. App. filed Jan. 25, 1917. Of the exposed resistor type.

1,247,297. ELECTRIC MACHINE; Frans G. Liljenroth, Westeras, Sweden. App. filed May 20, 1916. To construct commutators so that an increased resistance to discharges between the different bars may be obtained.

1,247,317. LIQUID GAGE; Tetsushiro Nakamigawa, New York, N. Y. App. filed Feb. 28, 1916. Provides a gage which will register the height of a liquid in a tank at some distant point.

1,247,337. ALUMINOUS ABRASIVE; Lewis E. Saunders and Ray Hill White, Niagara Falls, N. Y. App. filed Feb. 12, 1917. Improvements.

1,247,343. CONDENSER TYPE SUSPENSION INSULATOR; Sol S. Sonneborn, Brooklyn, N. Y. App. filed Feb. 10, 1917. Combines in one structure means for distributing electrostatic stress in an effective and efficient manner, providing high puncture strength, providing adequate leakage surface, providing dielectric contour lines of dielectric stress, providing extreme mechanical strength, and many special combinations of these features.

1,247,446. CONTROLLER; Charles L. Perry, Schenectady, N. Y. App. filed Sept. 21, 1916. The spacing between the successive operative positions of the controller and the spacing between the various contacts are materially less than has heretofore been considered necessary.

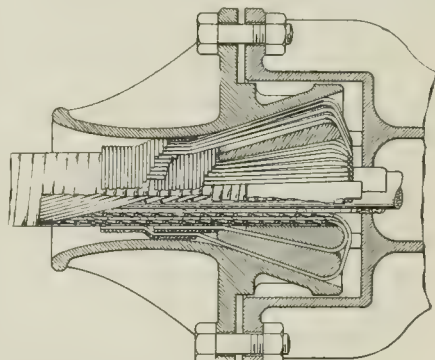
1,247,468. ELECTRIC SWITCH; George B. Thomas, Bridgeport, Conn. App. filed May 15, 1917. Push-button.

1,247,492. LAMP-SOCKET CASING; Reuben B. Benjamin, Chicago, Ill. App. filed April 19, 1912. Means for securing the cap and the shell together.

1,247,501. APPARATUS FOR WELDING; Harry E. Butcher, Cleveland, Ohio. App. filed March 18, 1915. Electric current as the heating agent.

1,247,531. SUPPORT FOR LINE WIRES; Vernon Head, Alexander, Tex. App. filed June 10, 1916. Improvements.

1,247,555. FUSE PULLER; Eugene H. Lowe, Modesto, Cal. App. filed April 27, 1917. Provides mechanism in connection with the ordinary fuse plug for permitting it to be engaged by the usual threaded insulator pin, to permit the withdrawal or replacement of the plug without requiring the same to be touched by the hands of the operator.



1,246,964—Electric Cable

1,247,566. STEAM UTILIZING PLANT; Thomas D. Nuttall, Bury, England. App. filed May 5, 1915. Relates to apparatus employing steam both for motive power and for drying or other analogous purpose, in cases where two or more machines and their adjuncts are employed.

1,247,576. CIGAR-VENDING MACHINE; Jesse T. Robinson, Montgomery, Ala. App. filed Oct. 23, 1916. Coin-controlled.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, A. H. Krom, 29 South La Salle St., Chicago. Annual meeting, May 14, 1918.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City. Annual meeting, Jan. 14, 1918.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio. Annual meeting, Pittsburgh, Dec. 27-29, 1917.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary - treasurer, Roy B. Fowles, Pine Bluff, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, George C. Holberton, San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, McKeesport, Pa. Annual convention, September, 1918.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, W. L. Connelly, Gibson, Ind.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, R. B. W. Pirie, 406 Yorkshire Building, Vancouver, B. C.

CALIFORNIA ASSOCIATION OF CONTRACTORS AND DEALERS. Secretary, James W. Redpath, 505 Rialto Bldg., San Francisco, Cal.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, Alan Sullivan, Excelsior Life Building, Toronto, Can.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION N. E. L. A. Secretary, F. D. Beardslee, Union Electric Light & Power Co., St. Louis, Mo.

EASTERN NEW YORK SECTION, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF CONNECTICUT. Secretary, George M. Chapman, Waterbury, Conn. Annual meeting, New Haven, Conn., May, 1918.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, J. E. Wilson, 263 Summer St., Boston, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo. Annual meeting, Jan. 19, 1918.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF PENNSYLVANIA. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, J. C. Staff, 573 Jackson St. Milwaukee, Wis.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, Shiras Morris, Hart & Hegeman, Hartford, Conn.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL CREDIT ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert E. Elliott, 502 Flatiron Building, San Francisco.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago.

ELECTRIC VEHICLE SECTION OF THE N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

Directory of Electrical Associations

Printed in the First Issue of Each Month

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, L. W. W. Morrow, Norman, Okla. Annual meeting, May, 1918, Oklahoma City.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, Dan Carey, Atlanta Builders' Exchange, Atlanta, Ga. Annual meeting June, 1918, Tybee Island, Ga.

ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, L. B. Van Nuys, Central Electric Co., Peoria, Ill. Annual meeting, Chicago, January, 1918.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, R. H. Abbott, Petersburg, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skillman, Indianapolis, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 111 Broadway, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

IOWA SECTION, N. E. L. A. Secretary-treasurer, L. E. Caldwell, Iowa City, Iowa.

JOVIAN ORDER. Jupiter (president), Henry J. F. Strickland, Dallas, Tex.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, R. M. Sutton, Wichita.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan. Annual meeting, Kansas City, Kan., Oct. 17-19, 1918.

KENTUCKY ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, F. F. Vallinoti. Annual meeting, May, 1918, Louisville, Ky.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 323 Chartres St., New Orleans, La.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Augusta, Me.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Monroe, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, H. E. Young, Minneapolis General Electric Company, Minneapolis, Minn.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, G. M. Jones, 112 South Seventh St., Minneapolis, Minn. Annual convention, January, 1918, Minneapolis.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary-treasurer, W. F. Wheeler, Hattiesburg.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass. Annual convention, New York, March, 1918.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, H. C. Brown, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill. Annual meeting, June 1, 1918.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York. Annual meeting, June, 1918.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION, affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore. Annual meeting Sept. 11, 1918.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OREGON ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, J. W. Oberender, 302 Dekum Building, Portland, Ore. Annual meeting, September, 1918.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, Crossley Building, San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davison, West Virginia Water & Electric Co., Charleston.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 152 Beech St., Yonkers, N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa. Annual meeting, Evanston, Ill., June, 1918.

SOUTH DAKOTA ELECTRICAL POWER ASSOCIATION. Secretary-treasurer, Frederick D. Brown, Huron, S. D.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus, Ga.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Bargebaugh, 703 First National Bank Building, El Paso, Tex. Annual meeting, April, 1918.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, M. S. Ashley, Fort Worth, Tex. Annual meeting, Galveston, Tex., June 15, 1918.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. E. Myers, 3 Gould St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C. Annual meeting, Charlotte, N. C., April, 1918.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt. Annual meeting, February, 1918.

VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 W. Jackson Blvd., Chicago, Ill. Annual meeting, Jan. 29-31, 1918, Memphis, Tenn.

WESTERN SOCIETY OF ENGINEERS. ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis. Annual meeting, March, 1918.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN

Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, DECEMBER 8, 1917

No. 23

The Lesson of Lost Water Power

THE war is burning deeply into national consciousness a conviction of the supreme value of power and the sources of power. Blazoned before the public so that he who runs may read is the lesson of lost energy. From bitter experience with coal shortage the public has learned the folly of our uneconomical policy regarding water powers. Our people know better than they did what useful water powers mean not only in coal saving but in conserving labor and transportation facilities, and they are demanding action by Congress—action that shall stop waste, action that shall harness resources of nature now going playfully to the seas while industries close down for lack of power. It is an emergency that we have to meet; legislation now will not save us from coal shortage this winter, but it will give us provident use of great resources for the future. For the public good Congress should act; it will find that any legislation permitting development on fair terms will protect our diminishing fuel reserves and conserve labor and railway equipment.

The Fruits of Co-operation

AS USERS and makers of electrical apparatus, our readers will be interested in the address of Clarence L. Collens, II, president of the Electric Power Club which embraces nearly all of the manufacturers of motors, transformers and controllers in this country. Rarely is occasion given for one branch of industry to know what is in the mind of some other branch, and especially in the minds of the manufacturers. We draw attention to this because it is a good omen. When an organization is animated with the desire to promote the best interests of the entire industry whole-heartedly and without reserve, it shows evidences of greatness and should be encouraged in its work. This accounts for the phenomenal growth of the Electric Power Club and for the excellent results it has been able to obtain in standardization. The Power Club now seeks to expand and develop. The leaven of co-operation has worked, and the membership recognizes in a large way that as the entire industry prospers each branch necessarily benefits. This is but the reaffirmation of the old proverb, "There is that scattereth and yet increaseth, and there is that withholdeth more than is meet; but it tendeth to poverty." The Electric Power Club does not withhold; it has given liberally of its time and thought, first in getting itself ready for co-operation and then in extending it to the other branches of the electrical industry, to the national government

and to the ultimate consumer. We need more of this spirit in the industry—fewer self-seekers and more co-operators.

Service Extensions

BESET by the difficulty of getting funds on one hand and by the high cost of material on the other, managers of central station properties naturally are not making any circuit extensions the income from which is insufficient to meet the fixed charges on the investment. Willingness to serve is, however, not lacking, merely the wherewithal. It is generally recognized that as the resources of the country are devoted more and more to the prosecution of the war conservation of men, money and material becomes imperative. As a policy this is both desirable and consistent with public interest, but until it is established by some central authority it will not be generally observed. It is evident from recent findings and discussions that there is no agreement among the various public service commissions on this matter; possibly the laws in the separate states are such that none can be had. However, there is no virtue in uncertainty, and, inasmuch as this question of making extensions has already arisen and bids fair to come up more frequently, it would be well if utilities and commissions would come to some definite understanding quickly. The Massachusetts commission has already expressed itself on war-time restrictions and service expenditures in the case of the New England Telephone & Telegraph Company. Ohio central station managers have discussed service extensions, and we give in this issue some sidelights on the question by one of the engineers connected with the California Railroad Commission. There is no trouble with the theory or difficulty in determining who shall make the investment; the trouble is that the theory is offset by the cold fact that one cannot get the material or raise the money with which to carry on the work.

Private and Public Lighting

ONE effect of the recent agitation against electric signs is being found in the realization that signs and display lighting have been no inconsiderable factor in proper illumination of city streets. Their use has been so gradual that their full effect is realized only by those who have given particular attention to the technique of street lighting. Now that these private auxiliaries to the public efforts are to a very considerable extent "down and out," their real importance has come to the fore. The result has been a striking amount of

discussion regarding the new necessities of lighting streets, squares and public places which have sunk into comparative darkness. Private enterprise in "white-way" lighting is familiar enough and has been an accepted part of the lighting scheme of a good many cities, particularly of the smaller sort. The window and sign lighting, however, which has attracted less notice, has been far from negligible in its results, and its absence is going to be generally noticed. The net effect is likely to be a material increase in the public lighting necessary for general purposes of usefulness in a good many streets, not universally, but wherever the public has become accustomed to a degree of illumination now absent. The ultimate result doubtless will tend to the conservation of fuel, because well-placed street lights are more efficient for their particular purpose than signs and windows. The man in the street, however, will certainly look askance at a general reduction of illumination, and city authorities will do well to follow up this suggestion and judiciously to add to or rearrange their street-lighting program to meet the requirements which have arisen.

Higher Steam Pressures

THOSE of our readers who are practically interested in the efficiency of steam production will find much to think about in J. T. Foster's article on high steam pressures. The tendency toward increasing pressure and increasing superheat as well has been very marked in the last decade, probably on account of the wider use of the steam turbine. Mr. Foster, however, goes further into the matter than has been usual in such discussions, and considers the increase in efficiencies, both thermal and with respect to the water rate, up to pressures on a far higher plane than those now customarily used. It has been a long road from a few pounds per square inch pressure obtained from a tank boiler to the water-tube boilers at 200 lb. or 250 lb. (14 kg. or 17.5 kg. per sq. cm.) pressure of the present day. If, however, there is genuine economy, including all things, in doubling any pressures now customarily used, that economy must sooner or later be sought.

To-day our standard boilers and piping belong to the region of 200 lb. or 250 lb. per square inch (14 kg. or 17.5 kg. per sq. cm.) pressure. Anything beyond this would be rated as highly special and frowned upon accordingly. In the stress of war we probably have not time to go into the development of apparatus of unusual and extraordinary properties, but it is well to look forward and to forecast the gains which may be made in the future. In Mr. Foster's judgment 500 lb. or 600 lb. per square inch (35 kg. or 42 kg. per sq. cm.) is not outside the reasonable economic situation, there being promise of economy sufficient to outweigh the added charges against equipment. These figures look big for the moment, and they may or may not be reached in general practice, but it is reasonably certain that both higher pressures and higher superheats than are now employed are within easy sight.

The Unshaken Preferred Borrower

IN ORDER that the expansion of the electrical industry may proceed in a normal, orderly way it is to be earnestly hoped that the arrest in the decline of security prices is permanent. The rock foundation of the industry is the operating central station. That is the substantial property whose welfare and continued growth in response to public demand for service furnish the motive power for all other branches of the industry. Its economic value to the community rests not alone on splendid past performance but on the instant readiness to meet all legitimate calls for service, to go the limit in caring for the electrical needs of the community. The performance of its unquestioned large obligation to the community is, however, rigidly dependent upon its ability to market securities at fair interest cost. It cannot continue to meet its obligation with existing plant investment alone, for the steady growth in volume of business necessitates corresponding steady growth in generating and distribution facilities.

We have seen a tumultuous market in stocks and bonds, with fear, rampant and vicious speculation, anxiety over war taxes, increasing credit tightness, international influences of varying importance. Through it all there is the increasing, insistent demand for more power for industry, for every kilowatt-hour that the plants can produce. We have blackness in the investment market, loud cries from consumers for more and more energy from the production department, bankers unable or unwilling to float securities except at discouraging cost, customers closing plants or curtailing output to cut down the load on the peak. The thing is an anomaly; it cannot last. Industry of intrinsic soundness and of indispensable character is bound to get recognition and protection.

It is not our function to record day-to-day fluctuations in security prices; it is our function to discuss great movements in security values when they touch, as this one does, the throbbing heart of central station growth, its ability to meet and anticipate demands for service. In these times there is sharp scrutiny by bankers to determine what are essential and what are non-essential industries. In Washington, the nerve center of business for the duration of the war, the public utility has been judged by standards applied by keen-minded public servants with the authority of autocrats. In their sharp eyes the public utility ranks among those at the top.

If the frank attitude of the Washington authorities means anything—and we are confident that from their deliberate position there will be no serious recession during war—it means that public utilities will receive every possible consideration. When the need of the central station is urgent we have an unshakable belief that it will have a fair chance at the guarded reservoirs of capital. While we shall have in effect if not in reality a capital administrator, just as we have a Fuel Administrator and a Food Administrator, the electric central station as an institution is a vital part of the community body; it cannot be severed if real life and

vitality are to course through the arteries of commerce. Its standing as the signer of notes is a high one. Market values may be borne down by the weight of general conditions, but real values are unshaken, and in time they will help the electric companies to their old preferred position as borrowers.

Unsymmetrically Spaced Conductors

IT IS well known that a three-phase system of line conductors may be regarded as equivalent to a combination of three independent single-phase lines, each carrying a star-branch load, and a neutral or zero-potential return path of negligible impedance. The three single-phase branches act as though provided with a perfect ground return. If the generator impresses a symmetrical three-phase voltage on the system at the sending end; if, moreover, the load is symmetrically applied at the receiving end, and finally if the three conductors are uniform, symmetrical and symmetrically spaced, then the three-phase system is a perfectly balanced system, whatever its power factor may be, and the three component single-phase systems into which it may be theoretically analyzed are identical, except as to phases.

In practice the preceding ideal conditions are always departed from to some extent and are sometimes departed from greatly. The load applied to the system is ordinarily dissymmetrical, the currents demanded from the generator are dissymmetrical, and the generator in turn delivers unbalanced voltages at the sending end. Moreover, the three line conductors are ordinarily disposed dissymmetrically on the poles, thereby introducing dissymmetries in the line potential drops, so that unbalanced systems may be said to constitute the rule and balanced systems the exception. A certain degree of unbalance in the magnitudes or in the phases of the delivered voltages or the delivered currents may be disregarded as insignificant; but beyond this limit, which depends on the nature of the service, unbalance becomes a serious detriment to good operation.

The article this week by George S. Humphrey takes up this important question of unbalance as affected by line dissymmetry. There are several ways in which the problem can be attacked. The way selected in this article is to treat each wire as having a definite resistance and reactance for each of the three loops of a three-wire system, and to analyze each line current into its loop components, so as to obtain resultant vector voltage drops. Some very practical conclusions are

thereby deduced, which, while they may not all be new, are certainly not generally known. One deduction in particular is that when the three untransposed line wires lie on the same cross-arm, at equal horizontal separating distances, the virtual effect is to alter the linear resistances of the outer wires, that of one outer being increased and that of the other outer as much decreased. Moreover, the outer linear reactances are equal, and greater than the linear reactance of the middle wire. The virtual change in linear resistance of the outers is independent of the size of wire or of their horizontal spacing on the cross-arm. The article deserves the careful attention of transmission-line students.

Engineering Research and Publicity

THE last annual report of the British Privy Council's committee for scientific and industrial research deserves careful consideration in many respects, especially as showing a much closer unification and co-ordination of effort among the various research agencies than has been achieved in this country. The activities recorded deal not only with war necessities but with the intensive post-bellum period of co-operation within the empire and competition without. Government agencies, technical societies, various manufacturers' associations and institutions of learning are all brought under the guidance of a single committee, to which the imposing sum of £1,000,000 has been allowed by Parliament. It is not to be denied that in some respects this country is ahead of England in research, especially in the magnificent equipment of the research laboratories of large manufacturing concerns. As a matter of fact, the very first issue of the British committee's papers bearing on industrial research is devoted to industrial research in the United States, and its author paints a glowing picture of research facilities available in this country. Nevertheless, the British have accomplished a wonderful amount of organization within the brief period of two years and under the most trying war conditions. It is to be hoped that our Council for National Defense and its Research Council will publish a similar report before long and that they will be able to show similar results. In particular we are anxious to know how far they have succeeded in drawing into their work the national engineering societies, the principal industrial associations and institutions of learning. Some of the council's work is confidential in its nature, but a great deal can be given professional publicity following the praiseworthy example set by the British committee.

VARNISHED cambric is used in so many places for insulation that the paper to be presented in next week's issue on "Apparent Dielectric Strength of Varnished Cambric" should be of interest to practically all electrical engineers. The information represents about three years' co-operative work between the Electrical

The Coming Issues

Testing Laboratories of New York and Drs. A. E. Kennelly and R. J. Wiseman. Another article which will be presented in the next issue of the ELECTRICAL WORLD will dwell on the characteristics of different types of motors and the industrial applications to which they are adapted.

Advisability of Higher Steam Pressures

Discussion of the Question of Increasing Present Steam Pressures, with an Estimate of the Increased Cost of Equipment—Curves Showing Improvement in Water Rates and Thermal Efficiencies

BY J. T. FOSTER

SINCE there is no reason to believe that central station operating expenses will decrease appreciably in the near future, the question of increasing steam pressures should be of more than academic interest. At the time the subject was first brought prominently before the engineering world in 1915 there seems to have been some doubt as to whether it would be practicable to attempt a gain in thermal efficiency by increasing pressures much above those now in use. Since that time, however, it appears that considerable thought has been given to the subject, and a number of prominent engineers have expressed the view that high pressures are not only feasible but inevitable.

WATER RATES IMPORTANT

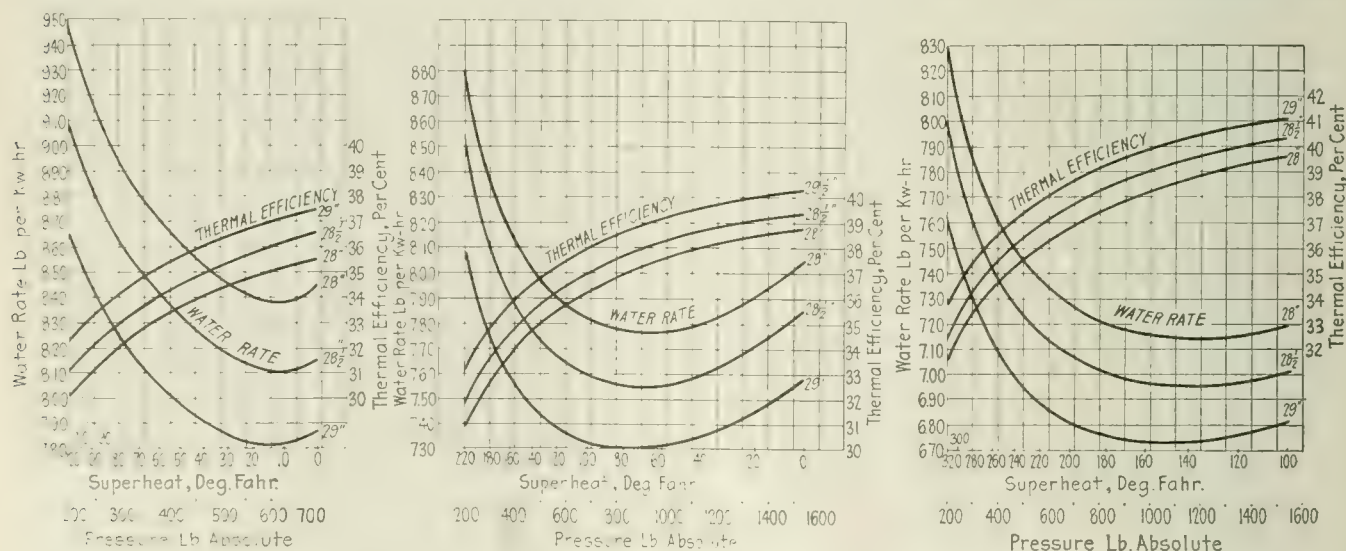
Previous discussions of this subject have been confined to thermal efficiencies, but a consideration of water rates is probably of more interest to the average engineer and in addition brings out some points not apparent from an examination of the thermal-efficiency curves. The points plotted in the accompanying curves are calculated from Goodenough's formulas, published in Bulletin No. 75 of the Engineering Experiment Station of the University of Illinois.

Fig. 1 shows thermal efficiencies and water rates on the basis of a constant boiler temperature of 500 deg. Fahr. (260 deg. C.) and for vacuums of 28, 28½ and 29 in. (71.2, 72.5 and 73.7 cm.). The superheat, of

seen that under these conditions the water-rate curve drops to a minimum in the region between 800 lb. (56 kg.) and 1000 lb. (70.3 kg.) pressure, and that from 800 lb. on the thermal efficiency increments become less and less.

With a boiler temperature of 700 deg. Fahr. (370 deg. C.) the conditions are as shown in Fig. 3. Since the steam is still superheated 100 deg. Fahr. (37.7 deg. C.) at 1550 lb. (108.5 kg.) pressure, it would be possible to plot additional points up to approximately 3000 lb. (210 kg.) without running into the region of wet steam. However, very little additional information would be gained from carrying the calculation any further, as will be seen from an examination of Table I. As shown in this table, the thermal efficiency increments per 100 lb. (7 kg.) increase in pressure above 1100 lb. (77 kg.) are very small, while the water rate increases quite rapidly.

For the purpose of comparing thermal efficiencies and water rates at a vacuum of 28½ in. at the exhaust and boiler temperatures of 500 deg., 600 deg. and 700 deg. Fahr., parts of Figs. 1, 2 and 3 are replotted in Fig. 4. Taking all the factors into consideration, it would appear that the most economical point would be at that pressure and temperature at which the water rate is lowest. This point would be at a pressure of 1100 lb. (77 kg.) and a temperature of 700 deg. Fahr. (370 deg. C.). It is not to be expected, however, that



FIGS. 1, 2 AND 3—THERMAL EFFICIENCIES AND WATER RATES WITH DIFFERENT VACUUMS, STEAM PRESSURES AND SUPERHEATS AT 500, 600 AND 700 DEG. FAHR. RESPECTIVELY

course, decreases with increasing pressure, the dry and saturated condition being reached in this case at approximately 680 lb. (47.6 kg.).

Similar information is plotted in Fig. 2 for a boiler temperature constant at 600 deg. Fahr. (310 deg. C.). In this case saturation is not reached until the pressure reaches approximately 1550 lb. (108.5 kg.). It will be

an attempt will be made to reach this condition at once. It is more probable that the increases will be made in 100-lb. or 200-lb. (7-kg. and 14-kg.) increments and that progress toward the very high pressures will be based on accumulated knowledge.

The cost of equipment for operation at high pressures will, of course, be greater than the cost of equip-

ment for 200-lb. (14-kg.) pressure. While there is no accurate data as to probable costs when the pressure is as high as 1000 lb. (70.3 kg.), it has been possible to obtain data on which the percentages given in Table II are based.

It should be borne in mind that the figures in Table II, which may seem small, are percentages of the total

TABLE I—RANKINE-CYCLE WATER RATES AND THERMAL EFFICIENCIES AT CONSTANT STEAM TEMPERATURE OF 700 DEG. FAHR. (370 DEG. C.) AND VACUUM OF 28½ IN. (72.5 CM.) WITH DIFFERENT STEAM PRESSURES

Pressure (Lb.)	Rankine-Cycle Water Rate (Lb.)	Thermal Efficiency (Per Cent)
1100	6.96	39.3
1200	6.96	39.6
1300	6.96	39.8
1400	6.97	40.0
1500	7.00	40.2
1600	7.03	40.4
1700	7.07	40.6
1800	7.10	40.8
1900	7.16	40.8
2000	7.22	40.8

cost of the plant, which cost includes foundations, structural steel, brick work switching equipment, bus and cell work and numerous other items whose cost will be fixed regardless of the operating pressure.

STRUCTURAL CONSIDERATIONS

Practical considerations seem to offer no insuperable difficulties. The materials now in use for piping with steam at 200 lb. (14 kg.) pressure should have ample strength to withstand higher pressures and temperatures, but welded joints would undoubtedly be necessary. Engineers experienced in the design of boilers and turbines have expressed the view that, while a

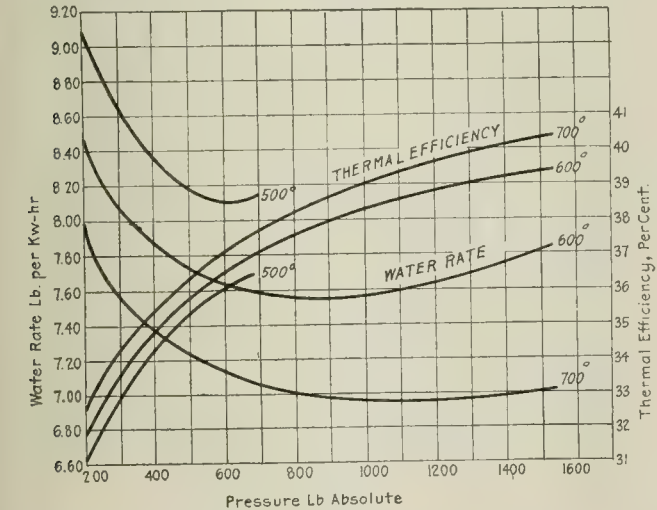


FIG. 4—EFFECT OF PRESSURE AND BOILER TEMPERATURE ON THERMAL EFFICIENCY AND WATER RATE AT 28½-IN. VACUUM

certain amount of redesign will be necessary, the changes in the case of 500-lb. or 600-lb. (35-kg. or 42-kg.) operating pressures are not radical, and that as soon as there is sufficient demand the work of developing high-pressure apparatus will be undertaken.

The main turbine for higher pressure will probably be a two-unit or three-unit combination so as to avoid

setting up excessive strains within a single casing. In such a case a breakdown of the high-pressure unit would probably make it difficult to operate the low-pressure end except through a reducer. As for economizers, no change will be necessary because it will be possible to operate under exactly the same conditions as at present. This can be accomplished by pumping

TABLE II—PER CENT* INCREASE IN TOTAL COST OF PLANT WITH ADOPTION OF DIFFERENT PRESSURES

Item	PRESSURE (Lb.)			
	300	400	500	600
Boilers	0.75	1.50	2.20	2.90
Turbines	1.40	1.40	1.40	1.40
Condensers	-0.20	-0.40	-0.50	-0.60
Economizers	0.00	0.00	0.00	0.00
Piping	0.50	0.90	1.30	1.70
Total percentage increase	2.45	3.40	4.40	5.40

*Referred to 200 lb. as a datum.

water to the economizers at the usual pressure and stepping up the pressure between the economizers and boiler to 500 lb. or 600 lb. (35 kg. or 42 kg.).

The operation of steam-driven auxiliary equipment could be accomplished by one of the following methods:

- (1) Using equipment designed as at present, operating on steam bled from the main turbine;
- (2) using equipment designed as at present, supplied from the high-pressure mains through a reducing valve;
- (3) using uniflow engines, which it is claimed are more economical at high pressures than small turbines of the same horsepower rating.

There appears to be no reasons why the gains indicated in the curves should not be realized to a large extent. The change from 200 lb. to 500 lb. or 600 lb. is no more revolutionary than the change which was made at the time standard practice raised the pressure from 80 lb. (5.6 kg.) to 200 lb. (14 kg.) or more. In view of the fact that the earlier change netted a gain of approximately 20 per cent, the expected gain in economy from the change to 500 lb. or 600 lb. does not seem excessive.

Chicago an Example for England

A writer in the *Westminster Gazette*, commending as an example the system of the Commonwealth Edison Company of Chicago and associated Insull properties, says that the solution of the existing state of things in England lies in: "(1) The establishment of a number of central station systems, themselves all linked up, and the installation of a comparatively few huge generating plants in convenient localities. (2) These plants should be established as nearly at the coal mine mouth as possible. (3) The plants should be hydroelectric wherever it is possible to assemble a sufficient volume of water with a fair drop to be worth while. The case of an artificial lake formed at Gatun, on the Panama Canal, with a drop of 85 ft., is to the point, since it may be advanced that there are no great powers available in the British Isles. (4) The determination and decision to scrap a very great number of existing plants. This is not so severe as might appear, as the life or use of most of the machinery in a modern plant is not set at longer than twenty-five years."

Speed, Torque and Power in Machine-Tool Work

Some Factors to Consider in Selecting Motors—Limitations of Constant-Speed Units and Advantages of the More Expensive Adjustable-Speed Motors in This Line of Work

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

SYNOPSIS.—Some of the factors which must be considered in determining the power required to drive given machine tools are discussed and the motor characteristics necessary for these conditions are outlined. Emphasis is placed upon the remarkable changes which have been wrought in the field of motor applications by the introduction of the adjustable-speed motor for machine-tool driving. Some of the limitations to the use of the constant-speed motor are outlined, and examples of cases are cited where there is an unquestionable advantage in the installation of the more expensive adjustable-speed motor with its special control equipment. Reference is made to the general classes of speeds employed and methods used in determining the horsepower rating of motors necessary for practical cases. The discussion is purposely carried out in a fundamental manner to serve as a groundwork for more detailed treatment of the subject which will be presented in a subsequent issue of the ELECTRICAL WORLD.

indicate respectively the maximum and minimum diameters of work to be handled by a lathe in a certain case. On the basis of the minimum cutting speed desired in the first instance and the maximum cutting speed desired in the second, the minimum and maximum

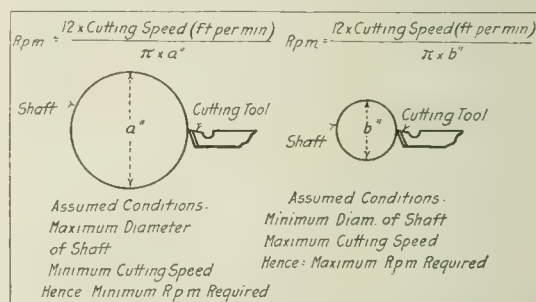


FIG. 1—EXAMPLE OF MOTOR-SPEED LIMITS WHICH MAY BE IMPOSED BY WIDELY VARYING SIZES OF WORK

revolutions per minute at which the spindle must be operated follow immediately.¹ In some cases the ratio of the maximum and minimum revolutions per minute may be relatively large, in fact, so much so that the ordinary adjustable-speed motor is not usually required to give this complete speed range without the addition of a back gear. Furthermore, in a machine which can accommodate such a wide range in diameters, many intermediate sizes of work are likely, with the corresponding necessity for intermediate revolutions per minute if the most economical cutting speeds are to be em-

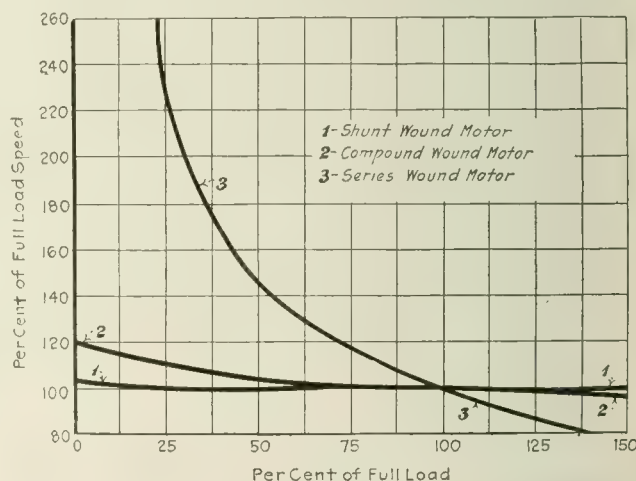


FIG. 2—TYPICAL SPEED-LOAD CURVES FOR SHUNT, SERIES AND COMPOUND MOTORS

played for each diameter. It follows, therefore, that adjustments for wide speed limits as well as for numerous intermediate speeds are often required, the latter being limited only by the variations in the sizes of

¹This point is to be discussed more in detail in connection with the operation of lathes, in a subsequent article, and hence is merely referred to here in a general manner by way of illustration.

CLASSIFIED according to speed, motors may be considered as falling in three classes, (a) constant-speed, (b) variable-speed, and (c) adjustable-speed machines. Classes (b) and (c), while clearly relating in turn to motors in which the speed falls off with increasing load owing to inherent characteristics of the motor, and to motors in which the speed may be adjusted over wide limits for given loads by external control, are terms which even now are used loosely in the machinery building trades. For example, there is a fairly prevalent custom of referring to the adjustable-speed motor as a variable-speed machine.

It is well to keep clearly in mind that the term "adjustable speed" means, in the ideal case, a motor which for a given adjustment of the controller operates at a constant speed for all loads, as it places the adjustable-speed motor in an entirely different class from the variable-speed-with-load motor.

Quite a few cases occur, where the machinery operates continuously at approximately constant speed, in which the constant-speed motor covers the needs of the case. Its advantages over mechanical driving methods then become almost altogether those due to the general points favoring electric drive in contrast with line-shaft and belt drive, as outlined in previous discussions of this phase of the subject.

It is perhaps well to note at this point that while direct-current constant-speed motors of the non-commutating-pole type may apparently be adapted to speed increments of, say, 50 or even 100 per cent above normal by ordinary field control, the magnetic saturation of the iron required for lower speeds and the poor commutation obtained at higher speeds limit the operation of such motors to relatively small ranges of speed. The characteristics of the variable-speed motor are so well known that they need not be referred to here, and particularly so because of the more or less special nature of its applications, some of which will be referred to in subsequent articles.

Consider, however, the two cases in Fig. 1, which in-

work being done on the particular machine tool in hand. The speed characteristics² necessary for such work are illustrated in Figs. 2 and 3.

Several years ago a prominent machine-tool expert made a statement (before the appearance of the adjustable-speed motor) to the effect that if a three to one speed-range motor should be developed and have no

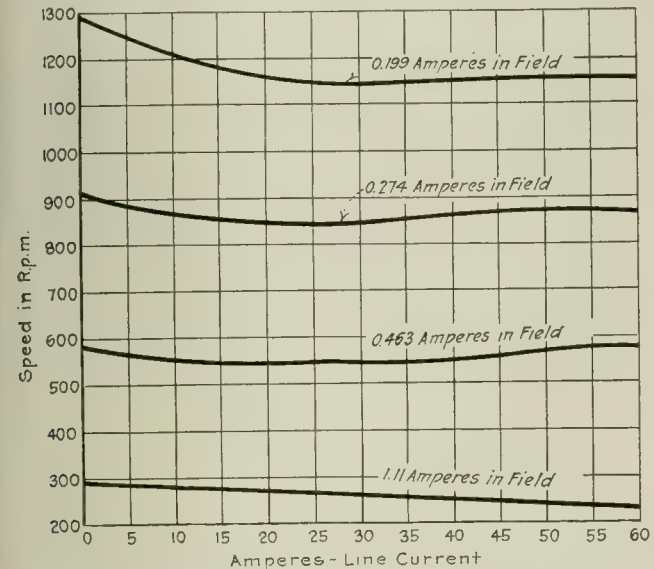


FIG. 3—SPEED-CURRENT INPUT CURVES FOR VARIOUS DEGREES OF EXCITATION IN ADJUSTABLE-SPEED MOTORS

greater variation than, say, 4 per cent in any part of the entire range of speeds and loads, a great step will have been taken toward the millennium of the machine-shop engineer, who is vitally concerned with cutting speeds. The curves in Fig. 3 show how near the modern commutating-pole, adjustable-speed machine has approached the ideal of constant speed with varying load for each given field current.

TORQUE CHARACTERISTICS

The duty cycle of typical machine tools, as shown by the record of a graphic meter, indicates the mechanical requirements of the load in terms of the electrical input to the motor. These records often show a marked peak at one or possibly several parts of the duty cycle, where relatively high torque is required to meet the requirements of the load. Considerably lower torque is required for the other portions of the cycle.

Consider Fig. 4, for example,³ which represents the approximate input current to a motor driving pipe-threading machinery. An excessive peak is evident near the center of the diagram and a relatively large demand for current occurred during the threading operation (to the right) compared with that during the facing and rounding-up operations (on the left). In general, therefore, the duty cycle of the driven machine, while it may be periodic, is both irregular and erratic.

In applying a motor to any given load where the duty cycle is irregular and where the mechanical demands on the motor are exceedingly variable throughout the cycle there is wide opportunity for a judicious selec-

tion of a motor which first of all shall be capable of meeting these mechanical demands effectively at each point in the cycle, and, second, for the use of a motor of the most economical size (see Fig. 5).

There has undoubtedly been an unfortunate tendency in the past to use motors which possess a higher horsepower rating than necessary. This may often be due in part to unwarranted emphasis upon the maximum or peak requirement during the cycle. Apparently a motor selected on a basis of the peak, and particularly if the peak be of a short-time duration, may be considerably larger than is required by the average demand and will hence represent an investment in excess of the actual requirements.

The solution in such a case depends on the determination of this average demand and then on the selection of a motor with a corresponding rating but which is capable of meeting the excess of the peak without exceeding its heating limits and commutation. It is very important in this connection to note that one of the principal advantages commonly assigned to the commutating-pole, adjustable-speed motor is its ability to supply high overloads for short periods with satisfactory commutation and, of course, it is assumed, without overheating.

On the basis given application engineers have grown accustomed to selecting a motor for a given duty cycle with a rating corresponding to the average demand, concluding that a certain percentage of overload during one or more periods of the duty cycle can be handled by the commutating-pole motor satisfactorily. It has been explained, however, by A. C. Lanier (see footnote 2) that there is a definite limiting current intake for a commutating-pole motor beyond which the uncompensated voltage causes objectionable sparking.⁴

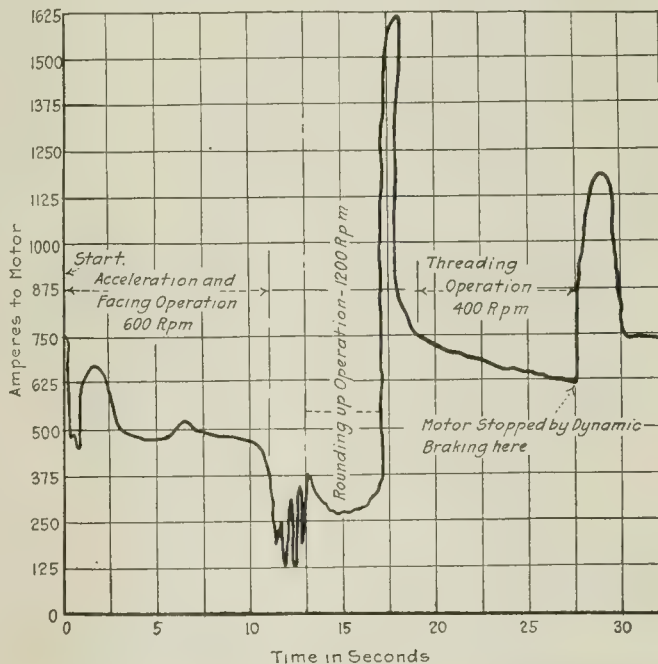


FIG. 4—DUTY CYCLE OF MOTOR DRIVING PIPE-THREADING MACHINERY

Hence it follows that the overload values of which the commutating-pole motor is capable have definite limits, as in the case of the older non-commutating-pole machines. Even if these limits are higher in the modern

²Fig. 2 is based on a discussion by A. C. Lanier, *Transactions A. I. E. E.*, Vol. 34, p. 177, and Fig. 3 on an article by the author in the *American Machinist*, Vol. 41, No. 19 (1914), p. 803. See also an article by the author, *American Machinist*, Vol. 41, No. 12, p. 491.

³From discussion by E. A. Lof, *Transactions A. I. E. E.*, Vol. 34, p. 767.

⁴To be discussed more fully in a subsequent article dealing with the electrical features of machine-tool motors.

types, the fact that they are definite makes it unusually important for the application engineer to exercise due care in his allowances for the excess loads which may be thrown onto the motor.

Although caution has just been suggested in the degree of overloads imposed on the adjustable-speed motor, good engineering dictates the use of the allowable

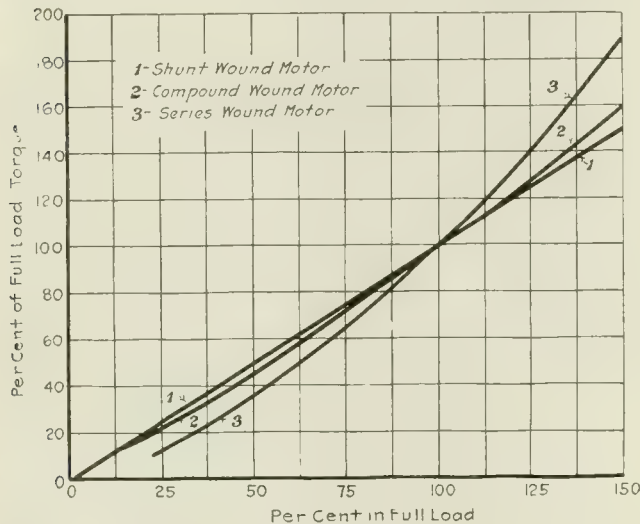


FIG. 5—TYPICAL TORQUE-LOAD CURVES FOR SHUNT, COMPOUND AND SERIES MOTORS

overloads up to the limits of good commutation and normal heating in the numerous cases where the average load requirements throughout the duty cycle are much below the few peaks which may occur in each cycle. The marked tendency, found in practical cases, to employ motors larger than necessary is shown graphically in Fig. 6. These examples are selected from figures of various authorities and merely indicate how undesirable this practice may become if it is not properly watched by those in a position to make a suitable selection of motor type and rating for the individual cases which arise almost continuously in the average plant.

HORSEPOWER DETERMINATIONS

As shown by Fig. 4, the actual current intake by a motor involved varies over a considerable range and the different values of current obtain for different time intervals. The problem, then, is to determine the rating of the motor which will be capable of supplying the various mechanical loads throughout the repeated duty cycle.

Several methods have been suggested for this determination, taking into account the variations of the load, and these will now be outlined briefly so that they may be used in the subsequent treatments of specific motor applications. Obviously, the horsepower rating depends on the heating produced by the varying current throughout the cycle. The two methods suggested here are based on a comprehensive discussion of direct-current motors for industrial applications⁵ by A. C. Lanier.

Method I.—If the motor is subject to a well-defined cycle which goes through more or less regular repetitions, the losses in the motor will consequently vary

throughout the cycle, and hence the heating and cooling rates. From these facts as a starting point it would be possible to plot a curve resulting from separate elements of individual heating and cooling curves as the current assumed higher or lower values during the cycle. Then the ultimate temperature of a given motor under consideration might be determined. However, it has been shown that when the load throughout the cycle does not vary over an unduly large range or where the time intervals of successive current demands are short the average value of the losses during the total working time may be used as the basis for the determination of the horsepower rating of the motor to use. In such cases that motor may be selected (as far as its horsepower is concerned) whose temperature rise for a like value of losses does not exceed safe limits throughout the total working period.

Method II.—Because of the difficulties so often encountered in securing a definite idea of the true duty cycle, and, moreover, where ordinary conditions of work make it unwise to attempt undue accuracy on account of irregularities which are so likely to arise, the root-mean-square value of horsepower may be taken as the basis of the rating to select.⁶

Abbreviating the term root-mean-square horsepower as r.m.s.h.p., the following equation may be written:

$$\text{r.m.s.h.p.} = \sqrt{\frac{\sum (\text{hp}_1 \times t_1 + \text{hp}_2 \times t_2 + \dots)}{t_1 + t_2 + \dots + \text{periods of rest}}}$$

where the r.m.s.h.p. is seen to be the result found by multiplying the hp. for one interval, throughout which this value of hp. may be considered constant, by the time t of the interval. This process is repeated for each part of the duty cycle, and all these products are added. This sum is then divided by the total time of the duty cycle including rest periods. The square root of this result is the desired value of the r.m.s.h.p.

Based on the horsepowers of various motors of the type to be used for different operation intervals and under approximately the same thermal conditions as those to be experienced in the given duty cycle, a choice may be made of the horsepower rating of the motor to be employed for the given case.

The above considerations demonstrate that the adjustable-speed motor has filled an unusually important place in the motor-application field. It is proposed,

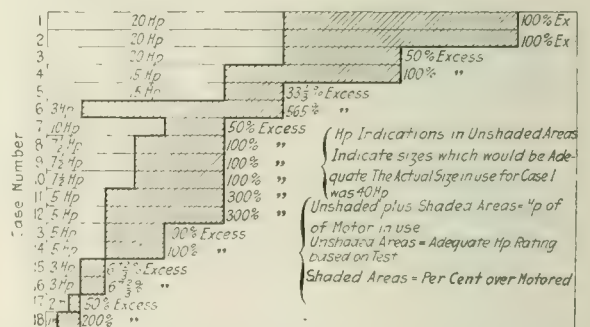


FIG. 6—TENDENCY TO OVER-MOTOR IN INDUSTRIAL PLANTS

moreover, in a subsequent discussion to give this point still greater emphasis on a basis of the economic advantages which it affords in many practical cases.

⁵A. C. Lanier, *Transactions A. I. E. E.*, Vol. 34, p. 191. The reader will also find Mr. Lanier's treatment of motor heating and ventilation beginning on page 188 of this same reference a most interesting discussion bearing on this phase of the subject

⁶Mr. Lanier qualifies the general use of this method by suggesting that it is most applicable to motors with relatively flat efficiency curves.

Service Extension Problems in California

Electric Utilities Must Pay Cost Within Corporate Limits When Acting Under General Franchise Unless Burdensome—For Rural Work No Rule Exists

BY JAMES F. POLLARD

Assistant Electrical Engineer California Railroad Commission

A PERPLEXING problem constantly confronting electric utility management is to determine where to draw the line between extensions of distribution facilities that should be constructed at the company's expense and those for which the consumer should pay all or a part of the cost of installation.

A discussion of this question by representatives of several central station companies in Ohio, as reported in a recent issue of the *ELECTRICAL WORLD*, seems to indicate that the general practice in that State is to require prospective residence lighting consumers to advance all of the cost of the necessary extension in excess of a stated sum per consumer. This sum varies as between companies from \$15 to \$25.

POLICY FOLLOWED BY CALIFORNIA COMPANIES

Apparently a somewhat more generous policy in this regard has been followed by most of the companies in California. Since the public utilities act became effective in that State, about four years ago, this matter has been subject to regulation by the California Railroad Commission. Theretofore some of the companies had established a more or less general policy as to extensions. They would build at their own expense extensions to serve business which promised a gross revenue of 33 1-3 per cent of the local investment in new lines and equipment. Some division of costs was required if the revenue was expected to be less than that.

In a city where the average consumer's bill is \$1.50 per month, for instance, an extension required to serve a residence of normal size would result in an annual gross revenue of about \$18, and the serving company would agree to make such an extension at its own expense for a consumer of this class up to a cost of \$54.

It must be recognized that the application of any policy of this kind will not be equitable in all cases, inasmuch as the annual cost of the service to a given consumer is not a direct function of the cost of the local investment.

There are other governing factors which remain constant whether a long line extension or a short one be required to reach the consumer's plant, as, for example, the fixed charges on generating capacity required to serve a given load and the cost of meter reading, billing and other office expense. The only factors which are in direct relation to the local investment are the interest, depreciation and maintenance thereof.

The California Railroad Commission early found it necessary to consider this question as well as a number of others leading to the establishment of uniform practices among the ninety-odd electric companies in the State. After extended investigations and hearings the commission rendered its decision in these matters on Nov. 5, 1915. Its ruling deals with the question of extensions as classified under two divisions, viz., those within incorporated territory and those in rural districts.

Cases covered by the first of these classes are governed by the following rule:—

"A water, gas, electric or telephone utility which operates under a general franchise authorizing the occupancy of all the streets of a municipality shall make, at its own expense, such street extensions as may be necessary to serve applicants; provided, that in any case in which the construction of an extension at the utility's sole cost will in its opinion work an undue hardship upon the utility or its existing consumers the matter may be submitted to the commission as provided by Section 36 of the public utilities act, unless satisfactorily adjusted by an informal application to the commission."

In making this rule the commission recognized the obligation of a utility which enjoys a general franchise within a municipality to serve adequately all of the inhabitants of that municipality unless very unusual circumstances make the discharge of this obligation an unreasonable hardship, in which event the burden of the proof that such circumstances exist is placed upon the utility.

In general, where the boundaries of the municipality are not spread out to unreasonable limits, the saturation of load on the lines in the more populous sections of the city furnishes adequate compensation to the utility for the less remunerative extensions in the outskirts.

The territory included within the corporate limits of some cities in California has been artificially expanded on account of real estate "booms" and through similar causes, so that the indiscriminate extension of facilities in the sparsely settled suburbs is entirely out of the question. The Railroad Commission has indicated its readiness to relieve a utility from the obligation imposed by this rule in any municipality where the existence of such a condition can be established.

The question of service extensions in unincorporated territory is not so susceptible to a definite general ruling, and the commission has practically left this open for decision after special consideration of the conditions surrounding each individual case.

RURAL CONDITIONS IN THE STATE

California's rural conditions are materially different from those in most of the Eastern States, in that there are many vast tracts of land suitable for agricultural development as yet unused except for cattle or sheep ranges. And even in the districts where the land is under cultivation the holdings are in larger units than is commonly the case in the East, so that the problem of delivering electric service to the ranchers is not very attractive to the utilities on account of the long lines which must be constructed to serve comparatively few.

Under these conditions, in dealing with the subject of extensions in rural territory, the commission made a separate ruling to the effect that the electric utility

"shall make such reasonable extensions in unincorporated territory at its own expense as it can agree upon with the applicant for service," with the further provision that in cases where an agreement cannot be reached the matter may be decided by the commission.

A great deal of agricultural land in the State requires irrigation, and a large portion of such land is supplied with water from underground sources through electrically driven pumps. The average plant, ranging from 5 hp. to 15 hp., is sufficient to water from 40 acres to 80 acres. Such districts are usually well covered with distribution networks ranging in potential from 2000 volts to 11,000 and 15,000 volts.

Requests for further extension of these systems involve considerations as to whether the immediate net result will be a financial loss to the company, and if this appears to be the case, whether the availability of electric service will foster development which may be expected to result in enough future business to warrant the company in assuming the burden of the prospective loss during the development period.

The first of these considerations is, of course, of interest to the public as well as the utility, inasmuch as it will eventually have an effect upon the rates to all consumers served by the company in question. It cannot be correctly answered, therefore, without a knowledge of the general condition of all of the company's business. If the utility is serving any considerable territory that is densely populated, and therefore very profitable, and if its business as a whole is netting a fair return on its capital invested, it may be reasonably expected to make many more unattractive extensions than would a company in a less favorable condition.

BASING RATES ON AVERAGE CONDITIONS

The principle which must be constantly borne in mind is that public utility rates must perforce be predicated upon average conditions. Therefore, the utility's obligation to serve adequately the territory which it occupies requires it to make some extensions which are expected to result in a net revenue more or less below the average, so long as there are reasonable prospects of taking on at the same time other business at returns considerably greater than the average.

Oftentimes a utility manager contends that he should not be expected to make a given extension, because it will not bring in some specified net return, as, for example, 8 per cent on the local investment. He bases his argument on the fact that the commission in some previous proceeding has indicated this to be a fair return to be used for general rate-fixing purposes on his system. If this line of reasoning were accepted, the obvious outcome would be that the utility would never take any business below this figure. Unquestionably much of its new business would bring a higher return, and the net result would be a total earning considerably greater than the commission had found to be proper.

What, then, is the lowest limit of return to which a utility may be reasonably expected to go in considering unprofitable extensions?

It has been suggested that if a given extension will just carry its own cost, and if its addition will not result in any actual loss, it is entirely proper to expect the utility to build it, the following items being those which should be considered as making up this cost:

(a) Interest on the investment in the extension

itself, at the average rate which the utility finds itself compelled to pay for borrowed capital.

(b) Depreciation, computed on the sinking-fund basis and with regard to the average life of the class of material used in the extension.

(c) Average maintenance costs on this class of equipment.

(d) Consumer costs, which may be taken as the average expense per consumer of reading meters, keeping accounts, billing and collecting.

(e) Taxes (in California they are 5.6 per cent of the gross income).

(f) Energy cost, based on the estimated amount of consumption which the new business will require at the bare cost to the company of delivery to its network.

If the total of these items of annual expense is just equal to the estimated annual gross revenue, the utility will at least suffer no loss and be in no worse position if it takes on the business in question than if it refuses to do so. There is, of course, a limitation in connection with such a scheme. If forced to take an absurd preponderance of such business, the amount of money invested without profit might become excessive as compared to the stockholders' equity, upon which a reasonable profit is entirely proper. The fact should be borne in mind, however, that it can reasonably be assumed that sufficient profitable business will be added at the same time to offset this feature. Where the above method of figuring extensions is employed due regard must in each case be given to future development.

In some instances, even though the prospective revenue is so low as clearly not to justify the utility in extending its lines at its own expense, the service is of such a value to the consumer that he is willing to assume a part or all of the burden of installing the necessary facilities. This may be done in several ways:

1. The consumer may advance all or a part of the cost of the extension and either retain ownership in the line or turn it over to the company. In the latter event it is customary to reimburse the consumer by means of a discount of his bills during a definite pre-arranged period of time or until the line is paid for.

2. The consumer may guarantee to the company a revenue over and above that which he would normally be expected to pay and which is at least equivalent to that outlined in the above cost of service. In this case the lines are built at the company's expense.

3. It has been suggested, though the writer has never known this suggestion to be carried out, that the consumer might be required to give some satisfactory bond which would guarantee a fair return on the company's investment during the life of the service and would save it from loss due to the cost of installing and removing the service equipment, together with any abnormal depreciation in the value of the material in the event that the extension is abandoned at any time before these expenses have been absorbed through the normal depreciation and amortization funds.

In connection with the first of these methods, if the consumer's advance is to be refunded as a percentage of his monthly bills, the question often arises as to the rate at which such refunds shall be made. A convenient rule to follow in this regard is to discount the consumer's bills by the same percentage that the gross revenue from the extension bears to its original cost.

Another frequent cause of dispute between electric

companies and their consumers is as to whether the utility must extend its lines across private property. A recent ruling of the Supreme Court which appears to have a bearing on this problem is to the effect that a railroad spur track which was required for the sole service of a single shipper and was on private property was not part of the railroad's public service.

If, however, a service line on private property may be extended and used for the service of other consumers, and if the utilities' ownership therein is protected by proper right-of-way grants, other considerations being favorable, it would seem to be of essentially the same status as a line along a public highway, and it is frequently so considered.

The utilities law existing in the State of Ohio specifically provides that a valuation for rate-fixing purposes must be made on the basis of reproduction new at the time of the rate investigation. Under these circumstances expensive extensions constructed at the present time might be materially discounted for rate-fixing purposes when prices have returned to normal.

This condition does not exist in California. The public utilities act there does not prescribe a definite basis for valuations, but leaves this to the discretion of the commission. Its decisions have clearly indicated that it will consider the actual investment in cases where this can be determined and where it was made in good faith and with reasonable business judgment.

Effects of Unsymmetrically Spaced Conductors

Unbalanced Loads Cause More Voltage Unbalance in Four-Wire Star-Connected Circuits Than in Three-Wire Delta-Connected Circuits—Single-Phase Regulators, Transposition of Conductors, Etc., Are Remedies

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WHEN the conductors of three-phase circuits are supported equidistant from each other and the load is balanced between the phases the voltage drops between the conductors are equal. However, the conductors of most distribution lines are not arranged in the form of an equilateral triangle, and the load is not always balanced between phases, so that the conditions are quite different. In this article, therefore, the author will call attention to some of the practical effects of unbalanced loads and unsymmetrical spacing of conductors on the voltage drop in distribution lines. Since the effect of electrostatic capacity on low-voltage lines is negligible, it will be disregarded.

From the examples given in the following text it may be noted that there is less unbalance in actual voltage caused by the unbalanced loads and unsymmetrical conductor spacing on a three-wire delta-connected three-phase circuit than on a four-wire star-connected circuit similarly loaded. However, there is a greater unbalance in the phase angles between voltages with the three-wire circuit. The drop in the neutral wire in a four-wire circuit is such as to increase the load voltage on the phase having the smallest load and decrease that on the phase having the greatest load. Moreover, the load currents in three-wire circuits combine to produce line currents which are less unbalanced than the load currents. Consequently greater care must be taken to keep the load on four-wire circuits balanced between phases. If it is impossible to obtain an approximate balance, the position of the several phase wires with respect to the neutral and the direction of phase rotation should be considered, since balanced voltages may be obtained even with unbalanced load. It is theoretically possible so to arrange conductors that balanced voltages may be obtained with any degree of unbalanced load, but this, of course, is impracticable.

If reasonable care is taken to balance the load, the unbalance in voltage caused by placing the phase conductors on the middle and end pins of standard N. E. L. A. six-pin cross-arms is not enough to be seri-

ous for conductors not larger than No. 2 copper. Phase conductors larger than No. 2, however, should preferably be placed on adjacent pins, since the larger ratio of reactance to resistance of large conductors makes the unbalance in voltage greater. The difference in voltage drop in the several phases may be overcome by the use of single-phase regulators, each properly compensated, including a compensator for the neutral wire of four-wire circuits. One or more banks of transformers connected to the circuit and delta-connected on the secondary side will also provide an approximate voltage balance, but the transformers must have sufficient capacity to carry the necessary circulating current in addition to their normal load current without heating. Transposition of conductors will also assist in balancing the load voltages. Regardless of what is done to offset the ill effects of unsymmetrically spaced conductors, the effective resistance and reactance of each conductor in a circuit will vary with each change of current in the conductors.

To demonstrate these facts, the formulas used in deriving the reactance drop, etc., will be presented first and then some typical problems will be solved.

The inductive reactance per wire per 1000 ft. (304 m.) of a single-phase, 60-cycle circuit may be determined from the following formula:

$X = 0.05275 \log_{10} (D - r)/r + 0.00573$, where X = ohms per wire per 1000 ft., D = distance between centers of conductors, and r = radius of conductor (both same size). The variation of inductive reactance with different spacings between conductors is shown graphically by Fig. 1 for No. 6, No. 2 and No. 2/0 copper wires.

The formula above and the curves in Fig. 1 apply also to three-phase lines if the load is balanced between the three phases, and, further, if the conductors are equidistant from each other. However, the conductors of most distribution lines are not arranged in the form of an equilateral triangle, and the loads on many of them are not balanced between phases.

Consider the three conductors *A*, *B* and *C* in Fig. 2, at distances D_{ab} , D_{bc} and D_{ca} apart and carrying currents I_a , I_b and I_c respectively. The conductors will all be considered the same size, having radius r . If conductors *A* and *B* were part of a single-phase circuit, the current in *A* would be equal and opposite to that in *B* ($I_a = -I_b$) and the reactance of each conductor would be equal to that of the other. Since conductors *A*, *B* and *C* make up a complete circuit, any two of them may

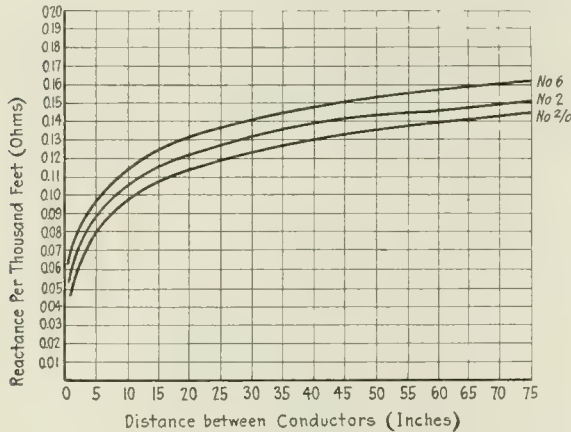


FIG. 1—UNIT REACTANCE OF DIFFERENT-SIZE CONDUCTORS WITH DIFFERENT SPACINGS

be considered returns for the third, and $I_a = -(I_b + I_c)$; $I_b = -(I_a + I_c)$, and $I_c = -(I_a + I_b)$.

The reactance of conductor *A* with respect to conductor *B* will be denoted by X_{ab} ; of *B* with respect to *C* by X_{bc} , and of *C* with respect to *A* by X_{ca} . The reactance drop in conductor *A* is the vectorial sum of the portion of its current which flows in *B* times the reactance between *A* and *B* ($-I_b X_{ab}$), and the portion of its current which flows in *C* times the reactance between *A* and *C* ($-I_c X_{ca}$). That is the reactance drop in conductor *A* is $I_a X_a = -(I_b X_{ab} + I_c X_{ca})$. Similarly $I_b X_b = -(I_a X_{ab} + I_c X_{bc})$ and $I_c X_c = -(I_a X_{ca} + I_b X_{bc})$.

From formula (1), $X_{ab} = 0.05275 \log 10(D_{ab} - r)/r + 0.00573$; $X_{bc} = 0.05275 \log 10(D_{bc} - r)/r + 0.00573$; $X_{ca} = 0.05275 \log 10(D_{ca} - r)/r + 0.00573$.

Obviously the number of conductors may be increased at will, and the reactance drop in any of them may be determined in the same way regardless of inequality of currents, or their phase angles, or unequal spacing of conductors.

APPLICATION OF PRINCIPLES

Problem I.—Consider first a circuit 3 miles (4.8 km.) long consisting of three No. 2 copper conductors with a 36-in. (91.4-cm.) equilateral triangular spacing and a balanced load of 26.7 amp. per phase (46.2 amp. per line), with 2300 volts at the generator end and a power factor of 0.80 (see Fig. 3).

The resistance of each conductor is 2.69 ohms and its reactance 2.14 ohms. Since the load is balanced and the conductors are symmetrically spaced, the drop in each of the three conductors will be the same. The load voltage on any phase is 2025, and the voltage drop is 12 per cent of the generator voltage, as may be found by any of the usual methods of calculating line drop.

Problem II.—Consider now the same circuit as in Problem I, with the same total load, but with one-third less current in one phase than in either of the other two (see Fig. 4).

The problem can be solved by using complex quantities, and the small phase difference between the generator voltages and the corresponding load voltages will be disregarded (viz., E_{ab} considered in phase with $E_{a,b}$, etc.). Assuming a vertical line of reference, $E_{ao} = 1328 + j0$ $I_{a,b} = 29.8 - j3.6 = (30 \text{ amp.})$
 $E_{bo} = -664 - j1150$ $I_{b,c} = -12.0 - j16.0 = (20 \text{ amp.})$
 $E_{co} = -664 + j1150$ $I_{c,a} = -11.8 + j27.6 = (30 \text{ amp.})$

$$I_{aa'} = I_{a,b} + I_{a,c} = 41.6 - j31.2 = (52.0 \text{ amp.})$$

$$I_{bb'} = I_{b,c} + I_{b,a} = -41.8 - j12.4 = (43.6 \text{ amp.})$$

$$I_{cc'} = I_{c,a} + I_{c,b} = 0.2 + j43.6 = (43.6 \text{ amp.})$$

$$E_{aa'} = (41.6 - j31.2)(2.69 + j2.14) = 179 + j5$$

$$E_{bb'} = (-41.8 - j12.4)(2.69 + j2.14) = -86 - j123$$

$$E_{cc'} = (0.2 + j43.6)(2.69 + j2.14) = -93 + j118$$

$$E_{a,o'} = E_{ao} - E_{aa'} = 1149 - j5$$

$$E_{b,o'} = E_{bo} - E_{bb'} = -578 - j1027$$

$$E_{c,o'} = E_{co} - E_{cc'} = -571 + j1032$$

$$E_{a,b'} = E_{a,o'} + E_{b,o'} = 1727 + j1022 = 2007 \text{ volts}$$

$$E_{b,c'} = E_{b,o'} + E_{c,o'} = -7 - j2059 = 2060 \text{ volts}$$

$$E_{c,a'} = E_{c,o'} + E_{a,o'} = -1720 - j1037 = 2008 \text{ volts}$$

$$\text{Average} \dots\dots\dots = 2025 \text{ volts}$$

The average voltage drop is 12 per cent of generator voltage as in Problem I, but the drop in phases *ab* and *ca* is 12.7 per cent, while that in phase *bc* is 10.4 per cent. The maximum unbalance in load voltage is 1.7 per cent from the average. One line (star) current is 20 per cent greater than the other two, while two load (delta) currents are 50 per cent greater than the third.

Problem III.—Consider now the same line and load as in Problem I, but with a flat spacing of $14\frac{1}{2}$ in. (36.8 cm.) between the middle and either outside conductor, as would be the case if the circuit were placed on one end of a N. E. L. A. standard six-pin cross-arm (see Fig. 5).

The reactance of each of the circuits *ab* and *bc* is 1.80 ohms, while that of *ac* is 2.05 ohms. Using the same axes as in Problem II.

$$I_{aa'} = 37.0 - j27.7 \quad E_{aa'} = 161 - j9$$

$$I_{bb'} = -42.5 - j18.1 \quad E_{bb'} = -82 - j125$$

$$I_{cc'} = 5.5 + j45.8 \quad E_{cc'} = -75 + j124$$

$E_{a,b'} = 2032 \text{ volts}$, $E_{b,c'} = 2052 \text{ volts}$, $E_{c,a'} = 2029 \text{ volts}$, an average of 2038 volts.

It should be noted that the resistance and reactance of the middle wire are the same as for equilateral-triangle construction. The equivalent resistance and reactance of the two outside wires may be found by dividing the voltage drops ($E_{aa'}$ and $E_{cc'}$) by the respective currents, which gives the following for the

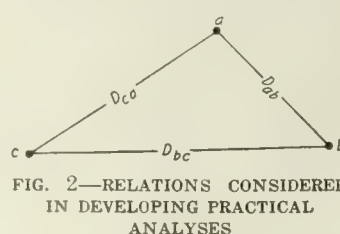


FIG. 2—RELATIONS CONSIDERED IN DEVELOPING PRACTICAL ANALYSES

equivalent impedances of the several conductors: $Z_a = 2.91 + j1.94$; $Z_b = 2.69 + j1.80$, and $Z_c = 2.47 + j1.94$. The non-symmetrical arrangement operates to increase the resistance of the con-

ductor which carries the current, leading that in the middle conductor by 0.22 ohm, and decreasing that of the third conductor by the same amount. This is due to transformer action between the two circuits formed by the middle wire and either of the two outside wires. The effect is independent of the size of conductors and also of their spacing, so long as the middle one is midway between the other two and amounts to

0.073 ohm per mile (0.045 ohm per km.) for 60-cycle circuits. The maximum unbalance in load voltage with balanced currents is 0.7 per cent from the average.

Problem IV.—Next consider the same line and load as in Problem III, but with two of the conductors placed on the middle and end pin of one end of a standard N. E. L. A. six-pin cross-arm, and the third on the middle pin on the other end, leaving the two-pole pin positions for series circuits (see Fig. 6).

Reactance of circuit ab (separation 14.5 in., 36.8 cm.) = 1.80 ohms; reactance of circuit bc (separation 59 in., 124.5 cm.) = 2.32 ohms; reactance of circuit ca (separation 73.5 in., 186.4 cm.) = 2.40 ohms.

Solving the problem in the same manner as before, it is found that $E_{a,b} = 2038$ volts; $E_{b,c} = 2036$ volts; $E_{c,a} = 1994$ volts, an average of 2023 volts. The equivalent impedance of each conductor, as found by

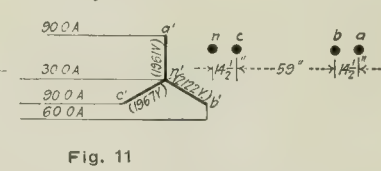
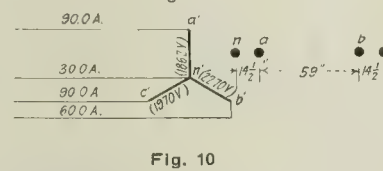
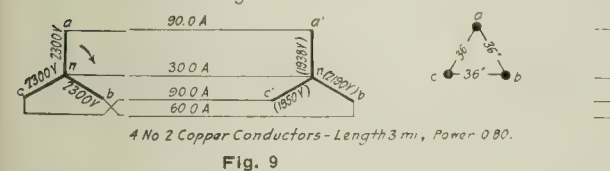
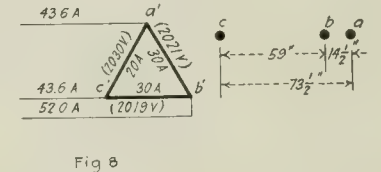
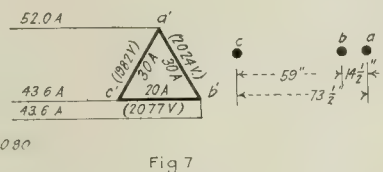
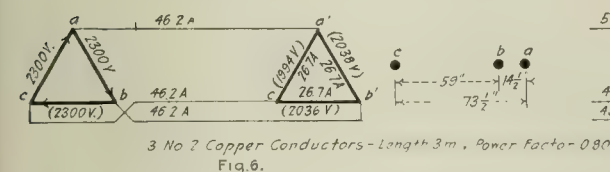
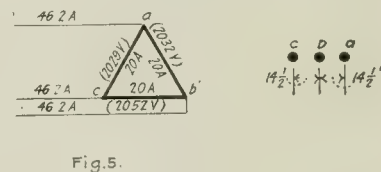
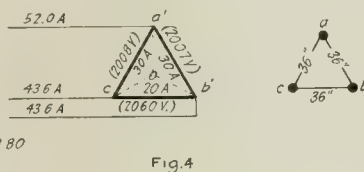
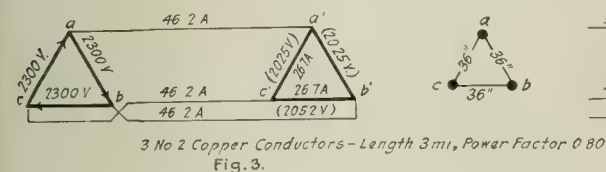
their respective currents. The maximum unbalance in load voltage is 2.3 per cent from the average with a maximum unbalance in load current of 25 per cent and in line current of 12 per cent from the average.

Problem VI.—Suppose the 20-amp. load on phase b,a , and the 30-amp. load on phase c,a , of Problem V are interchanged, and all other conditions are left as in Problem VII (see Fig. 8).

Solving, $E_{a,b} = 2021$ volts $Z_a = 3.26 + j1.97$
 $E_{b,c} = 2019$ volts $Z_b = 2.34 + j2.06$
 $E_{c,a} = 2030$ volts $Z_c = 2.62 + j2.32$
 Average = 2023 volts Average = $2.74 + j2.12$

By transferring one-third of the load from phase $c'a'$ to $b'c'$ the maximum unbalance in load voltage is reduced from 2.3 per cent to 0.3 per cent of the average.

Problem VII.—Next consider a four-wire star-connected circuit with 2300 volts between phase wires and



FIGS. 3 TO 11—SEVERAL PRACTICAL EXAMPLES OF UNSYMMETRICALLY ARRANGED CONDUCTORS CONSIDERED IN DETERMINING UNBALANCING EFFECT

dividing the complex expression for the drop by the corresponding current, is: $Z_a = 3.21 + j2.09$; $Z_b = 2.24 + j2.07$; $Z_c = 2.62 + j2.36$, an average of $2.69 + j2.17$.

The average equivalent resistance is found to be equal to the actual resistance of each conductor, and the average equivalent reactance is equal to the average of the reactances of the three pairs of conductors, since the load is balanced. The maximum unbalance in the load voltage with balanced current is 1.4 per cent from the average.

Problem V.—Consider now the same load as before, but unbalanced as in Problem II and with the conductors spaced as in Problem IV (see Fig. 7).

Solving, $E_{a,b} = 2024$ volts $Z_a = 3.09 + j2.09$
 $E_{b,c} = 2077$ volts $Z_b = 2.18 + j1.91$
 $E_{c,a} = 1982$ volts $Z_c = 2.62 + j2.37$
 Average = 2028 volts Average = $2.63 + j2.12$

In this case the average equivalent resistance is not equal to the actual resistance of either conductor since the load is not equally divided between the conductors. However, the apparent increase in resistance of conductor A, multiplied by the square of the current flowing in it, must equal the sum of the apparent decrease in resistance in B and C multiplied by the squares of

neutral and the same conductor spacing as in Problem II, with the neutral wire at the center of the 36-in. (91.4-cm.) equilateral triangle.

Since the line voltage is $\sqrt{3}$ times that in Problem II, the currents will be made three times the corresponding previous currents in order to make corresponding line drops, since the capacity of a power line varies as the square of the line voltage (see Fig. 9).

The reactance of each pair of phase conductors is 2.14 ohms, while that of each phase conductor with respect to the neutral is 1.94 ohms. Solving, $E_{a,n} = 1938$ volts; $E_{b,n} = 2190$ volts; $E_{c,n} = 1950$ volts, an average of 2026 volts. The average drop is the same as in Problem II, but the maximum unbalance in load voltage from the average is 8.1 per cent instead of 1.7 per cent.

If the neutral wire were of No. 6 instead of No. 2 copper, the load voltages would be: $E_{a,n} = 1846$ volts; $E_{b,n} = 2294$ volts; $E_{c,n} = 1960$ volts, an average of 2033 volts. The average load voltage is slightly larger than before, and there is practically no drop in the B phase; however, the maximum unbalance is 12.8 per cent.

Problem VIII.—Consider now the same line and load as in Problem VII, but with the conductors placed on the two end and middle pins of a standard N. E. L. A.

six-pin cross-arm with the neutral on an end pin (see Fig. 10).

Solving, $E_{a'n'} = 1862$ volts	$Z_a = 3.02 + j2.21$
$E_{b'n'} = 2270$ volts	$Z_b = 2.02 + j1.89$
$E_{c'n'} = 1970$ volts	$Z_c = 2.48 + j2.28$
	$Z_n = 4.40 + j1.58$
Average = 2034 volts	Average = $2.98 + j1.99$

The average load voltage is slightly more than with the triangular spacing, but the maximum unbalance is 11.5 per cent. The average equivalent resistance is 11 per cent more than the actual resistance of one conductor. The maximum unbalance in both load and line current is 25 per cent from the average. The load currents in the three-wire delta circuit combine in such a way that the line currents are only half as much unbalanced as the load currents, and this is one reason for

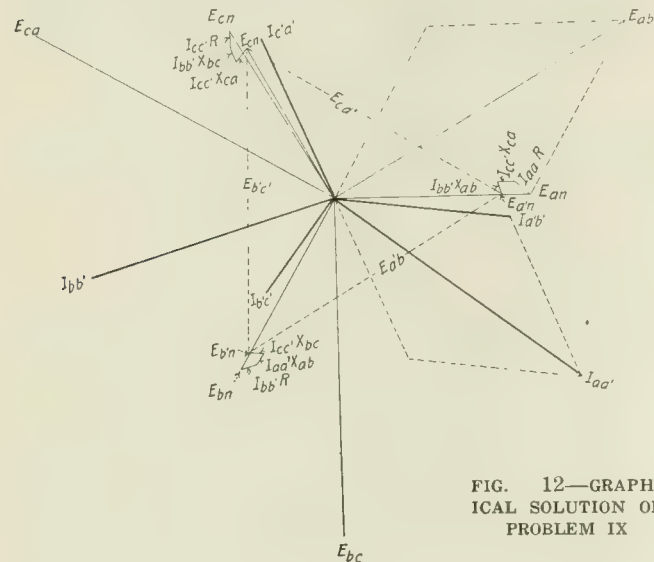


FIG. 12—GRAPHICAL SOLUTION OF PROBLEM IX

the greater unbalance of load voltage on the four-wire circuit. Another reason for this greater unbalance will appear later.

Problem IX.—Reverse the phase rotation of the conductors in Problem VIII and leave all other conditions the same as before (see Fig. 11).

Solving, $E_{a'n'} = 1961$ volts	$Z_a = 2.90 + j2.28$
$E_{b'n'} = 2122$ volts	$Z_b = 3.36 + j1.89$
$E_{c'n'} = 1967$ volts	$Z_c = 2.35 + j2.21$
	$Z_n = 1.00 + j1.58$
Average = 2017 volts	Average = $2.40 + j1.99$

The average load voltage is slightly less than before, but the maximum unbalance is only 5.2 per cent from the average. Thus the unbalance in load voltage was reduced by one-half by reversing conductors A and C with respect to the generator.

A graphical method of treating the problems which have been solved by use of the complex quantity will now be considered. Fig. 12 gives a graphical solution of Problem V.

First the generator star voltages (E_{an} , E_{bn} and $E_{cn} = 1328$ volts) are drawn to scale at angles of 120 deg. apart. The loads on three-wire circuits are usually delta-connected, so the star voltages will be combined to produce the delta voltages ($E_{ab} = E_{an} - E_{bn}$, etc.). Since the power factor of the load is 0.80 lagging, current $I_{a'b'}$ is drawn at an angle of $36^\circ 52'$ ($\cos 36^\circ 52' = 0.80$) behind the corresponding voltage E_{ab} , etc. This current should actually be shown at angle $36^\circ 52'$

behind voltage $E_{a'b'}$, but since the latter voltage is unknown, the currents will be referred to generator voltages instead of load voltages, and the resulting error will be inappreciable. The load currents must then be combined into the line currents ($I_{aa'} = I_{a'b'} - I_{a'c'}$, etc.).

First consider the drop in conductor A. The resistance drop ($I_{aa'}R$) must be subtracted from generator voltage (E_{ab}); therefore it must be drawn exactly opposite in phase to current $I_{aa'}$, and equal to 52.0×2.69 , or 140 volts. The reactance drop is made up of two components, since the current returns through two conductors located at unequal distances from the one

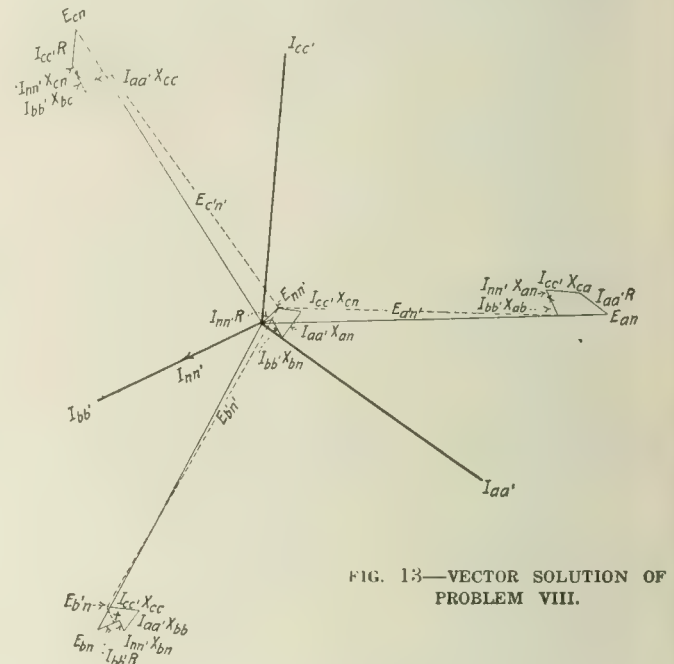


FIG. 13—VECTOR SOLUTION OF PROBLEM VIII.

considered. The reactance of the circuit formed by conductors A and B is 1.80 ohm, so the drop in A due to the part of its current which returns through B ($I_{bb'}X_{ab}$) is $46.2 \times 1.80 = 83.2$ volts. Since the current in A is in the opposite direction to its return current in B, and reactance drop lags 90 deg. behind the current producing it, the vector representing the reactance drop in A ($I_{bb'}X_{ab}$) of the current $I_{bb'}$ must be drawn 90 deg. ahead of the current $I_{bb'}$. In the same way the reactance drop in A due to the part of its current returning through C ($I_{cc'}X_{ca}$) equals $46.2 \times 2.40 = 111$ volts, leading current $I_{cc'}$ by 90 deg. The vector for voltage $E_{a'n'}$ has now been found. In the same way the voltage drops in conductors B and C and the resulting load star voltages $E_{b'n'}$ and $E_{c'n'}$ may be found. The load voltages $E_{a'b'}$, $E_{b'c'}$, and $E_{c'a'}$ may then be measured to scale from the drawing.

Fig. 13 gives a similar vector solution of Problem VIII, the various vectors being computed and drawn exactly as before except that the work is somewhat more complicated by the addition of the current in the fourth or neutral wire. To find the effective resistance and reactance of each conductor a line is drawn from $E_{b'n'}$ perpendicular to $I_{bb'}R$. The distance from $E_{b'n'}$ to the point of intersection X will then be the equivalent resistance drop, and the distance from $E_{b'n'}$ to the point of intersection (X) will be the equivalent reactance drop. The resistance and reactance drops measured to scale divided by the current give the equivalent resistance and reactance.

War Means Close Co-operation with Government

Under Present Conditions Government Finds It Absolutely Necessary to Deal
with Each Industry as an Organized Unit—Electrical
Manufacturing in the Future

BY CLARENCE L. COLLENS, II.

President Electric Power Club

FOREWORD.—Serving the government to the fullest possible extent, electrical manufacturers are under the vital necessity of so shaping their general policies that they shall be in complete accord with the crystallizing national idea of co-operation. The presidential address of Mr. Collens before the Electric Power Club meeting at Hot Springs, Va., on Nov. 12 and 13, published in part herewith, is a thoughtful presentation of the drift of tendencies before the war, of the conversion into definite co-operative action as a result of the war, and of the practical questions which should be taken into account in planning for the future.

THE past history of the Electric Power Club has been a consistent record of steady progress and growing influence, and it is naturally with a keen sense of responsibility that I have taken up the work of my predecessor in office. My first effort has been an attempt to formulate in my own mind the exact function of a trade organization such as the Electric Power Club, and I must confess that the more I have thought on the subject the more complex the problem has become.

I have started with the premises that unrestricted, unregulated competition is an evil of the past and that the competition of the future will always be tempered by co-operation among manufacturers, expressing itself in trade and industrial associations. Such associations are no longer viewed with suspicion by the purchaser or by the government. In fact, under present emergency conditions, the government has found it absolutely necessary to deal with each industry as an organized unit and not as individual manufacturers, and there are many favorable indications of a changing attitude on the part of the government in its relation to organized business. A single striking example is the recently created Excess Profits Advisory Board "to analyze the law and to digest and consider, in connection with plans for its administration, suggestions received from those who will be required to pay the taxes."

THE FUTURE OF INDUSTRY

Representatives of commercial and industrial organizations are being invited to sit with this board and take part in the discussions. Even discounting the present emergency conditions, we can take it for granted that industry in future will develop more and more into a triangle of relationships, buying public on the one hand, co-operating manufacturers on the other, and a supervising, regulating government in between. The conditions imposed by the war will foster close co-operation between organized business and the government, and any future necessity for an increasing degree of government regulation or control will be determined very largely by the manner in which co-operating business conducts itself. Proper self-regulation will mean a minimum of external regulation.

To what extent and in what ways can a trade organization exercise a proper and necessary function in this

triangle of relationships? At what point in co-operation does rational competition cease and co-operation become combination in restraint of trade?

The answer is exceedingly simple, but its application is not. There is no limit to co-operation provided the end sought does not in any way work against the real interests of either one of the two main parties in the triangle of relationships. This means eliminating all conditions which work a hardship on the industry just as much as imposing no conditions which work a hardship on the purchasing public. To the extent that we will apply this principle any work undertaken will promote the interests of the industry as a whole and will meet with general approval. To the extent, however, that co-operation among manufacturers develops into one-sided self-seeking industry will invite for itself a well-earned and possibly more irksome form of government regulation and supervision than anything now contemplated.

SHOULD BROADEN OUR ENDEAVOR

In the past our effort has been largely that of standardizing the product manufactured. This work has now progressed to a point where it is merely one of perfecting the details of the framework already created. Valuable and absolutely necessary as this work has been and will continue to be, have we not now reached a point where we should attempt to broaden the scope of our endeavor and approach any other general problems which will promote the interests of the industry as a whole?

Are our commercial practices entirely free from injustices either to competitors or to purchasers? Are there any fixed policies on the part of the larger units in the industry, or of the smaller, which tend to limit proper competition, or are either monopolistic or destructive in tendency? Do we discriminate between buyers who have every right to equal consideration? We have standardized the product manufacturer, and I personally feel that we can now properly consider any general problems in the sale of that product, imposed either by buyer or by seller, which upset normal competitive relations between manufacturers or introduce unnecessary financial hazards in the industry.

We also have the practically untouched field of application problems and any interchange of information which will assist in extending the use of electrical machinery or in creating a wider market. Our standardization booklet should have complete data on the size of motor, proper basis of rating and usual type of control for all standard machinery. There is no reason why it should not become a standard textbook on the use and application of electrical machinery to the same extent as it is now a recognized standard for the rating of electrical machinery.

We should prepare for the opportunity to co-operate

in extending and strengthening the export market which will be possible with the passage of the Webb-Pomerene bill. This will probably receive early consideration by the Senate when Congress reconvenes. It has already passed the House.

TENDENCIES IN GOVERNMENT PRICE HANDLING

Finally we have a right to satisfy ourselves that competitive conditions are not limiting the return in the industry to a point where the invested capital is not properly protected or, taking fully into account the risks and hazards of the business and the skill of design and manufacture required, which does not guarantee a proper progressive development. We have already taken two steps in the right direction, first, by standardizing the product manufactured, and second, by promoting a uniform system of cost accounting. I am not prepared to say how the third step can be taken and will simply mention some tendencies which are now evident in the way the government is handling the price question.

In the past the government has simply been interested in preventing restraint of trade, either by combination of competitors, collusion among competitors or elimination of competitors by unfair practices. Without such it has been felt that proper competitive conditions on the question of prices would be maintained by the ordinary laws of supply and demand. The war, however, has forced the government one step farther. Mr. Hoover, the Food Administrator, says: "The large question of the hour is price-fixing, for where the demand is far beyond the supply, whether food or otherwise, the old law of price-fixing by supply and demand is broken." This forces us to an interesting corollary. Is not the law of price-fixing by supply and demand equally broken when the supply far exceeds the demand? If the government limits prices to a normal profit during excessive demand, cannot manufacturers rightly demand of the government such control of competitive conditions as will properly protect the capital invested during subnormal business and excessive supply?

Secretary McAdoo recently described the conditions which would have existed among the farmers of this country if the government had acceded to Germany's demand, kept its ships at home and given up its rights to the free commerce of the seas. With the export trade suddenly cut off and a surplus supply at home, he said it would have been impossible to control the situation soon enough to prevent tremendous economic loss and damage. Actual price-fixing is, however, only an emergency measure which will not outlive the emergency which created it, because it cannot be carried to its logical conclusion without extension to all important elements of cost entering into every commodity, including even labor itself, and would die of its own stupor.

Another tendency of the government to curb excessive prices is a progressively increasing tax on excess profits. On the face of it, with a sufficiently high tax, this may seem a simple means of discouraging unreasonable prices, but it has what I consider an inherent defect. Excess profits which are the result of excess prices in an industry may properly be subject to tax, and to the extent of excess prices the tax will fall on all alike. But where excess profits are the result of

individual initiative a tax on excess profits penalizes the manufacturer who from the standpoint of competition and ultimate lower prices should be encouraged.

Assuming that competitive conditions are normal and have brought prices on the average to a level where there is no more than a proper return to the industry as a whole, the manufacturer with profits above the average, and under an excess profit tax the highest tax, is the manufacturer who because of efficiency in design, buying, manufacture or distribution has the lowest cost, whereas the inefficient manufacturer with profits below normal pays no tax. You say that all the efficient manufacturer has to do is to reduce his price to a point where he will have to pay no tax. If he does this, it means stagnation as far as his business is concerned, because rapid, progressive growth and ultimate strength are only possible for the manufacturer whose profits are well above normal. Encouraging all such manufacturers will in the end force all other competitors to more efficient methods and average competitive prices to a lower level.

As a war measure and on the principle of taxing those most able to pay, the present excess profits tax is a proper measure, but as an indirect means of price regulation it is far from perfect. Personally, I am of the opinion that it is very much better for co-operating manufacturers to control the price problem from within under proper government supervision than to have it controlled from without by means of restrictive regulatory legislation.

WILL STILL HAVE COMPETITION

I do not feel that any degree of co-operation will destroy those forms of individual initiative which are the basis of rational competition. We will still have the competition that is normally brought about by differences in and economy of designs, by quality, organization, energy, aggressiveness, executive ability, personality, sales policies and different degrees of efficiency in manufacture and distribution. We will also always have price competition; that is, as long as there are differences in design and in cost some manufacturers will be able to make lower prices than others, but they should be consistently lower, not that form of price competition which forces prices away down on some particular job or proposition where competition is severe, the loss to be made up either on other non-competitive products or on other jobs where there is no competition.

In undertaking a broader program there must be absolute frankness and sincerity of purpose, both in our relations with each other and with the government. Secrecy invites suspicion and distrust. If the object sought is in the interests of the business, we should have no hesitancy in taking the government into our confidence. Organized industry co-operating with the government is a far more hopeful picture than organized industry controlled by prohibitory legislation from an antagonistic, suspicious government.

I have not mentioned the co-operation which must be undertaken by this organization in the prosecution of the war, as this will be the subject of a separate report. In this we must give unstintingly of ourselves and of the full resources of our factories to the end that the government shall be supplied with what it needs in the shortest possible time.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

COST OF MANHOLES ON STREET-LIGHTING SYSTEM

Table Giving Details of Labor and Material, Transportation and Other Expense for Constructing Small Manholes

The data in the accompanying table show what it has cost the electrical department of Lincoln Park, Chicago, to construct 129 manholes of different sizes under various conditions. For purposes of analysis the costs have been divided into four classes, namely, labor, material, transportation and station expense. The latter item, which is taken as 15 per cent of the cost of the job, includes overhead and engineering charges. All of the holes, except those mentioned in the table as item No. 1, item No. 8 and item No. 11, were constructed with 24-in. (0.61-m.) round lawn covers of the locked type. The covers in the holes mentioned as items No. 8 and No. 11 were standard 28-in. by 32-in. (71.1-cm. by 81.2-cm.) street covers. As will be observed from the tabulation of "Conditions Encountered," the digging was comparatively easy in

the fact that a truck with a small crane on the rear end was used to assist in setting the frames and the concrete slabs which are used to cover the top of the brickwork and to act as a setting for the frame. The hole mentioned as item No. 8 appears expensive, and this is attributed to the fact that it was a special job. The costs in item No. 9 are interesting as showing the higher costs which rebuilding occasions.

CIRCUIT-BREAKER SIGNAL FOR HAND-OPERATED BOARD

Device Used in Plant of Textile Mill Is Visual as Well as Audible—Reasons That Led to Its Installation

BY L. E. WOOD

It is usually the custom in power houses to provide some form of signaling so that the operator shall know when a circuit breaker has tripped. The accompanying illustration shows the device developed by the writer installed in a large textile plant in Canada.

DETAILS OF COST OF MANHOLE CONSTRUCTION UNDER VARYING CONDITIONS

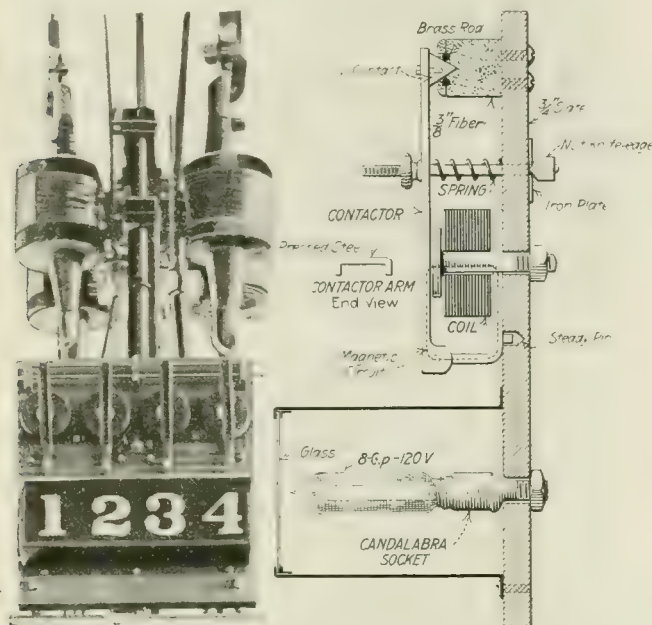
Item No.	Number Holes	Date of Construction	COST PER HOLE					Size of Hole	Conditions Encountered
			Labor	Material	Transportation	Station Expense	Total		
1	6	1916	\$13.91	\$17.32	\$9.20	\$6.06	\$46.49	3 ft. by 3 ft. by 4 ft.	In lawn—frost in ground 3 ft.; sand, loam, rubbish, no paving
2	34	1916	9.56	16.97	.32	4.04	30.95	3 ft. by 3 ft. by 4 ft.	In loam—no paving, sand and loam, some sodding.
3	11	1917	6.40	11.71	1.41	2.93	22.45	20 in. by 36 in. by 42 in.	In lawn—sand, some sodding
4	8	1917	8.93	14.31	1.99	3.80	29.03	3 ft. by 3 ft. by 4 ft.	In parking—sand and loam and rubbish, no paving.
5	11	1917	20.95	14.15	5.81	6.15	47.06	3 ft. by 3.5 ft. by 4 ft.	Same as No. 4.
6	6	1917	8.93	14.31	1.99	3.80	29.03	3.5 ft. by 3.5 ft. by 4 ft.	Same as No. 4.
7	8	1917	10.75	17.09	5.33	4.97	38.04	3 ft. by 3 ft. by 4 ft.	Same as No. 4.
8	1	1917	11.85	31.73	3.00	6.00	52.58	3 ft. by 3 ft. by 4 ft.	Same as No. 4.
9	7	1917	8.41	28.58	1.71	4.81	43.51	4 ft. by 5 ft. by 4 ft.	Same as No. 4—rebuilding job.
10	8	1917	8.57	27.09	2.88	5.78	44.32	3.5 ft. by 3.5 ft. by 4 ft.	Sand and rubbish, no paving.
11	29	1917	25.38	29.58	5.04	6.00	66.00	3.5 ft. by 3.5 ft. by 5 ft.	Paving cut and repaving—heavy concrete base under asphalt and rubbish.
Grand average for total of the 129 manholes.			\$13.92	\$19.43	\$3.10	\$4.84	\$42.11	About 3 ft. by 3 ft. by 4 ft.	

most places on account of the sandy soil. In some holes, however, buried rubbish was encountered, which somewhat added to the cost of excavation. Comparison of the total cost mentioned in item No. 11 with the other costs brings out quite clearly the extra expense involved in tearing up and replacing pavement. In this instance the pavement was placed on a concrete base, which further impeded progress and added to the cost. In item No. 1 the transportation expense seems to be out of proportion, but this item includes some cost which in other jobs is charged to labor, owing to

The reason for evolving this device was as follows: The main switchboard of the plant in question consists of the feeder panels, twenty-two of which originally contained six triple-pole 100-amp. knife switches with fuses back of the panels. In modernizing the board, which became necessary owing to a large increase in load, the choice lay between scrapping the twenty-two panels and making use of such parts as could fit in with any scheme decided upon. After careful consideration it was decided to adopt oil circuit breakers, so that only the marble of the old panels could be uti-

lized, each allowing space for two 350-amp. C. G. E. type F oil switches. The switches, relays, ammeters and wattmeters were purchased and fitted to the old panels. The current transformers are so placed as to leave the back of the panels clear of all obstruction except switches, in addition to being in the direct line of the feeders, which pass through the ceiling. In in-

ers, which should be in the form of projections instead of colored markers, as the latter will wear off or become covered with coal dust. To ascertain the amount of coal in the bunkers it is necessary only to count the number of projections visible on each pipe, calculate the average, and then refer to some table like those now used in most plants based on the ultimate capacity of the bunker when filled up to the level of the beam. The readings taken will represent the deviation of the surface of the coal from the level represented by the beam and will indicate how much should be subtracted from the ultimate capacity of the bunker. Old 4-in. (10-cm.) boiler tubes may be used for this purpose. When a



METHOD OF MOUNTING ON BOARD; DETAILS OF SIGNAL

stalling the breakers some means of notifying the operator when the circuit was opened were necessary.

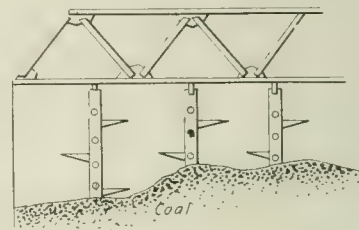
The signal device described here was made in the company's shop. A piece of slate $\frac{3}{4}$ in. by 15 in. by 16 in. (1.9 cm. by 38.1 cm. by 40.6 cm.) was used as a base, on which were mounted two $\frac{3}{16}$ -in. (4.8-mm.) brass rods threaded for two nuts and lug. At one end these were supported by pieces of $\frac{3}{8}$ -in. (9.5-mm.) thick fiber, fastened to slate base. Each slate base is suitable for four circuit breakers. A relay was made for each breaker, suitable for 120 volts direct current, the armature of which was fitted with V-contacts, so that when the coil was energized it short-circuited the two brass rods and so closed the signal circuit, operating a double 10-in. (25.4-cm.) gong supplied from a 110-volt, 60-cycle circuit.

MORE ACCURATE METHOD OF MAKING BUNKER SURVEYS

Simple Way Which Eliminates to a Certain Extent the Inaccuracy of the Existing Method of Estimating Coal Bunker Contents

BY H. WYGODSKY

Using the present common method of estimating the amount of coal in bunkers, considerable error may be made if the elevation of the coal is not measured in enough places and if the readings are inaccurate, as they may be in dark places. For this reason the writer suggests the following more accurate method. Pipes are arranged vertically in the coal bunkers at the points at which readings are to be taken and fastened to the overhead beams as illustrated here. At regular intervals along the pipe, say every foot, are placed mark-



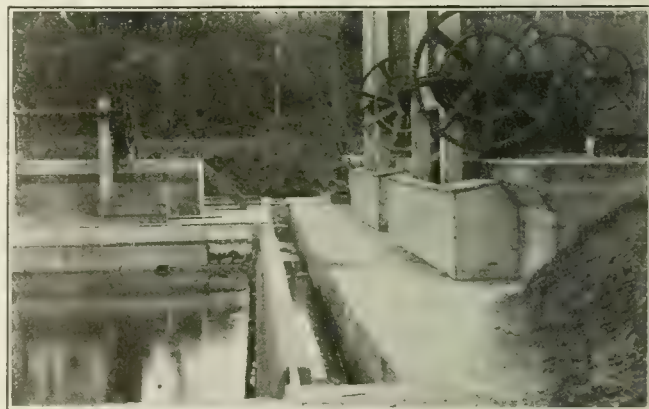
VERTICAL PIPES INSTALLED IN BUNKER

sufficient number of holes are provided in the pipes they may also be a great help in ventilating the coal, thus aiding in the prevention of fire in the bunkers. With a bunker of about 2700 tons (1830 t.) capacity and a top surface of 61 ft. by 75 ft. (18.6 m. by 22.9 m.) about fifty pipes should be installed to obtain accurate results.

SLUICE FOR CLEARING TRASH FROM RACKS

Channel Back of Tops of Racks Into Which Trash Can Be Raked and Sluiced Into River Below Plant

At the plant of the Central Massachusetts Electric Company in Palmer, Mass., which has recently been remodeled for improved hydroelectric service, a sluice has been provided for the removal of leaves and other



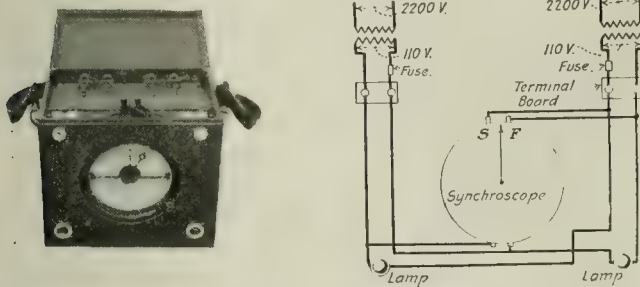
CONSTRUCTION OF CHANNEL FOR CLEARING TRASH

trash raked from the racks at the intakes. Behind the concrete structure at the top of each rack is a channel about 17 in. (43 cm.) wide and 24 in. (60 cm.) deep, with an outlet to the adjacent river. Wooden stop-gates of 2-in. (5.08-cm.) plank are provided at several points in the trash sluiceway to admit water from the forebay for flushing out the sluices.

PORTABLE SYNCHROSCOPE FOR TESTING AND PHASING

Outfit Built by a Western Company Is Equipped with Transformers, Lamp Receptacles and Synchroscope

To facilitate the testing and phasing out of transformers and lines a portable testing set has been made by the Puget Sound Traction, Light & Power Company



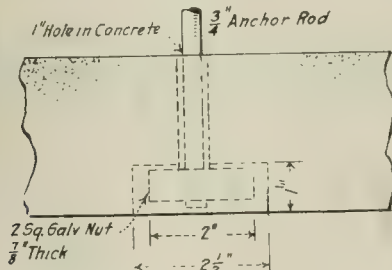
EXTERIOR VIEW OF PORTABLE SYNCHROSCOPE AND WIRING CONNECTIONS

of Seattle, Wash., by mounting two 2200/100-volt potential transformers and one Westinghouse synchroscope in a light oak box. A terminal board is provided on the low-voltage side to facilitate the attachment of a voltmeter, while two lamp receptacles permit the use of a light or dark lamp synchronizing connection. The box is constructed with a waterproof cover and porcelain bushings for the high-voltage and voltmeter leads. A sheet-iron cover slides in front of the face of the synchroscope to protect it from injury. This device was described by J. Hellenthal, general substation construction foreman of the Puget Sound company, at the recent annual meeting of the Northwest Electric Light and Power Association at Spokane, Wash.

ANCHOR ROD DESIGNED TO BE REMOVED UNDAMAGED

Square Nut Is Employed in Place of Regular Hexagonal Nut and Is Drawn Up Into Recess When Anchor Is Set

Where pole lines are extended or remodeled it is frequently necessary to abandon an anchor already installed. As an anchor rod usually protrudes a foot or



DETAILS OF ANCHOR ROD

more above ground and would constitute a danger to pedestrians, its removal is essential. In order to avoid cutting off the protruding end, which is a waste both of labor and material, one company utilizes a scheme which permits releasing the rod and removing it undamaged. The anchor itself consists of a concrete slab or pyramid, and in the bottom surface, surround-

ing the hole through which the anchor rod passes, where the nut of the rod would naturally bear, a recess is cast into the concrete, $2\frac{1}{2}$ in. by $2\frac{1}{2}$ in. by 1 in. (6.4 cm. by 6.4 cm. by 2.54 cm.) deep. In the place of the ordinary hexagonal nut on the anchor rod a special square nut 2 in. by 2 in. by $\frac{7}{8}$ in. (5.08 cm. by 5.08 cm. by 2.25 cm.) thick is employed. When the anchor is set the nut is drawn up into the recess. When it is desired to remove an anchor the rod is twisted, and as the walls of the recess prevent the nut from turning it unscrews and the rod may then be pulled out. With ordinary care used to see that the nut beds properly in the recess when the anchor is set, few cases will be found in which the anchor rod cannot be removed and saved.

SOUTHERN COMPANY SETS POLES AT 25 CENTS EACH

Gang of Twelve Men, Including Foreman, Set Sixty-eight Poles in a Day in Building Cross-Country Line

BY E. B. HOOK, JR.

Superintendent, Construction Georgia Railway & Power Company, Atlanta, Ga.

The construction department of the Georgia Railway & Power Company, Atlanta, Ga., claims title to the record for setting poles, both for number of poles set



POLE ON "DEAD-MAN" READY TO BE "WALKED IN"

in one day and for minimum cost each. Recently a crew engaged in building a cross-country transmission line set sixty-eight 30-ft. (9.1-m.) creosoted pine poles in one day. This crew was composed of twelve men, including the foreman. The poles were piked in and tamped. The holes had been previously dug and the poles hauled in on the right-of-way.

Two of the crew preceded the pikers and placed the poles conveniently to the holes. The setting crew then lifted the top of the pole on to a "dead-man," took their position with their pikes and "walked it in," lined it and tamped it up.

The pay for this crew per day, including the foreman, is \$17; therefore the cost of setting the poles was 25 cents each. Forty of the poles were set before dinner and only twenty-eight in the afternoon. This was on account of a drizzling rain which set in about midday and handicapped the work to some extent and also caused darkness to come about a half hour earlier than usual. If the weather had been clear all day, the men assert they would have set at least seventy-five poles and possibly eighty.

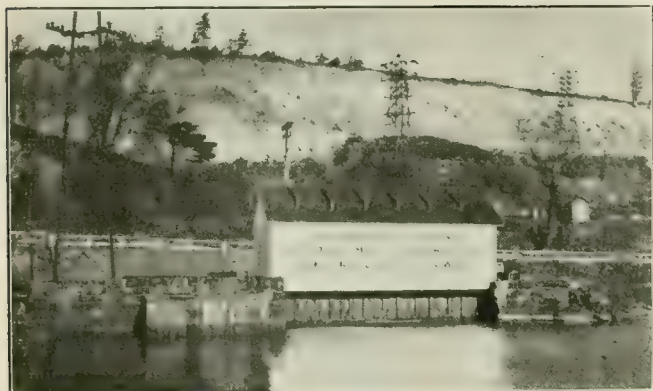
CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

ADVERTISING ELECTRIC SERVICE ON GATEHOUSE

**Massachusetts Property Uses Building Well Situated
Along Steam and Electric Lines and
Close to Automobile Highway**

Effective publicity for electric service is secured by the Central Massachusetts Electric Company at its generating plant and substation in Palmer, Mass., as shown herewith, by an advertisement of the facilities of the system on a gatehouse at the entrance of the local forebay. The gatehouse stands between the Boston & Albany Railroad and the Worcester-Springfield interurban electric line, so that by "signing" both sides



MAKING USE OF AN ADVERTISING OPPORTUNITY

of the building every passing car comes within range of this effective publicity. A main automobile highway between Springfield and Boston also passes the plant close by the gatehouse.

FOSTERING THE INITIATIVE OF EMPLOYEES IN SMALL TOWNS

**Practice of Paying Straight Salary Declared to Be
Wrong, as It Robs the Man of Incentive
to Do More Than Just His Job**

The vice-president of an electric light and power company operating in a number of small and medium-sized cities in the Middle West recently advanced the opinion that paying men on a straight salary basis was about as poor a plan of payment as could be worked out for companies of the character with which he is familiar. Taking the case of the local manager of one of his own towns, for example, he analyzed the situation as follows: "Suppose I hire a man as local manager for D—. When I send the man out to this small town I tell him to endeavor not to absorb the easy-going lackadaisical spirit of the small town. I tell him to try to live above that plan and, even though every other merchant in the city sits in his place of business and waits for business to come to him, to get out and

do a little hustling and make everybody see that he is a real live wire. Now if I should send him down with those instructions and with the assurance that he will be paid a fixed salary, instructions may carry him along for a while, but the effect will not be permanent. On the other hand, if I send him down with the instructions and with the assurance that he will be paid a certain fixed salary plus a commission on all of a certain class of business turned in, it is pretty much of a certainty that the man, in addition to doing his job, will put in some extra hours endeavoring to close up the class of business which will bring him a commission.

"Our local managers are paid from \$75 to \$150 a month. In addition to this they are usually given an opportunity to earn about \$1 per horsepower connected on all new power business turned in. Power business was selected as the particular class of service upon which we should pay commissions in our towns, since there was great need of building up the day load. We do not have this plan working as smoothly as we should like in all places, but in the main it has been found that it keeps the small town employees more interested in themselves and in the welfare of the company."

ILLUMINATING ENGINEERING AS A COMMERCIAL FORCE

**Threefold Actual Basic Commercial Purpose of the
Illuminating Engineer on Central Station
Industry Outlined**

In a paper prepared under the auspices of the lighting sales bureau of the National Electric Light Association by O. R. Hogue, C. L. Law and E. E. Whitehorn, for the 1916-17 correspondence convention of the Illuminating Engineering Society, attention is directed toward illuminating engineering as a commercial force. In developing this idea the authors said:

There is a great deal of unfortunate misunderstanding as to the commercial purpose and practical value of the science of illuminating engineering to the lighting industries. Its laws and principles have been discussed and analyzed through years of evolution, its practices have been defined, its ever-growing wealth of experience has been related and passed on for wider use, but men have kept on thinking of it largely as a scientific propaganda. The most important fact remains that this same science of illuminating engineering has marshaled to the service of the central station, gas or electric, a great creative force for the development of further bigger, better business in the lighting field.

It is because this fact has not been generally recognized with the enthusiasm it deserves and generates once the idea is grasped that we see so many central stations and so many gas-lighting companies still going on without any real effort to treat their lighting business seriously. They seem to be content to sell just light—the raw material—instead of accurate illumination as the finished product. Yet we know well that by the systematic application of

illuminating engineering the profits of such lighting business can be immeasurably increased as has been proved in the experience of many cities.

It is worth while, therefore, to consider what really are the actual basic, commercial purposes of illuminating engineering in the central station industry, for instance. There are three purposes:

1. To help develop new lighting business by converting new customers to the use of electric light.
2. To improve the lighting of present customers and increase its usefulness and value to them, and in this way gradually to raise the standard of illumination throughout the community and thus automatically to increase the company's lighting business.
3. To promote the satisfaction of present customers by giving them better service and more effective lighting that will tend to make them regard more highly the influence and benefits of good illumination, and in this way ultimately to win for the company a greater popularity in the community.

The paper then went into the details of how illuminating engineering departments work in a few cities of different size.

PRESENT VALUE OF LIGHTING AND APPLIANCE BUSINESS

**Attractive Publicity, Intelligent Solicitation, Honest
Advertisements and Service Required to Secure
Maximum of This Business**

BY THOMAS ROBSON HAY

In a great many localities central station growth has been of the mushroom variety, and this is especially true of the last two or three years. Power requirements have grown in an unprecedented manner, due principally to the erection of new plants and to the enlargement of existing plants to take care of increasing requirements. On account of the increasing cost of machinery and fuel, together with intelligent and active solicitation, a large portion of this business has been secured by the central stations. The purchase of the needed power has facilitated and expedited the commencement of operations; has reduced delays due to power plant troubles, with the consequent loss of production; has economized in the use of labor—a very important consideration at this time—and has relieved the management of the necessity of providing a continuous supply of fuel. By the purchase of electric power from the central station the entire boiler and engine-room force can in most cases be eliminated and the men released for employment elsewhere in the factory or outside. Furthermore, all new plants are modernized as to power application, machine lay-out, etc., and put in such shape as to enable minimum production costs for the different conditions of operation. Non-delivery of coal in sufficient quantities and at high prices becomes no longer a troublesome factor of operation to the mill, and any delays or inconvenience on account of gas shortage—when gas might be used—are thereby obviated.

At normal prices for fuel, labor and materials, the present industrial conditions as regards the central station would be desirable, as many of the plants are operating on a twenty-hour to twenty-four-hour production schedule, thus making for a relatively high central station plant load factor. Under the existing abnormal condition, however, the situation is anything but pleasing from a net income point of view, as fuel costs, the largest single item entering into the production of electricity, have in many cases increased two or three

times, with labor and materials likewise considerably higher.

NEED FOR INCREASED CENTRAL STATION RATES

All central stations are required to sell energy for electric light and power in accordance with published schedules of rates, and in most states are allowed to change these rates only on approval by the state commission. So far as the central stations are concerned, these published schedules of rates were deemed satisfactory two or three years ago. The abnormal increases in the cost of raw materials, such as fuel, copper, labor, etc., entering into the production of electricity, besides overhead expenses, have so increased the cost of their production that, in spite of the large increase in gross income, unless the central stations are permitted either to raise their rates or to make some additional charges per unit—especially as regards increased fuel costs—net earnings and the working surplus will be very materially decreased. If continued for any length of time, this condition will, of course, affect adversely the amounts available for improvements and extensions and for the payments of dividends and, in the end, will tend to bring the central station into a condition where the vast amount of new capital required will not be available except at what are practically prohibitive rates. It is not to be presumed that the present condition as to production and delivery costs will continue, and, although in normal times the net income of the average well-managed central station is adequate, it would yet seem that in order properly to meet unusual conditions the incorporation of a "coal clause," based on increased cost above a certain base price, should be a permanent part of central station policy, at least as regards wholesale power rates.

In view of the present conditions mentioned as obtaining in the industry the present would seem an opportune time to redouble efforts to increase the sale of electricity for house lighting and for the operation of the various appliances that are on the market. This class of load is of special value in helping to flatten out the station load curve, particularly for the smaller operations. Such business has a high revenue return and will in many cases not only act to increase the net return from all connected business but will also be an active agent in further popularizing the use of electricity, particularly among the laboring classes, who are now earning more than ever before and consequently have more to spend. They will feel more able to make the expenditure for house wiring and fixtures and appliances than would have been the case several years ago, and the service, once in, will be used for as long as the particular property is occupied. But in order to secure this business the prospective customer must be convinced that he will be justified in making the expenditures and that the expenditures once made will be a good investment.

FOUR THINGS NECESSARY

In order to secure this business four things are necessary: (1) Attractive and appealing publicity; (2) intelligent solicitation; (3) delivery of goods as advertised; (4) service.

1. Perhaps the most effective way of advertising is by means of newspapers. The copy ought to be attractive and informing. To be effective, it must be well written, must be truthful as to statement of fact, and,

when illustrated, the cuts must be vitalized with action and suggestion—not stereotyped by the use of uninteresting illustrations lacking any suggestion of comfort, convenience and utility. Too little printed copy is better than too much. Technical expressions are better eliminated, for always must the public that it is especially desired to reach be kept in mind.

2. Intelligent solicitation means, first of all, preparing and mapping out a fairly definite and comprehensive plan of procedure. By means of records or on the advice of the salesman, if no records are available, each man's quota can be determined and the particular line of goods to be pushed can be allotted to each district. In the districts inhabited by the laboring people house wiring and then the sale of inexpensive appliances, such as fixtures, irons, toasters and the like, can be concentrated on. In the better residence districts more expensive appliances, such as washing machines, vacuum cleaners, lamps and the like, can be pushed. By assigning quotas the approximate gross sales can be determined, and from this information the prices at which the articles may be sold can be arrived at and some idea of the possible volume estimated.

By proper standardization of the different classes of houses to be wired as to rooms and then as to outlets, labor and materials, a fairly low cost can be realized and a quick turn-over of labor and material obtained.

3. It is essential that all goods be delivered and all sales or special offers be conducted exactly as advertised. Such action acts to establish firmly the integrity and honesty of the company and of its employees and vindicates the truth of all statements made or implied. The principal consideration is not only that the company shall establish itself as an integral and respected member of the community but that, as a result of its reputation, it shall be able to reduce the cost of selling and of overhead, thus making possible a lower cost to the buyer or consumer without diminishing the net profit to the company. Sales that are made by advertisements, by the circulation of printed matter and by the company's reputation are much less costly than those that are personally solicited and are indications of right relations between the public and the company.

4. Above all, the utility must sell service. By intelligent publicity and service a community can be so educated to use electricity in its different applications that a large number of sales will be made automatically and the effect of competition be reduced to a minimum. Never should the impression be conveyed in advertisements or by the statement of representatives that something is being offered for nothing, as the value of the product is thus apt to be depreciated in the eyes of the public and the company, and all that is otherwise offered is apt to be regarded in a less favorable light than might otherwise be the case. The use of premiums is, of course, a different matter, but it should be always made clear that the premiums are awarded for a tangible and real consideration.

MAKING "BOOSTERS" OUT OF CUSTOMERS

When a customer has been secured his contract should be fulfilled at the earliest possible date, and all goods purchased must be promptly delivered as agreed. If the making of a connection is delayed and if a house cannot be wired so promptly as the customer thinks it ought to be, intelligent explanation by the salesman or

by the office man will usually act to account satisfactorily for the delay and to keep the customer in a friendly and tolerant attitude. Always it should be the function of the company to convert each individual member of the community into a friend and a "booster" for all things electrical, instead of having him as a "knocker" and an enemy. Where dissatisfied customers are located, or where individuals in a community are found who insist on "knocking" because of a real or fancied grievance or because of a generally hostile attitude toward the company, these individuals should be sought out, their story solicited and a reasoning and logical argument presented to overcome objections offered, so that the "knocker" may be converted into a friend and a "booster." An electric light and power company, to become a real and vital force for community welfare, must be a public servant in the broadest sense of the word, and must enter into the community life as a progressive and honest force having the interests of the community uppermost. In serving the public and its interests the company is equally benefited and its right to existence is justified.

PROPORTIONS FOR GENERAL AND LOCALIZED LIGHTING

Ohio State University Tests Show Preponderance of Choice for 40 per Cent Localized and 60 per Cent General Lighting in Combination

Results of a test made at the Ohio State University to determine what are the preferred proportions in combining general and localized lighting were given by Prof. F. C. Caldwell on Nov. 15 before the Chicago Section of the Illuminating Engineering Society. The paper presented by Professor Caldwell at this meeting is also to be presented in the 1916-17 correspondence convention of the Illuminating Engineering Society by Professor Caldwell and W. M. Holmes. Important excerpts from the paper follow:

The solution of the problem involves so many factors that it would probably be impossible to find a ratio which could be universally applied. A step in this direction, however, has been taken by working out one or two definite cases where the conditions are made simple and are carefully defined. While the results obtained from such an investigation hold only for the assumed conditions, they may serve as an indication of probable requirements for other and more complex cases.

The conditions of the test were as follows: The test took place in a small room with a white ceiling and very simple dark-colored furnishings; the general lighting was obtained entirely by reflection, the localized lighting from a table lamp with opaque reflector and diffusing glare. One hundred observers expressed their preference, from which and for the conditions described the following conclusions are drawn:

1. With light ceiling and dark walls and throughout a range of foot-candle intensities on the work from 2 to 6, about 40 per cent of localized and 60 per cent of general lighting is preferred.

2. Within the above range this ratio is not materially affected by the intensity of illumination upon the working plane.

3. This ratio is approximately the same for men and women.

4. Changing the walls to a light color does not greatly affect this ratio.

5. For the above preferred proportions of direct and indirect light and with dark walls the ratio of the brightness of the ceiling to that on the working plane lies between 2.5 and 3.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Lamps and Lighting

A Combination of Refractor and Diffusing Globe for Street Lighting.—WARD HARRISON.—The author points out that for many years the general trend of development in arc lamps has been toward increasing the relative proportion of light flux emitted in zones near the horizontal and that the use of high-efficiency incandescent units with refractors makes it possible to direct the light where it is most needed. By means of a refractor one can more than double the normal candle-power of the lamp at angles near the horizontal and thus increase the intensity midway between units, at which point the illumination is usually not more than 5 to 10 per cent of the average over the street surface. The opal globe is deficient in revealing smaller obstacles or irregularities in the road surface throughout an extended region midway between lamps. A disadvantage of every form of street-lighting unit is that in the absence of most rigid inspection and maintenance the efficiency of the system becomes rapidly impaired from the collection of dust and grime. The author illustrates and describes in this paper a type of unit which has been developed in order to combine in one fixture the advantage of both the opal globe and the refractor, to improve the appearance of the source when lighted and to minimize the depreciation due to dirt. Communicated discussions are given with this article. —*Transactions Illuminating Engineering Society*, Oct. 10, 1917.

Generation, Transmission and Distribution

Plotting Blower-Test Curves.—A. H. ANDERSON.—To the several methods of plotting blower-test curves another method is contributed by this author, its utility being demonstrated by the solution of problems from graphically recorded test data. Diagrams are given for impellers with blades tilted forward, with blades radial, and with blades tilted backward, the co-ordinates used being revolutions per minute and static pressure in inches of water. Two series of curves are given, one showing various rates of discharge in cubic feet per second and the other the volumes discharged per second per horsepower. —*Journal A. S. M. E.*, November, 1917.

Economic Steps Taken by Vienna Electric Service Company.—The operation of municipal electric systems in Vienna during 1915-16 was influenced to a considerable degree by the necessity of surrendering large amounts of lead and copper to the war department. In addition, it had to reduce the operating expenses and get along without materials which are scarce and unavailable. Considerable metal required by the war department has been made available by interconnecting plants and dispensing with the smaller ones, thereby allowing the utilization of considerable metal represented by the old equipment. A number of the large storage batteries in various substations were turned

over to the government so that the lead could be recovered. This was done under the condition that the electricity works were to receive within a year after the signing of peace new storage batteries to take the place of the old ones without charges of any kind. One station was able to turn over a large amount of materials, including old wire and conduit, to the war department by rearranging its switchboards more efficiently. Metal was released in another station by transforming from a steam plant to a transformer station. Owing to the commandeering of all lead and copper for the war department, distribution systems have not been extended much. Whatever had to be done in the line of opening new connections was permitted by changing branch lines. In a number of cases where cables of large cross-sections were taken out of service they have been cut up in lengths of about 100 m., stripped of insulating material and sheathing, and the copper wires unwound, straightened and cleaned and finally redrawn into smaller wires. —*Elektrot. und Maschinen.*, September, 1917.

Traction

Operation of Railway Substations Without Attendants.—W. D. BEARCE.—The author gives a brief historical review of the progress made during the past three years in the equipment of automatic substations for railway service. While about thirty automatic railway substation equipments are under construction at Schenectady, the following description is mainly confined to railway systems which are now actually operating attendantless substations. —*General Electric Review*, November, 1917.

Regenerative Braking.—WALTER V. TURNER.—The returning of energy to the line, permitted by regenerative braking, is generally the least important advantage when considered from the standpoint of the possible total economy, which includes the saving of time, the reducing of wear and tear on the brake shoes and wheels, and the reduction of heating of shoes and wheels. Furthermore, with regenerative braking the speed of the trains can be kept much more uniform than when airbrakes are used alone. The joint use of both brakes possesses the advantage that more tonnage per day can be hauled down grades and higher speed can be permitted, with a safety factor equal to that obtained at present with the airbrake alone. The author calls attention to the necessity of some interlocking arrangement between the regenerative brakes and airbrakes so that the airbrake cannot be applied while the regenerative brake is in use, and he suggests a scheme that can be used in order to attain this object. —*Electric Journal*, October, 1917.

Operating Experiences on the Philadelphia-Paoli Electrification.—LAURENCE M. WILSON.—Some of the experiences that have been passed through with this

equipment are outlined. Among them are the elimination of trouble from sleet collecting on the pantagraph tubing, a method of splicing pantagraph tubing, a method of keeping snow out of the transformer windings, changes that were made in the insulation between the main and auxiliary field windings to prevent breakdown between these two circuits, a method of providing additional starting torque, the elimination of resistors during acceleration to reduce energy consumption, and provision of a series transformer in the lead from the pantagraph to lower the latter in case of a short circuit such as a ground in the high-tension winding of the transformer.—*Electric Journal*, October, 1917.

Transformer Conduction Motors.—R. E. HELLMUND.—The author explains in a relatively simple manner the working principles of transformer conduction motors such as are used in the suburban service of the Pennsylvania Railroad at Philadelphia.—*Electric Journal*, October, 1917.

Installations, Systems and Appliances

High-Tension Insulators.—After indicating the electrostatic formulas which serve as the basis of his theory, the author traces the equipotential lines and the lines of force around a conductor charged to a certain potential and surrounded by a metallic plate connected to ground. If the conductor is surrounded by a dielectric other than air, account must be taken of the laws of refraction for lines of force and equipotential lines. Varied examples help in the comprehension of the method, and conclusions are drawn not only from the point of view of the form that should be given to insulators but also concerning the composition of the insulating material, which may perhaps be constituted of many substances of specifically different inductive powers.—*Revue Gén. de l'Elec.*, Oct. 27, 1917.

Annealing and Heat Treating of Steel and Melting of Non-Ferrous Metals in the Electric Furnace.—T. F. BAILEY.—The author gives some of the important uses to which car-type annealing furnaces, continuous pusher type furnaces, automatic heat-treating furnaces and brass-melting furnaces have been applied. As there seems to be no real necessity for the use of a crucible excepting in the melting of precious metals, and because of their high cost, rapid destruction and the necessity of handling small quantities of metal with attending high labor charge when they are used, the tilting-hearth-type furnace was developed. This type of furnace was first used for aluminum and aluminum alloys, and later the same type with slight modifications in the details was used for pouring brass. This furnace, with a normal rating of 105 kw. and a melting capacity of 600 lb. (272.2 kg.) per hour, has melted the following materials and superheated them to a suitable pouring temperature with an average condition as noted: New red brass—85 per cent copper, 15 per cent tin, 400-lb. (181.4 kg.) heats in one hour, with 90 kw.-hr., or 450 kw.-hr. per ton; scrap yellow brass (case I)—72 per cent copper, 28 per cent zinc, 750-lb. (340.2 kg.) heats in one hour ten minutes, with 120 kw.-hr., or 320 kw.-hr. per ton; (case II), 70 per cent copper, 30 per cent zinc, 800-lb. (362.9 kg.) heats in one hour eighteen minutes, with 110 kw.-hr., or 275 kw.-hr. per ton; brass chips and borings—70 per cent copper, 30 per cent zinc, 700-lb. (317.5 kg.) heats in two hours thirty minutes, with 220 kw.-hr., or 720 kw.-hr. per

ton. Much lower current consumptions have been made in individual heats, but the above are the averages of several heats of each metal melted. The author points out that of all the electric furnaces of the types described now developed the tilting-type furnace is the one permitting the greatest saving in cost over fuel-fired furnaces of any type, whether fired with oil, gas or coke, as the metal loss is lower and the crucible cost is eliminated entirely, while the labor item is less on account of size and convenience of operation. The following figures may be safely taken as operating conditions with yellow brass in a shop operating twenty-four hours per day:

	Per Ton
Electricity, 400 kw.-hr. per ton, at 1 cent.....	\$4.00
Metal loss, 1 per cent zinc, at 10 cents per lb.....	2.00
Labor, one man per hour per 600 lb., at 36 cents per hour...	1.20
Renewals and repairs.....	1.00
Total per ton of melt.....	\$8.20

A discussion of this paper is also given.—*Journal of the Cleveland Engineering Society*, September, 1917.

Electrochemistry and Batteries

Notes on the Electric Storage Battery.—EDWARD WANTON SMITH.—A review of the theory of operation, construction, performance and uses of nickel-iron-alkaline and lead-acid storage batteries.—*Proceedings of Engineers' Club of Philadelphia*, September, 1917.

Miscellaneous

The Coal Problem in Argentina.—In spite of all that railroads and industries have done to replace coal by other combustibles, the fuel problem in Argentina grows daily more acute. Unless public service companies are able to import coal, in a short time they will be affected in a manner prejudicial to the public interest. This is especially true of the lighting companies, both electric and gas, which are about to ask permission from the authorities, as the railroad companies have already done, to increase their tariff, possibly by 25 per cent. Coal has risen in price from between \$13 and \$14, the pre-war figure, to more than \$40 a ton, while the government charges more than \$90 a ton for the state-owned petroleum, or nearly four times the normal price.—*La Electricidad y la Maquinaria*, Buenos Aires, Sept. 30, 1917.

Critical Speeds of Loaded Shafts.—W. M. WALLACE.—This article describes experiments that were conducted for the purpose of testing the accuracy of various simple methods of determining the whirling speed of a shaft of variable section and the effect of radial clearance at the bearings on the whirling speeds.—*London Engineer*, Sept. 21, 1917.

Unification of Frequencies in Italy.—No less than five frequencies now exist in Italy, so the Italian Electrotechnical Association is planning a campaign to standardize frequencies. Forty-two-cycle is in the lead as regards actual territory covered, being used in nearly all the north provinces and to some extent in the south. Fifty-cycle, however, is a close second, prevailing in Turin, Genoa, Milan, largely in the center and south of the peninsula, and in Sicily and Sardinia. In the districts around Rome 46-cycle energy is used, and throughout the country there are isolated 16-cycle and 25-cycle installations.—*L'Elettrotecnica*, Oct. 15, 1917.

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

ORGANIZATION MEETING OF WAR SERVICE COMMITTEE

Clarence L. Collens, II, Appointed Temporary Chairman and W. W. Nichols Temporary Secretary at the Preliminary Gathering

At the organization meeting of the war service committee of electrical manufacturers in New York on Nov. 28, as mentioned briefly in last week's issue of the *ELECTRICAL WORLD*, Clarence L. Collens, II, was appointed temporary chairman and W. W. Nichols temporary secretary. The committee discussed at length ways and means of doing the work for which it was created. It also considered the appointment of committees to facilitate its activities. The war service committee is composed of two representatives each of the Associated Manufacturers of Electrical Supplies, the Electric Power Club and the Electrical Manufacturers' Club.

The resolution passed at a recent meeting of the Electrical Manufacturers' Council, under which a war service committee is being appointed, says:

First—That there be appointed a committee of six to be known as the general war committee of the electrical manufacturing industry.

Second—That such committee be appointed by the Electric Power Club, the Electrical Manufacturers' Club and the Associated Manufacturers of Electrical Supplies, two members being named by each.

Third—The functions of such committee to be: (a) to determine the needs of the government for electrical material under prevailing conditions; (b) to establish such connections with the various agencies of the government as will insure continuous information as to such needs; (c) so to organize the industry through specific or emergency committees as will insure the meeting of governmental requirements for material or information; (d) to transmit to the government the needs of the industry to the end that the government's requirements may be met speedily, efficiently and with the minimum of industrial disturbance.

Fourth—That this committee be empowered to hire such assistance and make such expenditures as may be necessary properly to accomplish said functions, and that such expenditures be assessed equally upon the three organizations herein mentioned.

ELECTRIC POWER CLUB WAR SERVICE COMMITTEE

Data Will Enable Electrical Division of the War Industries Board to Improve Its Service to the Nation

The electrical division of the War Industries Board of the Council of National Defense has issued the following bulletin, dated Dec. 1:

The war service committee of the Electric Power Club convened in Washington on Nov. 24; after reviewing the needs of the government and our allies, it determined upon a survey of the industry. The data collected will be brought to Washington for co-ordination at the second conference to be held early next week. With the data proposed this

department will be in position to handle inquiries much more efficiently than at present.

The loan of experts for assistance was arranged for, and it is expected that with a department of sufficient personnel needs of the government can be directed toward the companies in best position to satisfy those needs in the time required.

Our duty is to assist the government, but, indirectly, we shall be assisting the government if we assist you when needed in your own individual problems. We place our services freely at your disposal in so far as your difficulties concern your production for war needs.

You will be interested to know that the War Industries Board has under discussion plans for supplying material for manufacture for stock articles, which will in turn be drawn from stock for war needs. The problem is a general one affecting industries other than ours.

WAR SERVICE COMMITTEE OF ASSOCIATED MANUFACTURERS

Conference of Chairmen and Representatives of Sections of Associated Manufacturers of Electrical Supplies—Meeting Set for Dec. 13

To further the organization of the general war service committee of the electrical manufacturing industry, a meeting was held on Dec. 3, at the offices of the Associated Manufacturers of Electrical Supplies. It was called by request of R. K. Sheppard and J. R. McKee, the representatives of the association on this committee.

There were present the following chairmen and representatives of the various sections in the association:

J. R. McKee, General Electric Company.
R. K. Sheppard, Simplex Wire & Cable Company.
E. Whitmore, Manhattan Electrical Supply Company.
J. E. Way, R. Thomas & Sons Company.
R. W. Seabury, Boonton Rubber Manufacturing Co.
E. B. Hatch, Johns-Pratt Company.
J. H. Trumbull, Trumbull Electric Manufacturing Co.
C. L. Eidlitz, Metropolitan Electric Manufacturing Co.
W. D. Steele, Benjamin Electric Manufacturing Co.
D. H. Murphy, American Conduit Manufacturing Co.
C. O. Baker, Wheeler Reflector Company.
H. R. Sargent, General Electric Company.
J. C. Dallam, General Electric Company.
H. W. Bliven, Harvey Hubbell, Inc.
A. F. Chamberlain, Robbins & Myers Company.
C. E. Corrigan, National Metal Moulding Company.
J. B. Adams, Irvington Varnish & Insulator Company.
Russel Dart, Alphasduct Company.

Mr. Sheppard and Mr. McKee explained at length the position in which the government was placed and what it desired to accomplish through the manufacturers of the association. After an extended discussion it was decided to hold a meeting of all the executive and associate members of the association at Delmonico's, New York, on Dec. 13, at 10 a. m., after which meetings of all sections will be held to appoint representatives to co-operate with the general war committee of the electrical manufacturing industry.

CALIFORNIA TO STUDY THE OPERATION OF UTILITIES

War-Time Survey by State Railroad Commission to
Cover Ways and Means for Increasing Efficiency
of Hydroelectric Systems

The California Railroad Commission has instituted investigations into the maintenance of railroads and possible economies in operation and the construction and operation of electric and gas utilities during the war.

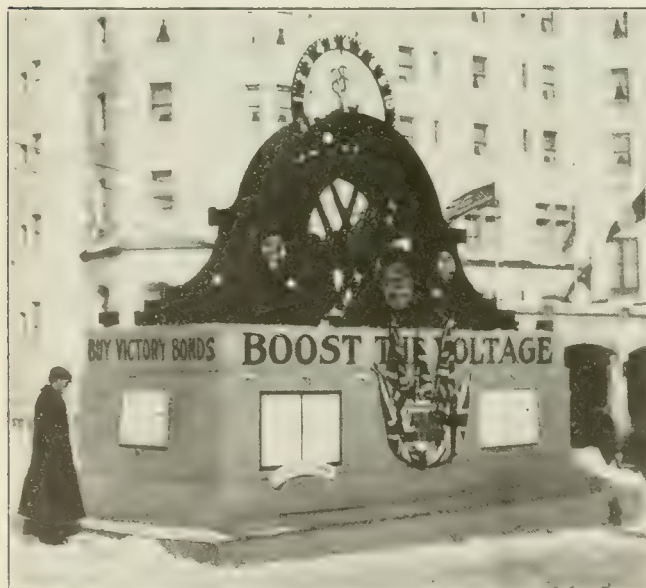
In co-operation with corporations affected, the commission will survey railroad, electric and gas industries to discover, if possible, ways and means for decreasing expenditures and increasing the aid which these companies can give the federal and state governments. The commission will endeavor to provide for fuel conservation, manufacture by gas companies of by-products for war use, raising efficiency of hydroelectric concerns, making railroads most serviceable.

Commissioner Max Thelen will conduct the gas investigation beginning on Dec. 8, Commissioners Harvey D. Loveland and Edwin O. Edgerton the railroad investigation, with a hearing on Dec. 14, and Commissioner Frank R. Devlin the electric utilities investigation, beginning on Dec. 10.

ELECTRIC AID FOR THE CANADIAN VICTORY LOAN

Dynamo Temporarily on the Plaza in Ottawa Shows
the Mounting Totals of the Subscription
in that City

A. A. Dion, general superintendent Ottawa Electric Company, shows a striking use of electrical equipment in that city to aid the successful sale of Canada's Vic-



ELECTRICITY HELPS CANADA'S LIBERTY LOAN

tory Loan. The accompanying illustration of a temporary installation on the "Plaza" in Ottawa indicates the way in which the electric company co-operated.

The dynamo was kept in motion by a small motor within the base. At night it was illuminated. The

half circle on the top showed, by means of the pointer, the number of millions subscribed in Ottawa from day to day. The pointer was kept vibrating constantly so as to attract attention and make it look like a voltmeter when the voltage was a little unsteady. A "registration book" 20 ft. (6 m.) high formed part of the plan.

COAL OPERATORS ASKED TO FOLLOW PRIORITY PLAN

Requests of Federal Fuel Administrator Provide for
Preferential Shipments for Thirty Days—
Position of Utilities

Requests to coal operators issued by the United States Fuel Administration on Dec. 2 established the order of preference in which coal needs are to be filled. The requests, directed to about 5000 producers, provide for preferential shipments for thirty days.

The following request was directed to all operators in Ohio, Michigan, Kentucky, Illinois, Indiana, Alabama, Tennessee, Colorado and Oklahoma:

Subject to compliance with orders heretofore issued by the Fuel Administration for preference in shipments for certain specified purposes, the Fuel Administration requests that you give preference in shipments for the next thirty days on government orders, railway fuel, domestic requirements, public utilities and munition plants.

It is necessary in the present situation to give preference in shipments as requested, and we solicit and thank you in advance for your co-operation in this direction.

We will appreciate it if you will advise the Fuel Administration of any free tonnage you have available which we may call on you to ship for emergency requirements.

All operators in Pennsylvania and Kentucky were requested in a similar form to give preference in shipments for the next thirty days on "government orders, railway fuel, domestic requirements, public utilities, steel plants, by-product coke ovens and munition plants."

All operators in West Virginia and Virginia were requested to give preference to shipments for thirty days on "government orders, railway fuel, tidewater shipments for New England, domestic requirements, public utilities and munitions plants."

The requests cover practically all of the coal production of the country outside of the Rocky Mountain coal districts. The Rocky Mountain output is largely consumed in localities where it is produced.

TWO-YEAR NOTES SOLD BY BOSTON EDISON COMPANY

Issue of \$3,000,000 of 6 per Cent Securities Quickly
Absorbed by Public at Price Yielding
About 6.65 per Cent Net

An issue of \$3,000,000 of two-year 6 per cent notes, dated Dec. 1, has been sold by the Edison Electric Illuminating Company of Boston to Lee, Higginson & Company, Old Colony Trust Company, F. S. Moseley & Company, Parkinson & Burr and Kidder, Peabody & Company. The notes were offered to the public at 98¾ and interest, to yield about 6.65 per cent, and were sold very quickly. It is stated that with normal conditions of extension this will meet the capital requirements of the company to the middle of 1919.

POOL IN COAL SHIPMENTS PUSHED FORWARD IN OHIO Pending Completion of New Arrangements Central Stations Run Dangerously Close to Depletion of Fuel Supply

The plan for pooling coal shipments outlined in the ELECTRICAL WORLD of Nov. 24, 1917, was completed at a meeting of coal operators, railroad representatives and coal administrators of Ohio, Pennsylvania and West Virginia in Cleveland. Operation of the plan has been intrusted to a committee of seven operators in Ohio, Pennsylvania, West Virginia and Kentucky. Pooling points for the present will be at Cleveland, Cincinnati, Columbus, Toledo, Canton, Akron, Pittsburgh and Detroit.

Revocation of the government priority order, which has been sending about 5,000,000 tons of coal monthly to the upper lake country, will release this amount. This, with the pooling plan, it is thought, will relieve the shortage which has existed for several months in the states concerned.

Both the Cleveland Electric Illuminating Company and the Cleveland municipal light plant have had very narrow escapes. Their coal supply was almost exhausted, but small shipments arrived in bare time to prevent a partial closing down.

The Northern Ohio Traction & Light Company, Akron, was compelled to withdraw service from a number of industrial plants temporarily on Nov. 27 because of fuel shortage. General Manager A. C. Binn said that the supply would last four days and that effort would be made to continue operation of the electric railway and to furnish street lighting for Akron. By conserving supply through restriction of service he thought that it might last until shipments should improve the situation.

Until recently coal has been confiscated regularly in some parts of Ohio. The situation in northwestern Ohio was particularly acute, and at Delphos it was necessary to confiscate fifteen cars of coal in fifteen days. H. W. Brunell, Northwestern Ohio Light Company, assisted by the Mayor and Chief of Police of Delphos, participated actively in this work to keep industries, some of which are engaged in government

work, supplied with electric power. In some cases it was necessary for these men to operate railroad locomotives in order to get coal cars cut out of trains and on the electric light company side track.

SAVING FUEL BY SAVING POWER

Federal Administrator Points Out that Electric Railways Could Use Central Station Energy

Fuel saving through conservation of electric power used by electric railway companies is sought in a communication which the United States Fuel Administration has sent to the various state fuel administrators. State administrators are urged to secure the co-operation of electric public utility concerns to eliminate all wasteful use of electricity. The communication reads in part:

The conservation department of the Fuel Administration is, as you are aware, investigating every possible opportunity to save coal, which, of course, includes the saving of electricity.

An investigation convinces us that electric railways offer a chance for large savings, particularly through reductions in schedules. We are not suggesting changes in railway schedules which will seriously inconvenience the public, but it is well known that the pressure of private interests has in many instances led the electric railways to provide service which represents a wastage. In addition, our attention has been called to a number of other opportunities for economy of electric railway companies. One has to do with heating of cars. It has been stated that heating represents nearly 30 per cent of the electricity used. May it not be possible to make a substantial saving?

In many cases the system of power stations could be

revised with large fuel savings, as is done in Great Britain. There are, along lines of railways in thickly populated districts, power stations with more or less obsolete or inefficient equipment which could, we judge, be discontinued or reserved as relay stations through arrangements for railway companies to obtain power from other more efficient stations of other public utilities.

If public utilities which produce power at lowest cost could furnish the regular requirement of railways and the railway plants be merely maintained as relays, the saving in electrical power, and therefore in coal, would be considerable.

All companies should be urged to renewed vigilance in scientific economy in firing power plants and cutting off every kind of leakage and wastage, especially in transmission systems. We shall be glad to hear that you have found it possible to effect considerable savings.

PRESIDENT WILSON'S ADDRESS

The main part of the address of President Wilson to Congress on Dec. 4 was devoted to his powerful arraignment of "the masters of Germany," to his account of the circumstances that require a declaration of war against Austria and to his outline of just conditions necessary to righteous peace. There were also references to business, as follows:

WATER-POWER DEVELOPMENT IMPERATIVE

It is imperatively necessary that the consideration of the full use of the water power of the country and also the consideration of the systematic and yet economical development of such of the natural resources of the country as are still under the control of the federal government should be resumed and affirmatively and constructively dealt with at the earliest possible moment. The pressing need of such legislation is daily becoming more obvious.

PERMIT EXPORTERS TO COMBINE

The legislation proposed at the last session with regard to regulated combinations among our exporters, in order to provide for our foreign trade a more effective organization and method of co-operation, ought by all means to be completed at this session.

GO FURTHER IN PRICE-FIXING

Recent experience has convinced me that the Congress must go further in authorizing the government to set limits to prices. The law of supply and demand, I am sorry to say, has been replaced by the law of unrestrained selfishness. While we have eliminated profiteering in several branches of industry, it still runs impudently rampant in others. The farmers, for example, complain with a great deal of justice that, while the regulation of food prices restricts their incomes, no restraints are placed upon the prices of most of the things they must themselves purchase; and similar inequities obtain on all sides.

ELECTRIC SIGN RULES STRICT IN MICHIGAN

Acute Coal Conditions Lead State Fuel Administrator to Limit Burning Hours of Signs More Closely

Fuel Administrator Prudden of Michigan, with the authority of the Federal Fuel Administrator, has issued electric sign operation rules to apply in Michigan while the acute coal situation exists. This indicates that the national order is only a minimum restriction and that each state, if conditions seem to demand, can issue stricter regulations.

The Michigan order eliminates entirely the burning of all roof signs, outline lighting and marquis lighting. In other respects it conforms with the national order. However, owing to the fact that Detroit has Eastern time, the merchant with a directional sign may burn his sign only twenty minutes, since he may turn it on at 5.10 p. m. and off at 5.30 p. m. if he closes his store at that hour, as many do.

There is some talk of a similar order in Ohio.

Throughout the Middle West the sign order appears to be meeting with only such degree of obedience as is insisted upon by local central station companies. In the larger cities the companies seem to be enforcing it rigidly by employing patrolmen to see that owners comply.

An opportunity to observe the effect of the national order was afforded in Chicago on Nov. 28, when there was practically no daylight owing to a murky cloud of fog and smoke from morning until night. Ordinarily under these conditions signs are operated all day. On this occasion it was noticeable that only a few of the smaller signs, principally those connected on the same circuit with window lighting, were on.

ELECTRIC SIGN RULING BY FUEL ADMINISTRATION

Federal Administration Issues Letter to State Administrators Noting Reports that Order Is Not Being Closely Obeyed

The United States Fuel Administration issued the following electric sign ruling to state fuel administrators on Dec. 3:

We wish to call your attention to the electric sign order of Nov. 9 [This refers to the original order, published in full in the ELECTRICAL WORLD of Nov. 17, 1917, page 969.—EDS.] and request that you carefully note the following synopsis of the main points of the order:

First—The order provides that directional signs on retail stores may be illuminated from one-half hour after sunset until the regular closing time for transacting business, but not later than 11 p. m. Directional signs are signs over the door or extended over the sidewalk which give the name and the nature of the business. Exterior advertising signs other than those of a directional character shall not be illuminated earlier than 7.45 and shall be extinguished at 11 p. m.

Second—Directional signs on theaters are the name of the theater and the name of the performance. Such signs may be illuminated from one-half hour after sunset until one-half hour after the time scheduled for the commencement of the performance. The display or advertising signs on theaters and places of assembly, however, may only operate from 7.45 to 11 p. m.

Third—In the case of moving-picture theaters with a continuous performance directional signs may be illumi-

nated from one-half hour after sunset until one-half hour after the beginning of the last performance. Display advertising on such theaters may only operate between 7.45 and 11 p. m.

Fourth—Directional signs on hotels may be operated from one-half hour after sunset until 11 p. m., but display advertising on hotels, either on the roof or on the front of the building, may only be illuminated from 7.45 to 11 p. m. This does not prohibit the use of porch or entrance lights on hotels as excepted in paragraph (d).

There will without doubt come to your attention some cases where you will have to determine whether or not the sign is within the spirit of the order. The authority is given you in the latter portion of paragraph (c), which states that the size of the signs and the amount of electricity used to operate them shall be reduced at any time upon the direction of the State Fuel Administrator.

State fuel administrators should define the rulings carefully and make public announcement thereof.

We regret to note that reports are reaching us from some cities that the order is not being closely obeyed. It may be necessary, if the State fuel administrators cannot enforce the spirit of the order, to withdraw all exceptions and forbid the illuminating of all electric signs from 7.45 to 11 p. m. We earnestly request your hearty co-operation in enforcing compliance with our rulings.

PENDING CHANGES AT THE NATIONAL CAPITOL

One, Possibly Two, Members Will Withdraw from Federal Trade Commission—Chairmanship of Important House Committee

Interesting changes in regard to positions at Washington are expected and others are under consideration coincident with the opening of Congress this week.

William J. Harris, chairman Federal Trade Commission, announces that he will leave that body and endeavor to obtain the seat of Senator Thomas W. Hardwick of Georgia. There is a rumor that Joseph E. Davies, former chairman, now a member of the commission, will go to the Senate in place of the late Senator Husting of Wisconsin.

Representative Adamson of Georgia, chairman of the powerful and important committee of the House on interstate and foreign commerce, which will have much to say as to water-power legislation and railroad affairs, will retain his seat for the present. He was confirmed as appraiser of merchandise at New York by the last Congress, but there is a deadlock in his home district over the nomination of a successor, and as many important matters are to be before his committee at this session he has decided not to qualify for his new position until the Georgia political fight is settled.

Representative Thetus W. Sims of Tennessee is the ranking Democratic member of the House committee on interstate and foreign commerce and will succeed Representative Adamson.

Mechanical Service in the Signal Corps

Skilled mechanics are in great need back of the lines to keep the United States aviation service in effective and vigorous action.

The government must have plenty of skilled workers at once in the aviation section of the Signal Corps. Young men called in the draft may volunteer before Dec. 15 in such branches of the service as will enable them to serve their country with the greatest effectiveness according to their technical and mechanical skill.

Public Service of the Engineer

American Society of Mechanical Engineers, at Annual Meeting in New York This Week,
Discusses Service of the Engineer to the Public in War and
Peace Crises—Fuel Economy

WAR topics predominated at the annual meeting of the American Society of Mechanical Engineers, held in New York, beginning on Tuesday of this week and lasting until Friday. Dr. Ira N. Hollis, president of the society, spoke on "Universal Public Service in Peace and War"; Gano Dunn on "The Engineering Societies in National Defense"; Dr. Charles S. Howe on "Special Education in Time of War"; Prof. L. P. Breckenridge on "The Fuel Problem," and C. E. Skinner on "Engineering Research."

Many notable speakers, including ex-President Taft and Major-General Goethals, also addressed the meeting on war subjects, the former speaking on the "War's Call to Professional Men." On the evening of the first day's session an honorary membership was conferred upon Major-General Goethals in recognition of his achievements in engineering. These functions were followed by a reception to the new president of the society, Charles T. Main.

The fuel problem, for which all electrical engineers can help to find a solution, was discussed more at length in one of the parallel sessions on the second day of the convention. A full discussion of this subject is presented in this report.

Among other particularly timely subjects discussed were the "Employment of Women in Skilled Industries" and "The Engineer, the Cripple and the New Education." Accounts of these discussions will be presented in a subsequent issue of the *ELECTRICAL WORLD*, with features of the public hearing by the power test committee.

PRESIDENTIAL ADDRESS OF DR. HOLLIS

Dr. Ira N. Hollis, in his presidential address on the "Service of the Engineer to the Public in Times of Crises," said that our relation to the government may roughly be divided under four heads:

1. The civil routine, or conduct of business in government.
2. Civil research and publicity for the benefit of citizens.
3. Military training in peace.
4. Military training in war.

"The twentieth century is still young," said Dr. Hollis, "and we do not yet know what it will represent to the future historian. Will it be the debauch of science, or will it mean a new birth to Christianity? It is the engineers' task to decide this. There are two tendencies—one toward greater comfort and luxury, and one toward greater service. The first can plunge us only deeper and deeper into war for the control of a commercial output. It can only bring us more firmly under a governing class derived either by birth or by commercial success. The second means the complete emancipation of the individual trained to think of service as the chief source of good government and happiness in life. The only theory that will hold men together is that of service."

In opening his paper under the title "Engineering

Societies in the National Defense League," Gano Dunn took the occasion to direct the attention of the convention to the heroic deeds of American engineers on the battlefields of France during the past week. He pointed out that the engineers are now "coming into glory and honor."

The whole government of the United States, so far as the army and navy are concerned, Mr. Dunn said, rests on a foundation of engineers. In considering the relation of the engineer to the national defense the speaker started with the Naval Consulting Board. To this board were appointed two representatives from each of eleven different engineering bodies by the Secretary of the Navy on nomination of the respective societies. Ever since the beginning this body has been giving valuable service in many ways, some of which are: (1) The inventory of industrial resources; (2) experiments on and development of important devices, in which it is now helping both the army and the navy; (3) as a board on inventions. This board is examining thousands and thousands of suggested devices.

Next comes the National Research Council, started before the war as an outgrowth of the National Academy of Science formed during the Civil War. The keynote is science. Engineering has its place in this body only in its connection with scientific research.

The general engineering committee of the Council of National Defense is the next in order. The development of this committee was traced as follows: Engineering societies offered the services of their engineers to the President of the United States, which offers were turned over to the Council of National Defense. This body, in turn, placed them in the hands of a member on engineering, who went back to the societies, asking them to nominate members who could be appointed to the general committee. The national engineering societies have served as a center where the government could go for an adequate roster of all who could be called into engineering service.

Considerable confusion has arisen owing to the great number of committees, some thirty-two in all, representing engineering broadly, and with the realization of this situation representatives from each of these committees have met. At this meeting there was appointed a sub-committee to confer with the Engineering Council and the different societies and to report on a plan to prevent confusion of work. This is believed to be sound and fundamental, particularly when not so long ago it looked as though engineers, who clamored for public work, were least fitted.

Mr. Dunn was of the belief that the more committees there are that represent real service the better for all concerned. What he believed to be necessary are (1) a little more directive force and (2) a little more efficiency and co-operation with other committees before taking up any new work.

It was brought out that the general engineering committee of the Council of National Defense is on the point

of being asked by its chairman to resign because he believes its services to be incompatible with the ruling of the Attorney General on the basis of having business relations with the government. Mr. Dunn believes that if this were carried out to the limit the country would be robbed of engineering services.

In conclusion, Mr. Dunn pointed out that so far as he knew there is no case where the government has called upon an engineer for service where that man has not responded.

ENGINEERING RESEARCH

C. E. Skinner of the Westinghouse Electric & Manufacturing Company, in his paper on engineering research, emphasized the unlimited fields that are open to research and the necessity of taking advantage of these fields, not only for work in connection with the war but also for providing for the period of reconstruction that is to follow. He also spoke of the need of men and resources in the field of research.

The morning session closed with a paper on the agricultural problems by Dr. Liberty H. Bailey of Cornell University. Dr. W. H. Jordan was scheduled to speak on this subject, but was called away on war matters.

Charles S. Howe, president Case School of Applied Science, in his paper entitled "Special Education in Time of War," laid emphasis on the need for engineers that would arise after the war, pointing out to what extent engineering colleges had been affected by the call to arms. Students are enlisting all the time and thereby greatly decreasing the number of engineers who would have been available in the future. Dr. Howe also pointed out the extremely urgent demand to-day for trained engineers and the inability of the universities to fill this demand. At present, he stated, the universities are able to supply only about one-quarter of the demand. Efforts have been made by engineering institutions, he said, to obtain the government's consent to keep young engineering students out of the war until they have been adequately trained, but all suggestions of this nature so far made to the government have either been refused acceptance or are still under consideration.

He further brought out the question of the draft, pointing out that before Dec. 15 the young men of more than twenty-one in the universities either must have secured positions in the military forces or else be subject immediately to the draft. This, of course, would take practically all of the two upper classes except those physically unfit, while those in lower classes would undoubtedly be taken as soon as they were of age. He asked whether or not some change therefore should be made in the curriculum on the understanding that owing to army regulations an engineering course, generally speaking, could now be for only two years. The different ways in which universities are helping the government by giving special training, such as military drill, military engineering, practical work in mechanical and electrical engineering and in the chemistry of explosives, were outlined.

SPECIALLY TRAINED MEN IN THE DRAFT

The following telegram from Dr. Hollis Godfrey, member of the advisory commission of the Council of National Defense, addressed to Dr. Ira N. Hollis, was read:

Have just been authorized by the Secretary of War to request you to inform all your technical students that if they

wait until drafted they can upon summons to the draft camp take with them letter from you stating their special qualifications, such letter to be filed with occupational census questionnaire of War Department under authority of this authorized telegram. Secretary of War also authorizes me to say that every effort will be made to use each student's special training in connection with specialized occupation in the army so as to afford technical students of draft age fully as great an opportunity through the draft as if they enlisted now.

PREVENTABLE WASTE OF COAL

Of the papers presented at the three simultaneous sessions on Wednesday afternoon, one by David Moffat Myers on "Preventable Waste of Coal in the United States" should be of utmost interest to electrical engineers as it suggests a propaganda to conserve 1,000,000 50-ton carloads of coal per year in addition to releasing the cars required in transporting this fuel for other purposes. The author said in part:

While organized effort is being made to bring about efficiency in the production and distribution of coal, no parallel measures have been adopted to bring about a normal and practicable efficiency in its use. For well-known reasons the boiler plant offers the most lucrative field for producing economies, and these with a minimum of alteration in physical equipment. Hundreds of plants are consuming fuel wastefully, many at no greater than 58 per cent efficiency, whereas it would be comparatively simple to secure 70 per cent efficiency. In short, less than 75 per cent of this improvement would save about 1,000,000 50-ton carloads of coal a year, taking into consideration only those plants using coal for steam-producing purposes, which represent 67 per cent of the coal consumers. This saving is quite possible as few factory power plants exist where an improvement of 10 to 12 per cent in economy could not be made by establishing proper operating methods.

In general there are two plans for the conservation of coal which are at least worthy of consideration. One might be termed autocratic and involves the use of authority to compel coal users to execute such measures of economy as proper authorities might prescribe, limits to be set as to expense to users. Alterations should be directed chiefly to purely operating improvements.

The other plan would be largely an educational one, in which patriotism and efficiency would furnish the motive forces required. The teaching must be accomplished with the utmost simplicity and directness. Above all, it must be in such form as to be readily comprehended and applied. The requisite information must reach the owners and managers of industries, and there must be simple instruction sheets for the engineers and firemen. The vital importance of daily accurate records of coal and water must be taught and information given regarding practical appliances for automatic measurements of both.

Blank forms might be sent in advance to plant owners in order to be advised by them, first, whether they would be willing to co-operate with a governmental organization offering to assist them in reducing their coal consumption, and second, to obtain such data as to size, type, equipment, operation and fuel consumption of the plants as would enable a classification which would permit a government board of experts to send such instructions as would include the information needed for any one class of plants. This work would be very greatly aided by a staff of experts ready to visit plants when so requested by owners, and make investigations and recommendations and keep in touch with the progress of economies.

Present examinations of operating engineers for licenses call for practically no knowledge of steam and fuel economies. This is a very serious defect and is directly responsible for a large preventable waste of fuel.

The presentation of this paper aroused considerable valuable discussion. Among those taking part were E. M. Huyck, W. N. Polakov, Prof. L. P. Breckenridge, Norman Reinicker, J. S. Lane, E. N. Trump, E. A. Uehling, W. B. Jackson and Albert A. Cary.

Mr. Polakov, who in his remarks dealt especially with priority in fuel deliveries for efficient users of coal, said in part:

There are already many plants that have reduced their coal consumption from 20 to 40 per cent for the same output, by better organization of power plant work. Van H. Manning, director of the Bureau of Mines, recently said: "We cannot scrap all out-of-date power plants. We must start by doing the best with what we have. We must reach the man with the shovel." The strength of England, France, and also of the Central Powers, is due to the co-operation of industries. Those who fail to render service to the common cause are denied the privilege to mismanage their plants. Voluntary co-operation for which we long will come after the war as the result of new social readjustment, but we cannot wait. To-morrow may be too late. In other words, we must create conditions stimulating voluntary co-operation even under individualistic régime.

The solution, therefore, is the abolition of privilege to waste fuel in inefficiently conducted plants by giving priority in coal deliveries to those who prove that they do use fuel efficiently. Such encouragement of efficient plants rendering good service to the country and stimulating the inefficient to seek salvation through the means beneficial to the country can be accomplished along the following lines:

1. Rating by experts (nominated by the national engineering societies and supported by public opinion and government) of plants in the indispensable industries that are entitled, because of coal-saving methods in use, to the priority in coal supply.

2. Receiving of applications by the special service bureau of the American Society of Mechanical Engineers from the low-rated plants for assigning the expert help.

3. Serving the needs of such inefficient plants by offering services of recognized experts in power plant management for direction of the work.

4. Organizing a staff of steam, electrical and combustion engineers, whose members will be assigned to carry out the work in the plants of the applicants under the direction and supervision of experts.

5. Charging for such services an adequate compensation to cover the expenses involved (salaries, traveling and office) but no profit.

Mr. Myers' second plan, "an educational one, in which patriotism and efficiency would furnish the motive forces required," is in my opinion doomed to failure for the following reasons:

1. Teaching efficiency by a correspondence school method will accomplish little good, is incompatible with the professional dignity of this society and lacks the personal touch.

2. Endless variety of equipment, grades of fuel available, personality of men, nature of load, climatic conditions, etc., make the preparation of "simple instruction sheets for engineers and firemen" impossible, and if same are made they are so general as to be useless.

3. No instructions of real value could be given unless examination of the plant was made.

4. Keeping records, logs, etc., necessitates instrument equipment and measuring devices. All of this is good only when the data are used and interpreted by a trained man and this is done continually.

5. If the regular employees failed to secure high efficiency, it is not because of the lack of "circularized education," but chiefly on account of: (1) lack of time to carry on investigations and tests, all the time being absorbed by routine duties; (2) absence of instruments, facilities or encouragement; (3) lack of experience in this highly specialized line of research work.

6. The education should begin with owners and managers, not with the firemen.

7. Educational talks and circulars usually degenerate rapidly into debating societies, wasting time needed for deeds.

Summarizing, the problem is to be solved by groups and individuals available through the A. S. M. E., by the services of those who know how more power can be got out of a pound of coal. There is no necessity to compel plant owners to improve their methods since in such a step lies their self-preservation. But there is an urgent necessity from the national standpoint to conserve the fuel by prevent-

ing its waste by ignorance or indifference. The valuation of plant methods to establish ratings for priority in coal deliveries is therefore recommended.

Mr. Cary also recommended that engineers be required to pass an examination which would show their fitness to burn fuel economically, suggesting that it be conducted under the supervision of the War Coal Board, but also called attention to the fact that a large percentage of fuel could be saved by redesigning the furnaces for the particular fuel used.

Mr. Huyck pointed out that many industrial plants under the pressure of increased production are not giving proper attention to economical fuel utilization, and hence should be compelled to do so. In the period of depression which is likely to follow the war there will be still further need of increasing economy.

PRESSURE ON STEAM PRODUCERS MORE IMPORTANT THAN ON DOMESTIC CONSUMERS

Since 67 per cent of the total fuel mined each year is consumed by 250,000 steam-producing plants, whereas only 15 per cent is consumed by 20,000,000 domestic users, Professor Breckenridge urged centering conservation efforts on the former. This can be done by engineers in each state co-operating with the local representatives of the Fuel Administration. In New Haven, Conn., the Chamber of Commerce called together foremen, owners and operators of all plants in that city and opened the meeting with lectures on coal conservation. As a result of calling attention to the possibility of plants being shut down owing to coal shortage, an experience meeting ensued in which all took part. The meeting ended with the invitation to all plant owners to communicate with the fuel conservation committee if they wanted their operating conditions analyzed and economy measures suggested. Similar meetings were urged in other cities. Instructions cannot be given by correspondence. Results can only be obtained by visiting plants.

Mr. Reinicker urged the scrapping of old, inefficient equipment where deliveries can be secured on new apparatus.

Messrs. Lane and Uehling emphasized the need of instruments to tell firemen when they are securing the best economy.

Mr. Trump urged the adoption of bonus systems, as the firemen will then see some direct advantage in co-operating.

In closing the discussion, Mr. Myers called attention to the fact that the efficiency of any apparatus is equal to the product of the efficiency of the equipment and the efficiency of operation, so operation is just as important as the design. It is not a question of cost. Transportation is curtailed, the coal supply is disappearing, and plant production is reduced; therefore money has to be spent to conserve fuel. The owners and managers of plants must be made to understand that if they do not improve economy the government will curtail or even stop the supply of coal.

The things that can be done first to increase economy are the things that should be considered. Improvements of operating methods should not be delayed just because equipment is inefficient. This can be changed later.

Other papers of intense engineering interest were presented. Among these were: "A Commercial Analy-

sis of the Small Turbine Station," by W. J. R. London; "The Cooling of Water for Power Plant Purposes," by C. C. Thomas, and "The Transfer of Heat Between a Flowing Gas and a Containing Flue," by Lawford H. Fry. Abstracts of these and the discussions they aroused will be presented later.

WAR CONDITIONS AND THE BALTIMORE COMPANY

President Wagner Writes Confidently of the Position of Public Service Utilities, Particularly Those Supplying Electric Power

President Herbert A. Wagner of the Consolidated Gas, Electric Light & Power Company of Baltimore, in a reassuring statement to shareholders, says in part:

So far as public service companies are concerned, and particularly those supplying electric power, changing conditions have been so far very much to their advantage. This is particularly true in the Consolidated Gas, Electric Light & Power Company, where enormously greater amounts of electric power are required for new industries and large extensions to old industries which have been hastened by the great stimulus given by government contracts, not only for munitions and shipbuilding, but for staple products in unusually large quantities. As a result this company is more stably prosperous than ever before. There is no cloud on the horizon, and none is expected, which would by any probability impair the ability to continue paying dividends at 8 per cent. This rate was established in March, 1917, when it was recognized that war was imminent, and after full consideration of possible changes in business conditions. Nothing unprovided for at that time has come to pass or is indicated in the present situation.

While cost of supplies and labor is increasing, it is equally expected that constant efforts of the management to bring about increased revenue and greater economy in operation will fully compensate for such increased costs. A stabilizing factor of paramount importance should never be overlooked—the twofold advantage in its contract for a term of years for a controlling amount of hydroelectric power from the Pennsylvania Water & Power Company, and a contract also for a term of years with the Bethlehem Steel Company for a controlling amount of coke oven gas at a reasonable price from its Sparrows Point plant.

At present, output of electricity and gas and revenue is being increased by greater amounts than at any time in the company's history, and contracts entered into for sale of power assure continued large increase next year. The company has secured ample capital and made favorable contracts for apparatus, to take care of all expected increases in business for the next two years.

The company has further protection to earnings in the event of increases in cost of fuel used in production of electricity by introducing into its power contracts an automatic adjustment of the rate, depending upon the price for coal.

In past years the management has satisfactorily overcome all obstacles which might interfere with constant improvement and betterment in condition and earnings, in spite of periods of general business depression, rate decreases and increasing costs of material and labor. There has never been a year since the present company was in existence that did not show very substantial increase in earnings over every previous year. At no time has the company's financial condition taken a backward step or even stood still. This applies to the period from the year ended June 30, 1907, when the company was earning 2.11 per cent on its common stock, to the year ended June 30, 1917, when it was earning 15.16 per cent. When the management gives assurance that this advance will be continued without interruption it speaks from actual experience during its unbroken record and its demonstrated ability to forecast and prepare for future conditions likely to affect business.

This company has been assured by the United States Fuel Administrator that we need have no fear of insufficiency in

supply of coal, and that this company's needs have been taken care of. This is particularly for the reason that munition factories and almost all government contractors in Baltimore and vicinity are dependent upon electrical power from the company for their operations. This company is particularly fortunate in being served directly by the principal coal roads upon which bituminous coal mines are located within comparatively short distance from Baltimore.

Earnings for the last four months ending Oct. 31, 1917, as compared with like months for three years prior thereto, are shown in the following table:

July 1 to Oct. 31	Net Earnings	Increase	Per Cent Inc. Over Same Months, Prior Year
1917	\$1,340,975	\$160,231	13.57
1916	1,180,744	98,036	9.05
1915	1,082,708	52,277	5.07
1914	1,030,431		

CONFERENCE ON THE EXCESS PROFITS TAX

Meeting of Representatives of Some of the Leading N. E. L. A. Companies to Act on Invitation of Commissioner Roper

President John W. Lieb of the National Electric Light Association called a conference on Nov. 26 of counsel of some of the leading member-companies and some of their accounting and taxation experts to consider an invitation that had been received from Daniel C. Roper, Commissioner of Internal Revenue, to submit to the Excess Profits Advisory Board the suggestions of the industry as to the most practical method of computing the "invested capital" provisions of the excess profits tax law. At this conference there were present E. W. Burdett, representing the Edison Electric Illuminating Company, Boston; H. J. Hemmens and H. M. Edwards, representing the New York Edison Company; O. D. Young and J. F. Zoller, representing the General Electric Company; W. G. Beale, representing the Commonwealth Edison Company, Chicago; D. T. Flynn, representing H. M. Byllesby & Company; E. K. Hall, representing the Electric Bond & Share Company; P. H. Gadsden, representing the Charleston (S. C.) Consolidated Railway & Lighting Company; H. H. Crowell, representing Hodenpyl, Hardy & Co., and H. A. Moore of Cravath & Henderson, representing the Westinghouse Electric & Manufacturing Company.

The conference decided to ask the advisory board for a hearing, which was granted. Messrs. Crowell and Gadsden were selected by the conference to present certain suggestions to the advisory board at a hearing on Nov. 28.

Governor Whitman at Schenectady

Gov. Charles S. Whitman of New York, accompanied by nearly 100 State officials, visited the General Electric Company plant in Schenectady on Dec. 5 as guest of the company. From the band stand in Factory Street Governor Whitman addressed the employees during the noon hour in a stirring patriotic speech. After a buffet luncheon with company officials, Governor Whitman and the members of his official family made a tour of inspection through the plant, which is the largest manufacturing establishment in the State, covering as it does 328 acres of land, with 5,500,000 sq. ft. (467,000 sq. m.) of floor space, and employing 25,000 men and women.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Duty of Utility to Persons Engaged in Moving a House.—It has been held by the Missouri higher court in *Logan versus Empire District Electric Company* (L. R. A., 1917, E. 258) to be the duty of an electric company to anticipate the moving of buildings of greater height than the wires maintained by it and to take precautions to protect persons liable to be on such structures from danger of coming in contact with its wires.

Riparian Owners' Rights.—The plaintiff purchased from defendant riparian proprietors the waters that flowed in a creek and which they had appropriated and also stored other waters in a lake from which the creek was fed. The Supreme Court of Washington held, in *Pleasant Valley Irrigation & Power Company versus Barker* (167 P. 1092), that the defendants were not thereafter entitled to any waters in the creek. Under the code provision declaring that any person may take any water which he may have the right to use along any natural stream or lake of the State, but not so as to cause the water to rise above high-water mark, plaintiff, which owned the waters in a lake, was authorized to use a natural stream flowing from the lake in lieu of an aqueduct, and defendants, though owning the bed of the stream, which was non-navigable, and the banks thereof, cannot complain where the level of the stream was not raised beyond high-water mark and their property was not eroded.

Injuries to Employee Dumping Ashes.—The plaintiff was employed in a power house to take ashes from under boilers, wheel them to a pit partly filled with water and tip them into the pit. The ashes were sometimes hot or red hot, and plaintiff was injured as he tipped the ashes into the pit on one occasion by steam and heat flashing up and burning his eye. There was evidence that the hot ashes flashed up in the same way at other times. The Supreme Judicial Court of Massachusetts (117 N. E. 336) held that the facts did not show negligence, there being no suggestion that this method of disposing of the ashes was not proper and usual. Where the same method of disposing of the ashes had been followed during the entire period of plaintiff's employment and he was fully aware of all the ordinary incidents of the work, including the fact that there is liable to be a splash when a body is thrown into water, no warning was required. Where there was evidence that water from a pipe under the boilers trickled out to wet and dampen the ashes, and that they became cool if they stayed

long enough, and that on the occasion of the accident the water had stopped coming down, the testimony did not warrant a finding that this stoppage of the water constituted negligence on the part of the employer having a causal connection with the injury sustained by the plaintiff.

Admissible Evidence in Case of Shock.—In an action for the death of an employee based upon faulty insulation of a cord attached to an electric light, expert testimony as to the different ways in which a ground could be produced and that unless there was a ground a person could not get a harmful shock was admissible as bearing on the degree of caution required of the employer, the Supreme Court of Vermont held (102 A. 53). Evidence of the precautions taken by the employer to prevent grounds was admissible; expert testimony that moving the lamp from place to place would cause the insulation just above the socket to break away was admissible; testimony that deceased knew nothing about electricity was inadmissible; testimony that deceased talked about the dangers of his employment but made no mention of the dangers of electricity was admissible. It was the duty of the employer to exercise constant and active vigilance of a searching character to keep safe the electric light used by the foundry employee. In an action for the death of an employee it was held under the evidence that the lack of insulation of the electric light cord was a proximate cause, if not the only cause, of the accident.

Liability for Injury from Dam Maintenance.—The property rights relative to the passage of waters that naturally percolate through the land of one owner to and through the land of another owner are correlative, and each landowner is restricted to a reasonable use of his property as it affects subsurface waters passing to and from the land of another, the Supreme Court of Florida held in *Cason versus Florida Power Company* (76 S. 535). Where a riparian owner by erecting and maintaining a dam across a stream raises the level of the stream so that the flow of percolating waters from the adjoining lands of another owner is obstructed, and because of the dam the waters from the stream percolate through the land of the riparian owner into such adjoining land, causing its subsurface waters to rise and remain so near the surface as to injure the land and the improvements and crops thereon, such use by the riparian owner of the land and waters may be unreasonable with reference to the rights of the adjoining landowner, and the party erecting and maintaining the dam may be liable in damages for such injuries to the adjoining property as are proximately caused by the dam, and the questions of unreasonable use and resulting damages should be submitted to the jury upon appropriate instructions, when there is any substantial evidence to sustain the contention that such use and damages are in question.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Present Conditions Not Merely Temporary.—In allowing the Milford & Uxbridge Street Railway Company to make increases in fares the Massachusetts Public Service Commission says: "There seems no reason to believe that if the full increase desired were allowed the company would be able under present conditions to earn an exorbitant and unreasonable return upon its investment. Nor can it be said that present conditions are merely temporary. Whatever may be the merits of the claim that a street railway company in these times ought not to ask a normal return upon its investment, it certainly is not the principle upon which the industries are acting which are supplying coal, steel and other materials to the railways; nor is it a principle upon which this commission would be justified in proceeding under law."

Rates, Value and Depreciation.—The Superior Court of Pennsylvania has rendered an opinion reversing an order of the Pennsylvania Public Service Commission affecting rates and valuation in the case of the Ben Avon Borough et al. versus Ohio Valley Water Company. It says in part: "The business of rate making should not be an effort to impose on either the public or the corporation, and, while it may be true that some corporations in the past have acted unfairly to the public, that would not justify a confiscatory valuation by the commission or a lowering of rates causing a confiscation. . . . To induce investment and the continuance of capital, there must be some gain commensurate with that of any other business. The mere assurance that the investment will not be confiscated will not suffice. . . . Depreciation, though largely theoretical in its nature, which is allowed on the reproduction cost seems to have a fixed place in valuation. If, however, replacements and renewals are amply provided for and made, depreciation only to a very small extent takes place. If through depreciation the value of the property is largely reduced, the securities which were placed thereon may be unnecessarily reduced in value. As these charges withdraw from the rate-making base, such depreciation naturally effects a purchase of a part of the property for the consumer, a thing never contemplated. A rate for renewals and replacements should be provided and expended for that purpose; when that is done, as is the custom in every utility concern, depreciation is a very small fractional per cent. This should be placed in a reserve, and it, with renewals and replacements, is properly allowable in fixing a schedule of rates."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

San Francisco Section, A. I. E. E.—At the Nov. 23 meeting of this association M. M. O'Shaughnessy, city engineer of San Francisco, gave an illustrated talk on "Construction of the Hetch Hetchy Project."

Southwestern Illuminating Society.—At a recent meeting of the Southwestern Illuminating Society held in Kansas City, Mo., E. G. Stephens of the Stephens Chandelier Company was elected president and James Mundstock of the Western Chandelier Company was re-elected secretary.

Pennsylvania Contractors Adopt Goodwin Plan.—At a luncheon held in Philadelphia on Nov. 23 the Pennsylvania Association of Electrical Contractors and Dealers adopted the Goodwin plan of electrical merchandising. The speakers were James R. Strong, William C. Goodwin, A. D. Babson and S. A. Chase.

Some Recent Investigations in Arc Welding.—W. O. H. Eschholz of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., presented a paper on "Some Recent Investigations in Arc Welding" before the Philadelphia Section of the Association of Iron and Steel Electrical Engineers on Dec. 1.

Jovian Electric League, Los Angeles.—The Nov. 21 meeting of this league was designated "Ladies' Day." The members and their guests were addressed by Judge Thomas P. White on "The Golden Rule" and by Claire Hosler Coombs, lecturer for the American Red Star, on "Over No Man's Land with the Horses and Dogs."

Chicago Section, A. I. E. E.—Bert H. Peck, electrical engineer, Illinois State Utilities Commission, read a paper on Nov. 26 to the Chicago Section, A. I. E. E., entitled "Engineering Data Necessary for an Electric Rate Determination." About 150 were in attendance, and the paper was discussed by Commissioner Walter A. Shaw, E. J. Fowler, J. G. Wray, R. F. Schuchardt and A. C. King.

Electrical Contractors' Association of Massachusetts.—A special meeting of this association was held at Worcester on Nov. 27 to adopt a new constitution. James R. Strong presented an explanation of the Goodwin plan. The State executive committee held a meeting immediately after the regular meeting and elected the following officers: State chairman, Alfred J. Hixon of Boston; secretary, J. E. Wilson of Boston; treasurer, Frank L. Barnes of Boston; State committeeman, W. K. Tuohey of Springfield.

New York Section, I. E. S.—A joint paper on the "Adaptation of Incandescent Lamps to Motion-Picture Lamps" will be presented by J. T. Caldwell of the National Lamp Works, A. R. Dennington of the Westinghouse Lamp Company, J. A. Orange of the General Electric Company's research laboratory and L. C. Porter of the Edison Lamp Works at a meeting to be held at the Edison film laboratory, New York City, on Dec. 13 at 8 p.m.

Electrical Men Form Business Club.—The electrical men of Philadelphia have formed an organization to be known as the Electric Club of Philadelphia. The following officers were elected at the first meeting: President, Washington Devereaux, chief of the electrical department of the Philadelphia Fire Underwriters' Association; vice-president, Frank H. Stewart of the Frank H. Stewart Electric Company; secretary, R. C. Williams, Jr., of J. F. Buchanan & Company, and treasurer, M. Edwin Arnold of M. E. Arnold & Company.

Institute Meeting in New York, Dec. 14.—The three hundred and thirty-fifth meeting of the American Institute of Electrical Engineers will be held in the Engineering Societies Building, 33 West Thirty-ninth Street, New York, Dec. 14, 1917, at 8:15 p. m. Two papers will be presented at this meeting—"Magnetic Flux Distribution in Annular Steel Laminæ," by Dr. A. E. Kennelly and P. E. Alger of the Massachusetts Institute of Technology, and "Phenomena Accompanying Transmission with Some Types of Star Transformer Connections—II," by L. N. Robinson of Leland Stanford, Jr., University. The latter paper is an amplification of Mr. Robinson's former paper presented at the Panama-Pacific convention of the A. I. E. E. (*Transactions*, Vol. 34, 1915.)

Two New Electrical Contractors' Associations Formed.—On Nov. 26 and Nov. 27 respectively the States of Indiana and Wisconsin discarded their old electrical contractors and dealers' associations to form new associations known respectively as the Indiana Association of Electrical Contractors and Dealers and the Wisconsin Association of Electrical Contractors and Dealers. Both of these organizations adopted in its entirety the model form of constitution and by-laws recommended by the National Association of Electrical Contractors and Dealers. For the purposes of interstate organization Indiana will be divided into possibly twelve or thirteen districts and Wisconsin has been divided into six districts. While officers for the State of Indiana have not yet been elected, the districting and further association plans are in the hands of Mr. Harris of Gary, Mr. Sandborn of Indianapolis and Mr. Swanson of Evansville. Mr. Sandborn was elected state director for the association. In Wisconsin the following district chairmen were elected: M. F. Patrick, Racine; J. D. Warden, Sheboygan; R. J. Nickles, Madison; W. R. Johnson; M. F. Metzger, Eau Claire, and William Meter, Oshkosh.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Power Rate Increase in Lexington, Ky.—An increase in power rates to larger customers may be made by the Kentucky Utilities Company, Lexington, Ky., according to a statement by F. W. Bacon, vice-president.

Ohio Commission Denies Rehearing in Cleveland Case.—The Ohio Public Utilities Commission has denied the request of the city of Cleveland for a rehearing on the valuation of the Cleveland Electric Illuminating Company property. The city may appeal to the Supreme Court. The company has filed reasons why a rehearing should be granted. It contends that the valuation is too low.

Washington-Idaho Power & Light Property Sold.—A. Welch of Portland, Ore., has purchased the property of the Washington-Idaho Power & Light Company, owner of the distribution systems in Lewiston, Idaho, and Clarkston, Wash. Associated with Mr. Welch is W. H. Wehring, prominent in Portland banking circles, together with Eastern financiers. The purchase was made from Liggett & Drexel of New York, who acquired the property about fourteen months ago from the Charles Francis Adams estate in the Lewiston-Clarkston Improvement Company. At that time the purchasers formed the Washington-Idaho Power & Light Company, and the power interests have become definitely separated from the land holdings of the improvement company.

Membership Drive for New York Electrical Society.—A well-directed and organized drive that is expected to result in the addition of 500 new members to the New York Electrical Society has been started by the membership committee, whose chairman is Walter Neumuller, New York Edison Company. Already sixty-one members have been obtained, and the number is expected to grow as the campaign gathers momentum. Mr. Neumuller has associated with him W. S. McClure and S. D. Ward, New York Edison Company, and H. A. Currie, W. J. Moore, W. D. Protosky and G. E. Stephens, all connected with New York companies. All society members have been asked to co-operate, and each member is made a member of an auxiliary membership committee. A chart has been prepared showing the number of new members anticipated each week. Alongside are placed the numbers actually gained. By June 1, 1918, the 500 mark is expected to be reached. Another plan is to keep each member informed. This will be accomplished by printing on the society letterhead a cut of a thermometer showing the degrees of advance.

Charles A. Morss, treasurer of the Simplex Wire & Cable Company, Boston, Mass., has been elected governor of the Federal Reserve Bank, Boston.

F. L. Converse, now associated with the Tacony Ordnance Company, Philadelphia, previously was connected, as an electrical engineer, with the Midvale Steel Works, Coatesville, Pa.

A. E. Lockwood, general manager of the Bluefield (W. Va.) Gas & Power Company, has resigned to enter the army, where he has been commissioned first lieutenant in the Signal Corps.

A. J. Jackson, for some time a salesman in the commercial department of the Wilkes-Barre Company, has been promoted to succeed Ray Stretch as commercial manager for that company.

A. E. Merchant, general manager of the Union Gas & Electric Company, Bloomington, Ill., for some years, has been appointed general superintendent of the New Orleans Gas Light Company.

Richard H. Rice, of the General Electric Company's steam turbine engineering department, West Lynn, Mass., was elected president of the National Conference of State Manufacturers' Associations at Indianapolis, Ind., Nov. 22.

Ray Stretch, who for the past year has been acting as commercial manager of the Wilkes-Barre Company, has been appointed general manager of the Union Gas & Electric Company of Bloomington, Ill., succeeding A. E. Merchant.

W. H. Martin has been appointed agent for the Bessemer district of the Birmingham (Ala.) Railway, Light & Power Company. Mr. Martin entered the employ of the company in 1915 as an appliance salesman, later becoming engaged in lighting promotion.

F. J. H. Kracke, Brooklyn, N. Y., Commissioner of Plant and Structure of New York, and **Charles B. Hubbell** have been appointed Public Service Commissioners of the First District, to act in this capacity in the absence of Col. William Hayward and Major H. W. Hodge, who are now in active service for the government.

J. V. Murdaugh, commercial manager of the Colorado Springs Light, Heat & Power Company, has resigned to accept a position with a firm in Little Rock, Ark., manufacturing carpets and cleaners. Mr. Murdaugh was formerly commercial manager of the Union Gas & Electric Company, Bloomington, Ill., and before that was stationed in Little Rock with the Railway & Electric Company.

P. D. Kline, who designed, constructed and placed in operation the Ogden, Logan & Idaho Railway Company, was its general manager for five years, and who became manager of the La Crosse district of the Wisconsin-Minnesota Light & Power Company on May 1 last, on Nov. 15 was promoted to the position of vice-president and general manager of the same company, with headquarters at Eau Claire, Wis., succeeding A. E. Peirce, who has accepted service as an officer with the general army.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

A. S. Witmer, for six years engineer of sales of the Louisville Gas & Electric Company and its predecessor, the Louisville Lighting Company, has been appointed manager of the commercial department of the Louisville company, effective Dec. 15. Mr. Witmer will on that date succeed Robert Montgomery, who reports to Camp Zachary Taylor, at Louisville, for duty as first lieutenant of infantry. Mr. Montgomery will fill the position, which he vacated last August to go to the Officers' Training Camp, until the middle of the month. The appointment of Mr. Witmer is until such time as Mr. Montgomery may return from military service.

J. C. Nichols, who has been commercial manager of the Union Gas & Electric Company of Bloomington, Ill., has severed his connection with that company and accepted the position of general manager of the Bluefield (W. Va.) Gas & Power Company, succeeding A. E. Lockwood, who has been commissioned a first lieutenant in the United States Army Signal Corps. Mr. Nichols entered the employ of the United Gas & Electric Engineering Corporation nine years ago in the office of the Colorado Springs Light, Heat & Power Company. Five years later he was transferred to the Elmira company in the gas sales department, and later made commercial manager in Bloomington.

Charles T. Main of Boston, a consulting engineer who has served in several public offices for the purpose of advancing the idea of good government, has been elected president of the American Society of Mechanical Engineers. Mr. Main was born in Marblehead, Mass., in 1856 and was educated at the Massachusetts Institute of Technology, from which he was graduated in 1876. Three years later, after continuous service in the institute as assistant in the department of mechanical engineering, he became a draftsman at the Manchester Mills, Manchester, N. H., leaving this concern in 1881 to enter the employment of the Lower Pacific Mills, Lawrence, Mass., where for eleven years he acted in the respective capacities of engineer, assistant superintendent and superintendent. Since 1892 he has practiced as a consulting engineer, with offices in Boston, until 1907 being associated with F. W. Dean in the firm of Dean & Main. Mr. Main has designed and supervised the construction of numerous industrial steam-power and water-power plants, among his largest undertakings being the Wood Worsted and Ayer Mills in Lawrence, Mass., and four hydroelectric developments for the Montana Power Company.

Obituary

Clinton White, for fourteen years a member of the Massachusetts Railroad Commission and of its successor board, the Public Service Commission of Massachusetts, died at his home in Melrose, Mass., Nov. 24, at the age of seventy-two. Mr. White was born in Charlestown, Mass. He was well known in utility circles for his profound knowledge of finance. He retired on account of age in 1915 from the Public Service Commission. He was one of the most highly regarded public utility commissioners who have had a share in New England regulative practice.

Charles Henry Wilmerding, ninth president of the National Electric Light Association, died at his home in Flushing, N. Y., on Tuesday of last week. Mr. Wilmerding was born in 1858 in New York City, and received his early education largely in Europe. His col-



C. H. WILMERDING

legiate work was done at Yale, from which he was graduated in 1879 as a civil engineer. This profession he followed first in the East and later in Colorado, where he was engaged for some time in mining and railroad work. During 1884 and 1885 he was assistant engineer on the new aqueduct in New York City, and in 1888 he first entered the field of electricity. In the fall of that year he became superintendent of the Chicago Arc Light & Power Company, and later its general manager. When that company consolidated with the Chicago Edison Company, the predecessor of the Commonwealth Edison Company, Mr. Wilmerding was appointed manager of the operating department of the combined companies. Mr. Wilmerding took considerable interest in association work and in 1895 was elected president of the N. E. L. A. at the Cleveland convention. In 1906 he returned from Chicago to New York, by that time having ceased to have any active connection with the central station industry. For some years past he had been in ill health and confined as an invalid to his home at Flushing, Long Island. He is survived by his widow, Mrs. L. F. Wilmerding, two married daughters, and a son, Lieut. C. H. Wilmerding, Jr.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

BROAD POLICIES FOR VACUUM CLEANER MAKERS

Kenney Patent Licensees Are Considering the Question of Co-operative Sales and Advertising Campaigns

When the ELECTRICAL WORLD, in its issue of Aug. 5, 1916, related the events leading up to the establishment of the validity of the Kenney patent, governing the manufacture and sale of vacuum cleaners, one case, against the Bissell Carpet Sweeping Company of Grand Rapids, Mich., remained unsettled. The Kenney patent, No. 847,947, was issued to David T. Kenney, March 19, 1907, and therefore it has seven years more to run. The United States District Court for the Southern District of New York, before which the original case was tried, sustained its basic claims controlling the production of the three classes of vacuum cleaners, viz., stationary, portable and the carpet-sweeper type. On a motion for a review of the decision, the United States Circuit Court of Appeals, Second Circuit, unanimously sustained the lower court's findings.

This is final unless a constitutional question should be raised to take it before the Supreme Court of the United States. This up to the present time has not been done, nor is an action of this kind anticipated by the Vacuum Cleaner Company, the owner of the Kenney patent. The litigation with the Bissell company contested the carpet-sweeper type, and the defendant was defeated both in the district court in Michigan and subsequently on appeal to the appellate court in that circuit. This case was argued and adjusted about six months ago. An accounting was ordered, submitted to the court, and affirmed. Therefore a license to manufacture was issued to the Bissell company of the same scope and nature as had been granted other manufacturers who had previously accepted the decree of the courts as a complete adjudication of the patents, twenty-five in all.

Following the adjustment of their legal differences, an association was formed by the licensees, originally twenty-five in number but now reduced to twenty-one by consolidations, to further the interests of the trade, but in no way to control production or fix prices. Each licensee is at liberty to manage and market his own output. A list of the members of the association, formed about a year ago and known as the Vacuum Cleaner Manufacturers' Association, follows:

- American Radiator Company, Chicago, Ill.
- Apex Electrical Manufacturing Company, Cleveland, Ohio.
- Birtman Electric Company, Chicago, Ill.
- Cleaner Manufacturing Company, Cleveland, Ohio.
- Duntley Company, Chicago, Ill.
- Frantz Premier Company, Cleveland, Ohio.
- General Electric Company, Schenectady, N. Y.
- Hoover Suction Sweeper Company, New Berlin, Ohio.
- Hugo Manufacturing Company, Warsaw, Ind.
- Invincible Manufacturing Company, Pittsburgh, Pa.
- National Sweeper Company, Torrington, Conn.
- W. C. Perkins Company, Chicago, Ill.
- Regina Company, New York City.
- Richmond Radiator Company, New York City.
- Spencer Turbine Cleaner Company, Hartford, Conn.
- Eureka Vacuum Cleaner Company, Detroit, Mich.
- B. F. Sturtevant Company, Hyde Park, Boston, Mass.
- United Electric Company, Canton, Ohio.
- United Vacuum Appliance Co., Connersville, Ind.
- United Vacuum Sweeper Company, Chicago, Ill.
- M. S. Wright Company, Worcester, Mass.

Various meetings of the association have been held from time to time, at which broad business policies and a concerted advertising and sales campaign have been discussed.

P. H. Seward, vice-president and general manager of the Richmond Radiator Company, who is chairman, said as yet no definite conclusions on these questions had been reached. Meetings have been held every three months, the last Sept. 15, and an effort is being made to hold another Dec. 15.

THE MEASURING DEVICES MARKET BROADENS OUT

Finding Out How to Make Existing Equipment Do Increased Work Instead of Buying More Is a Policy That Creates Demand

The shortage of capital, the uncertainty of deliveries and high prices are responsible for broadening the market for measuring devices of many kinds. For instance, a central station knows some of its transformers are overloaded. Under the conditions the manager dislikes to buy more transformers. He schemes to get along with what he has. But to be sure his scheme will work he must accurately measure the energy passing through the heavily loaded and lightly loaded transformers which he expects to change. So his engineer's requisition for instrument transformers and for recording instruments goes through without question. This is happening daily according to reports both from operating men and manufacturers. The same situation prevails in the boiler room of the power house, in the industrial plant and in every establishment where there is a possibility of shifting existing apparatus to new locations.

SCOPE OF WASHING MACHINE ASSOCIATION NOW ENLARGED

Meeting at Chicago Discusses Trade Problems, Pledges Government Support and Admits Canadian Manufacturers

The members of the American Washing Machine Manufacturers' Association again pledged their loyal support to the government at the meeting in Chicago at the Hotel Sherman on Nov. 21 and 22 by unanimously adopting the following resolution:

"The members of the American Washing Machine Manufacturers' Association, representing fourteen-fifteenths of all the capital employed in this country to manufacture washing machines for household use and whose production is valued at over \$10,000,000 per annum, in convention assembled, unanimously reiterate their pledge to the President of the United States and our country of their unswerving loyalty and of their willingness to devote the resources of their industrial plants to the use of our government for war purposes."

Sam T. White of the White Lily Manufacturing Company, Davenport, Iowa; W. L. Rodgers of the Pittsburgh Gage & Supply Company, Pittsburgh, Pa., and Raymond Marsh, secretary, of Chicago were elected members of the Washing Machine Manufacturers' Association war service committee to represent the industry before the War Industries Board. The association is now compiling a list of the equipment in all plants of all members for the purpose of offering the facilities of the washing machine manufacturers' plants to the government for war purposes.

At the request of Canadian manufacturers of washing machines, the constitution and by-laws of the association were amended to permit them to become members. The next meeting will be held in Chicago, at the Hotel Sherman, on Jan. 23 and 24, 1918.

FOREIGN COMPETITION

HERE AFTER THE WAR

Possibility That Engineer Soldiers, Besides Bringing Back New Ideas on Foreign Goods, May Have Agencies for Them

When this war is over, according to statements by authorities on the broader phases of manufacturing, foreign competition in the electrical field will be stiffer than any we have ever known. They base their conclusions on two facts. The United States has made foreign alliances. These obligations carry with them not only military but commercial understandings. When peace comes we will not tolerate our allies setting up tariff barriers against us and we will not expect to set them up against our allies. The belief exists that the tariff wall which kept the products of cheap foreign labor out of this country will have completely crumbled. Besides this, our engineer soldiers now abroad are not required to give their entire time to defeating Germany. They visit England, France, Italy and other countries on furloughs. In their leisure moments they visit things that interest them—engineering projects, power plants and the like. There is therefore the possibility that when they get ready to return to the United States some of them will bring along agencies for these foreign goods. Certainly they will bring new ideas regarding the applicability of foreign goods to American problems. Naturally the United States will then cease to be a secluded country. It will become a world nation engaged in world trade.

There is now plenty of time, it is believed, to prepare for what is coming. And it is not expected that industrial America will be found unprepared. Costs are being studied not only in the factories but in the distributing forces. More efficient methods of production and distribution are at hand. In fact, when industry returns to the manufacture of purely peaceful products, there will be available such increased manufacturing facilities that quantity production at correspondingly low prices is expected to result.

METAL MARKET SITUATION

Official Interpretation on Resale of Copper by War Industries Board—Tin Still Advancing

A supposed authoritative interpretation of the War Industries Board's order whereby certain jobbers were authorized to sell copper in less than carload lots appears to have been contrary to the rulings and conditions formulated. The main purpose of the board in the measures adopted for the distribution of copper was to prevent the metal from falling into the hands of speculators who would increase the price to the consumer or manufacturer of finished goods. What the board meant is that no sales of copper are authorized in either car lots or less except at 23.50 cents plus not over 5 per cent, or 24.675 cents. Wire base has receded a cent, but none is offering.

Tin continues to advance in price and become less in supply. Being largely used in the manufacture of babbitt metal, of which journals are almost solely made, its wide employment may be readily understood. The other changes are immaterial.

NEW YORK METAL MARKET PRICES

	Nov. 26			Dec. 3		
	£	s	d	£	s	d
Copper:						
London, standard spot.....	110	0	0	110	0	0
Prime Lake.....Govt. price	23.50			Govt. price	23.50	
Electrolytic.....Govt. price	23.50			Govt. price	23.50	
Casting.....Govt. price	23.50			Govt. price	23.50	
Wire base.....	28.00	to	30.00*	27.00	to	29.00
Lead, trust price.....	6.25			6.25		
Nickel, ingot.....	50.00			50.00		
Sheet zinc, f.o.b. smelter.....	19.00			19.00		
Spelter, spot.....	7.87½	to	7.97½	7.70	to	7.80
Tin, Straits.....	80.00			81.00		
Aluminum, 98 to 99 per cent..	34.00	to	36.00	34.00	to	36.00

OLD METALS

Heavy copper and wire.....	22.50	to	23.00	22.50	to	23.00
Brass, heavy.....	14.50	to	16.50	14.50	to	16.50
Brass, light.....	10.50	to	11.50	10.50	to	11.50
Lead, heavy.....	5.50	to	5.87½	5.75	to	5.87½
Zinc, old scrap.....	5.00	to	5.50	5.00	to	5.50

*Nominal.

THE WEEK IN TRADE

NO DIMINUTION in sales of electrical appliances, materials and supplies is reported. On the contrary, the volume is increasing, notably on the regular seasonable lines—Christmas outfits, heating and household specialties; but staples are showing very satisfactory totals in the selling end, differing according to sections. The average, however, is excellent. The shortages in certain lines, such as lamps, sockets, dry batteries, porcelain, etc., are unchanged, and prices are firm and steady. The labor situation everywhere is generally less strained.

Collections and credits appear to be adjusting themselves to changed conditions, and a better understanding prevails between jobbers, dealers and consumers, the undue consideration toward the latter heretofore existing being sharply curtailed. Trade acceptances are favorably regarded as the proper means for superseding questionable book accounts.

NEW YORK

Aside from the staple lines, which are selling as well as could be expected with peak prices and undependable deliveries to contend with, business is measuring up to fairly good weekly totals. Every effort is being made to get adequate holiday stocks in the hands of the dealer for what he anticipates will be a record breaker. Christmas outfits, electrical toys and merchandise of this character are going out in good volume, but heating appliances, vacuum cleaners, washing machines, toasters, grills and sewing machines are the strong sellers.

Collections are up to the mark, as might be expected at this time of the year. Credit men are making a strenuous endeavor to close their books in the best possible shape. Credits and accommodations on new business are becoming more and more stringent.

PORCELAIN.—While porcelain goods have been scarce, a still further shortage may be expected, reports from authentic sources state. Not only are additional labor disturbances mentioned as likely to occur in the factory centers, but there is a possibility of fuel shortage, especially in the natural-gas regions. Should this occur a sharp reduction in the output would naturally follow.

ELECTRICAL TOYS.—Earlier in the season a fair, if not an abundant, stock of electrical toys was looked upon as assured. The situation has undergone modification, and it seems probable that dealers and merchants who have delayed placing orders may be disappointed by having a depleted quantity for their holiday trade. Deliveries are erratic except to nearby buyers.

COLLECTIONS AND CREDITS.—With the close of the year special efforts are being made to close up all the accounts possible, and collections therefore are brisk. Credits are held firm, with no disposition to widen their scope for the present.

VACUUM CLEANERS.—The drive for the holidays has set in with prices firm. The pre-Christmas selling campaigns are along good lines from a trade point of view, and, with the scarcity of metals, general activity, poor deliveries and the evident intention of the public to buy freely, with cost not a primary consideration, sales in all makes are expected to be heavy.

DRY BATTERIES.—Not much if any improvement is noted in the supply of dry batteries, and stocks in the hands of the regular trade distributors are not at all to their liking. Prices and deliveries are unchanged.

LAMPS.—The shortage in lamps reported at various times is still mentioned as not bettering. All sizes are affected, the shortage of miniature and automobile and nitrogen lamps being the most acute.

POLE AND LINE MATERIAL, ETC.—Conditions are about the same as have ruled the market for a month past on price and deliveries, but this means they are better than three months back. The same may be said of pole hardware. A manufacturer of a pole specialty to whom was

recently given an order amounting to 10,000 pieces was obliged to cancel it on account of a lack of material, although on other standard goods he was in a position to make shipments in acceptable time. Glass insulators are a trifle easier in supply and deliveries, but the price is still firm. In fact, it is difficult to figure on any of this material when price or shipments are in question.

REFLECTORS.—Announcement is made this week of a 10 per cent advance on all Holophane "Decolites," effective Nov. 1 last. List prices and discounts are unchanged, the advance to be added as a separate item on each invoice. Also effective Nov. 1, advances in list price were made on a number of Ivanhoe metal reflectors.

CHICAGO

Evidence that the trade is more and more organizing itself on a "long-war basis" is beginning to be seen. The policy of no new central station extensions unless customers pay the cost is becoming more general. Certain utilities are planning to reduce their capital requirements. Stocks are also being reduced. It is claimed that this reduction is no greater than is usual at this period for inventory purposes among the jobbers, but among central stations it is a reduction calculated to help reduce capital in stocks of material. Collections are tightening up somewhat. Prices are steady. The week, on the whole, has been a quiet one in the trade.

ICE MACHINERY.—Seven of eleven ice plants in Chicago which as yet have retained steam drive are coming over to central station service this winter. These seven aggregate 3300 hp. and produce about 250,000 tons of ice a year. For these plants equipment has already been ordered. The field for more sales is still broad, however, with four ice plants aggregating in output 350,000 tons of ice a year and with sixteen refrigerating and cold-storage houses still using steam. The total of motor-driven ice plants in Chicago is now thirty-three.

CONDUIT.—The conduit situation is spotty. Some jobbers who buy from smaller mills can make deliveries out of stock. With other jobbers the situation is getting rapidly worse.

RUBBER-COVERED WIRE.—The price of wire still holds steadily at a 34-cent base. There have been a few spells of weakness created by manufacturers who needed a little immediate business.

APPLIANCES.—Business is not so brisk as usual for the season. Toys and novelties are especially dull.

FIXTURES.—For a time building in special lines seemed to be holding its own. Fixture manufacturers report, however, that conditions do not seem to be improving.

SILK SHADES FOR PORTABLES.—Electric shops are well stocked for Christmas trade. One Chicago firm received some export inquiries during the week.

STORAGE BATTERIES.—The decrease in flat-plate vehicle-type storage batteries made by one concern amounts to about 10 per cent. The decreasing price of lead made this possible. Some batteries, especially those in glass jars, are on the increase, so this movement cannot be taken as a general one in the battery field.

ELECTRIC ARC WELDERS.—Railroads, steel mills and other users of heavy steel and iron equipment are large purchasers of electric arc welders. The difficulty of securing deliveries on new apparatus has made it essential for these concerns to repair old equipment wherever possible and to scrap very little that can possibly be saved. The arc welding machines fit in well with this plan of operation. It is said that one railroad expects to purchase 150 of these outfits within the coming year.

WASHING MACHINES.—The Automatic Electric Washer Company of Newton, Iowa, which has been using twenty-five 200-ft. motion-picture films for the last two years among its dealers, has found this sort of popular publicity so well liked that it has taken a 1000-ft. film which it will permit its dealers to use. The film pictures a story called "Thrift," showing the domestic economy of the electric washer. The film will be ready for the dealers about Dec. 15.

BOSTON

The acceleration of war business and an increasing shortage of skilled labor dominate the electrical trade this week in New England. Jobbers are heavily stocked at Boston, but in interior business centers stocks vary as to completeness. Prices show little or no change compared with last week, except that rubber-covered wire and weatherproof wire are softening a little. It is reported that some manufacturing interests have begun to notice a falling off in purely industrial orders not related to war requirements. Contractors find little house wiring to do, but improvements and extensions in mills are still being carried on actively. Better news from the western front and from Italy, now regarded as a part of the former, have increased confidence. Collections are rather slow, but conditions appear fundamentally sound. High wages at the Squantum destroyer plant, at the Watertown Arsenal and Fore River shipyard, yielding wiremen in some cases \$10 per day, including overtime guarantee, make the problem of securing adequate labor difficult for the electrical contractor paying from 50 to 70 cents per hour. Much credit is due the smaller electrical contractors in particular for the patriotic spirit in which they are striving to meet present difficulties. It is not unlikely that some of these may be driven out of business by the competitive situation existing in labor matters with respect to government plant employment conditions unless some means can be found of tiding them over the current emergency. Contractors dealing chiefly with large industrial customers are in a better position with regard to collections and payments to jobbing houses, but many readjustments are under way. Central stations are almost swamped with business, and the reduction in output from sign curtailment appears to be cutting very little figure in view of the demands for industrial power. The bituminous coal situation is getting worse, although herculean efforts are being made to avert disaster. An epoch-making recommendation toward bettering electric railway finances was made a few days ago by Chairman Macleod of the Massachusetts Public Service Commission before the special legislative investigating committee on street railways. In sum, this recommendation was that the State should lend money to companies for rehabilitation and war service construction at rates below current prices of money.

LAMPS.—The situation is improving not a little and orders for current requirements are being filled from stock by some jobbing interests.

SMALL MOTORS.—Purely industrial orders show a reduction in some quarters. Shortage of labor and scarcity of materials militate against accumulation of factory stocks. Women are being used in light winding, and much overtime is being consumed on government work. A heavy demand is noted in small motors for tool driving in gun carriage, boiler, naval turbine and other war production.

CONTROLLING DEVICES.—In some cases deliveries as low as three to five weeks are being made, both on industrial and war orders. This condition applies, however, only in plants which anticipated present demands. Prices are holding firm.

WIRE AND CABLE.—Deliveries are lengthening by three to four weeks compared with recent tenders. Government orders are increasing and inquiries are still being received in connection with the destroyer plant at Squantum.

FIXTURES.—These are moving very slowly and the outlook is not attractive at this time for a satisfactory holiday business. Portable lamps, however, are moving faster and no further price advances are looked for.

TELEPHONE, SIGNAL AND RADIO EQUIPMENT.—Manufacturers are nearly swamped with government work in these branches. One factory reports that 60 per cent of its output is for war service. Labor shortage is a disturbing factor, and it is heard in some quarters that further moderate price advances are not unlikely. Deliveries of about 120 days are quoted on small motor-generator sets for signal service.

STORAGE BATTERIES.—Business is rushing and no signs of a price reduction can be seen. According to class of service, lead batteries are being delivered in New England in from one to two months from receipt of order. Deliveries for automobile service are from stock.

ATLANTA

The volume of business is holding up well, and the normal channels of trade are taking up the slack caused by a decrease in pressure from government requirements. Shipments on small motors, lamps, line hardware and miscellaneous supplies show a slight improvement. There is more or less activity in industrial construction, and a number of large plants are contemplated.

The establishment of an aviation training station at Montgomery, Ala., will no doubt call for a large quantity of electrical supplies. A report has been circulated that the government expects to spend an additional \$100,000,000 on building operations in the Southeast, but that is not confirmed at this time.

The government will, however, spend a considerable amount on the erection of a nitrate plant at Florence, Ala. It is also reported that a large industrial concern in the Birmingham district has set aside \$10,000,000 for improvements. The shipbuilding operations under way at the coastal cities have stimulated a demand for supplies, which for a time were dormant. All of this activity, together with normal requirements, has kept the electrical interests quite busy, and from the present indications it will be some time before any appreciable slackening will be felt.

PLUG CUT-OUTS.—The substitution of slate for porcelain on cut-outs has helped deliveries and allowed the jobbers to fill contracts and secure business that they might not have been able to negotiate had they depended on porcelain goods. A big demand is developing for the slate product, and the deliveries are good.

POLES.—The demand for poles continues steady, with slight price variations, depending on the supply. Deliveries are fair; the only difficulty seems to be in finding sufficient labor to get out the timber in the preliminary stage.

INSULATORS.—Price remains steady on both the glass and porcelain products. An improvement is noted in glass insulator shipments, but porcelain deliveries are very bad, and there is no immediate prospect of any betterment.

LINE HARDWARE.—The price and demand for this line remain steady. Shipments are growing better, however, showing an actual decrease from six to four weeks.

CABLE.—There is very little change to be noted, as the demand is comparatively steady. Prices continue the same and long deliveries are the order. Local stocks are very low.

CONTRACTING.—All concerns are busy, and the future looks good for continued activity. In addition to industrial work and new residence building, a number of old houses and buildings are being renovated and wired, which has tended to exert more or less pressure, especially when wiremen are scarce. While the lack of electrical workers has caused no end of delay on certain jobs most of the companies have adjusted their organizations to fit the draft and meet the situation.

FLEXIBLE CONDUIT.—More activity was noted in this line during the last week. Substantial quantities were offered, however, at prices slightly below the market prevailing for the last month. Southeastern stocks are in pretty fair shape.

SEATTLE

Seattle electrical jobbers in the past week have reported sales to shipyards, lumber mills and industrial plants about the same as last week or during several weeks. Sales of domestic appliances, particularly washing machines, toasters, lamps, percolators and irons, showed a pronounced increase, due undoubtedly to the approaching holidays. The pre-holiday sales in volume are expected to show a further increase during the next two weeks. The recently organized steel shipbuilding concern in Seattle placed an order for approximately \$15,000 worth of motors, also orders for wire lamps and other electrical equipment to be used in the erection of the proposed plant. A new wooden-ship yard in Tacoma is reported to be placing orders for considerable electrical equipment. Prices remain steady with no indication of an early increase or decrease. Shortages on lamps, certain kinds of wire conduit and motors still pre-

vail. Cantonment sales are keeping up well, although a decrease is due shortly with the completion of the work.

Collections for the month of November were easy to make. The satisfactory government collections show a marked improvement over the past few months, being much easier. A closer safeguarding of credits is being advocated and practiced in the Northwest. Retailers are urged to adopt up-to-date systems of accounting and in addition to desist from the giving of long time credits to consumers. Jobbers are pointing out that both jobbers and retailers are in a period of great changes that are almost revolutionary in character and are overturning the entire course of the business world. They feel that the old methods of long-time credits and open book accounts must give way to cash transactions and trade acceptances eventually. Ways to cut down the cost of doing business are receiving serious consideration. However, new industrial plants and shipbuilding concerns, with ample financial backing, are being favored with unlimited credit. A noticeable increase in the placing of credits is noted in Seattle particularly, and this placing will increase, according to an authority, until well after the first of the year, to accommodate new plants which are being started and which have stable financial support.

The lumber production for the week was within 15 per cent of normal. All the mills are pushing production to keep government orders moving. The Northwest mills are expected to be asked to figure on a government order for 700,000,000 ft. of lumber for the construction of cantonments in France. All spruce cutting has been taken over by the government, and standing areas of spruce in Washington and Oregon are to be made available at once for government usage.

The strike of telephone employees in Seattle, which began Oct. 31, ended Dec. 2. The company agreed to recognize the newly organized operators' union and to grant a slight increase in wages, the men's raise approximating 12½ per cent. Strikers in Portland, Tacoma, Spokane and other smaller cities are reported back at work.

Heating devices are moving exceptionally well, owing to colder weather and the increasing cost of fuel, together with poor deliveries. Stocks are comparatively well filled and prices remain steady. Portable lamps show an impetus due to the Christmas trade. There are ample stocks, and prices show no increase. One Seattle dealer states that his volume of sales on lamps during the last two weeks has never been equaled. Electrical fixtures show increased sales.

SAN FRANCISCO

No changes are occurring in trade and market conditions. Prices are steady. The demand continues brisk for supplies and materials for industrial construction, and in practically all other lines where stocks are available sales are at least fair. The volume of business in November last in electrical supplies is generally conceded to be about equal to that transacted in November, 1916. A considerable volume of business continues to come in from small country towns which very helpfully supplements the activity in industrial lines. There is an optimistic attitude in the field, and prospects for a continuation of generally good conditions are even brighter than earlier in the fall season. The prospects for electric appliances are less certain than for materials and supplies. Some dealers report more and some less business than last year. There is one unmistakable tendency, however, and that is toward a preference for handling those lines that are necessities rather than luxuries or that are in some way related to war-time needs.

The Railroad Commission of California last week announced that it would undertake an investigation of ways and means for conserving fuel and power. This will include an examination of the electrical systems of the State and will probably lead to the suggestion that certain transmission lines be interconnected. This move, significant of the desire to increase available power, agrees with the activity for some time displayed by practically all local companies in developing all power conveniently available on their systems. The demand for power has grown steadily and rapidly in recent months, and every indication points toward a continuation of the increase.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will run about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor		List per 1000 Ft.
B.&S. Size		
No. 14 solid.....		\$61.00
No. 12 solid.....		71.00
No. 10 solid.....		90.00
No. 8 solid.....		106.00
No. 6 solid.....		145.00
No. 10 stranded.....		95.00
No. 8 stranded.....		115.00
No. 6 stranded.....		160.00
No. 4 stranded.....		205.00
No. 2 stranded.....		266.00
No. 1 stranded.....		315.00

Twin-Conductor		List per 1000 Ft.
No. 14 solid.....		104.00
No. 12 solid.....		135.00
No. 10 solid.....		185.00
No. 8 stranded.....		235.00
No. 6 stranded.....		370.00
No. 4 stranded.....		575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor		No. 14 Solid
Less than coil.....	List to + 10%	
Coil to 1000 ft.....	10% to \$59.17	
		No. 12 Solid
Less than coil.....	List to + 10%	
Coil to 1000 ft.....	10% to \$59.17	

Twin-Conductor		No. 14 Solid
Less than coil.....	List net to \$105.00	
Coil to 1000 ft.....	\$70.00 to \$105.00	
		No. 12 Solid
Less than coil.....	List net to \$135.00	
Coil to 1000 ft.....	10% to \$130.9	

DISCOUNT—CHICAGO

Single-Conductor		No. 14 Solid
Less than coil.....	List to + 10%	
Coil to 1000 ft.....	List to — 10%	
		No. 12 Solid
Less than coil.....	+ 10%	
Coil to 1000 ft.....	10%	

Twin-Conductor		No. 14 Solid
Less than coil.....	List to + 10%	
Coil to 1000 ft.....	List to — 10%	
		No. 12 Solid
Less than coil.....	+ 10%	
Coil to 1000 ft.....	List to — 10%	
		No. 12 Solid
Less than coil.....	+ 10%	
Coil to 1000 ft.....	— 10%	

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10% to list net
1/5 to std. pkg.....	15% to 20%
Std. pkg.....	28% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+20% to 12%
1/5 to std. pkg.....	List to 20%
Std. pkg.....	30% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31 to .3175	.32 to .3275
Barrel lots.....	.28 to .2875	.29 to .2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, Per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less Than	Coil to 1000 Ft.
3/8-in. s. stp.....	\$75.00 \$63.75 to \$69.75
3/8-in. d. stp.....	75.00 to \$2.50 68.25 to 75.50
1/2-in. s. stp.....	100.00 85.00 to 93.00
1/2-in. d. stp.....	100.00 to 110.50 91.00 to 100.00

NET PER 1000 FT.—CHICAGO

Less Than	Coil to 1000 Ft.
3/8-in. single strip.....	\$75.00 \$63.75
3/8-in. double strip.....	78.75 71.25-71.75
1/2-in. single strip.....	100.00 85.00
1/2-in. double strip.....	105.00 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	2.....	.47
5/8.....	.15	2 1/2.....	.55
3/4.....	.18	3.....	.65

NET PER 1000 FT.—NEW YORK

Less Than	\$15 to \$60	\$60 to \$150
\$15 List	List	List
7/32-in.—	\$25.00-\$55.00	\$20.50-\$24.75
1/4-in.—	\$25.00-\$55.00	\$20.00-\$22.00
3/8-in.—	\$28.00-\$60.00	\$22.50-\$27.00
		\$22.00-\$24.00

NET PRICE 1000 FT.—CHICAGO

Less Than	\$15 to \$60	\$60 to \$150
\$15 List	List	List
7/32-in.—	\$36.67-\$55.00	\$25.00-\$37.50
1/4-in.—	\$40.00-\$60.00	\$22.50-\$24.75
		\$25.00-\$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List	Elbows, List
1/4.....	\$0.05 \$0.19
3/8.....	.06 .19
1/2.....	.07 .19
3/4.....	.10 .25
1.....	.13 .37
1 1/4.....	.17 .45
1 1/2.....	.21 .50
2.....	.28 1.10
2 1/2.....	.40 1.80
3.....	.60 4.80

DISCOUNT—NEW YORK

Less than 2500 lb.	1/4 in. to 1/2 in.	3/4 in. to 3 in.
2500 to 5000 lb.....	4% to 6%	7% to 9%
	6% to 9%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

Less than 2500 lb.	1/4 in. to 1/2 in.	3/4 in. to 3 in.
2500-5000 lb.....	1.3% to 3.7%	4.3% to 6.7%
	3.3% to 5.7%	6.3% to 8.7%

(For galvanized deduct six points from above discounts.)

FLAT IRONS

NEW YORK

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

CHICAGO

List.....	\$5.00 to \$6.00
Discount.....	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.00 to \$5.75
1/5 to std. pkg.	4.50
Standard package, 500.	List, each, \$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500.	List, each, \$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List.
Regular, clear:		Each
10 to 40-watt—B.	100	\$0.27
60-watt—B.	100	.36
100-watt—B.	24	.65
75-watt—C.	50	.65
100-watt—C.	24	1.00
200-watt—C.	24	2.00
300-watt—C.	24	3.00
Round bulbs, 3 1/8 in., frosted:		
15-watt—G.	25	.50
25-watt—G.	25	.50
40-watt—G.	25	.50
Round bulbs, 3 1/2 in., frosted:		
60-watt—G.	30	.72
Round bulbs, 4 1/8 in., frosted:		
100-watt—G.	35	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$30.00 to \$33.98
Coil to 1000 ft.	25.50 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$30.00 to \$36.24
Coil to 1000 ft.	22.50 to 27.18

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	\$20.00 to \$29.00
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CHICAGO

Net per 100	\$19.25 to \$25.75
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OUTLET BOXES

Nos.	List.
101—A, A1 1/2, 4 S.C., 6200, 320.	\$30.00
102—B.A., 6200 S.E., 300, AX, 1 1/2, 4 S.	30.00
103—C.A., 9, 4R, B 1 1/2.	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

Black	Galvanized
Less than \$10.00 list	25% to 37%
\$10.00 to \$50.00 list	20% to 32%
	45% to 37%
	37% to 40%

DISCOUNT—CHICAGO

Black	Galvanized
Less than \$10.00 list	40% 35%
\$10.00 to \$50.00 list	50% 45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80 to \$33.00
1/5 to std. pkg.	14.80 to 19.00
Standard package, 2200.	List per 1000, \$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80 to \$18.00
1/5 to std. pkg.	13.00 to 14.80
Standard package, 2200.	List per 1000, \$20.

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net	Std. Pkg.	4000
5 1/2 N. C.—Solid Nail-it—N.C.			

Less than 1/5 std. pkg.	\$27.50 to \$29.00	\$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

	Per 1000 Net	Std. Pkg.	4000
5 1/2 N.C.—Solid Nail-it—N.C.			

Less than 1/5 std. pkg.	\$11.85 to \$15.00	\$20.75 to \$30.75
1/5 to std. pkg.	9.00 to 11.10	16.30 to 24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/2-in. cap key and push sockets	500	\$0.33
1/2-in. cap keyless socket	500	.30
1/2-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List to net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List to net
1/5 to std. pkg.	List to —15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	\$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00

Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

High Grade	
Less than \$10 list	List net to +5%
\$10 to \$25 list	11%
\$25 to \$50 net	14% to 15%
Low Grade	
Less than \$10 list	5% to 10%
\$10 to \$25 list	16%
\$25 to \$50 list	24% to 25%

DISCOUNT—CHICAGO

High Grade	
Less than \$10 list	List to +5%
\$10 to \$25 list	List to —11%
\$25 to \$50 list	List to —14%
Low Grade	
Less than \$10 list	List to —5%
\$10 to \$25 list	List to —16%
\$25 to \$50 list	14% to 15%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to —15%
Std. pkg.	List to —30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List
No. 155	Each \$0.34
No. 160	.60

DISCOUNT—NEW YORK

Black	Galvanized
Less than \$2.00 list	List
\$2.00 to \$10.00	List to +10%
\$10.00 to \$50.00	10% to 20%
list	5% to 10%
	20% to 30%
	15% to 20%

DISCOUNT—CHICAGO

Black	Galvanized
Less than \$2.00 list	25%
\$2.00 to \$10.00	25%
\$10.00 to \$50.00	25% to 35%
list	20% to 25%

TOASTERS, UPRIGHT

NEW YORK

List price	\$5.00 to \$7.50
Discount	25% to 30%

CHICAGO

List price	\$5.00 to \$6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools.	\$0.44 1/4 to \$0.65
No. 18, full spools.	0.43 1/4 to 0.55

CHICAGO *

	Per Lb. Net
No. 18, less than full spools.	\$0.57 1/2 to \$0.65
No. 18, full spools.	0.50 1/2 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net			
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.	1000 to 5000 Ft.
11.	\$15.00-\$18.00	\$13.00-\$14.00	\$11.25-\$12.00	
12.	23.25-27.09	21.30-23.22	19.35-20.85	
10.	32.40-37.80	29.70-32.40	27.00-29.25	
8.	45.70-53.34	41.90-45.73	38.00-41.38	
6.	72.40-84.42	66.35-72.35	60.30-65.50	

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14.	\$18.00	\$13.50	\$12.00
12 ...	25.21-28.63	21.30-24.54	17.40-22.50
10 ...	34.44-38.25	29.82-32.72	24.25-30.60
8 ...	48.84-54.27	42.18-46.43	34.45-43.20
6 ...	70.80-92.61	61.16-79.23	51.15-74.09

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$35.25 to \$40.00
25 to 50 lb.	35.25 to 39.00
50 to 100 lb.	34.25 to 38.00

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	\$40.25 to \$42.00
25 to 50 lb.	39.35 to 41.00
50 to 100 lb.	38.35 to 40.00

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Strand Connectors

Strand connectors that save the expense of dead-ending messengers on poles are made by the Diamond Expansion Bolt Company of New York City. It is the usual custom in pulling mes-



WILL NOT CHAFE THE CABLE

senger strand to take the dead-end, no matter where it occurs between poles, and wrap the surplus wire around the pole. This connector is placed wherever the dead-end occurs between poles, and the wire is secured at both sides of the connector by means of heavy-pattern three-bolt guy clamps. The whole equipment is compact and slightly and will not interfere with or chafe the lead-covered cable which is supported beneath it.

Electric Fountain

One of the latest electric fountains developed by the Frank Netschert Company, 61 Barclay Street, New York City, uses translucent glass with green or amber shading in the construction of the dome and the brim of the bowl. The center figure is of porcelain. Color changes are effected with a set of tinted electric lamps mounted within the dome. When water is placed in the bowl to a depth of 2 in. (5.08 cm.) the fountain will operate continuously. The 110-volt motor-driven pump throws a spray 22 in. (55.8 cm.) in height.

Compensator Outfit for Projection Lamps

A compensator outfit has been recently developed by the General Electric Company of Schenectady, N. Y., to control the current for the new Mazda projection lamps that have just been put on the market. In order that the projection with these lamps shall attain the highest efficiency and economy a current control must be used with the lamps. This outfit, known as the "Compensarc," type I, has been developed in conjunction with the lamps so that with the Mazda lamps it forms a complete working unit capable of giving the best results.

The outfit is a self-contained device requiring no auxiliary attachments, and is rated at 750 watts, 110/220 volts alternating current primary and 20/30 volts secondary. The working parts consist of a compensator, starting switch, rheostat and ammeter. The starting switch, rheostat handle and

ammeter all appear on the face of the cabinet panel where they are handy to the operator. The starting switch at starting up the lamp automatically puts some resistance in the lamp circuit so that excessive rush of current through the cold lamp filament is prevented.

The finer adjustments of electric current through the lamp are controlled at the will of the operator by means of the rheostat handle, the rheostat, having very fine adjustments, being placed in the primary circuit. The ammeter indicates at all times the current passing through the lamp, and the rheostat enables the operator to make any necessary adjustments to compensate for the slight variations in the commercial line voltage.

The field of application of this projection equipment is the medium and smaller motion-picture theaters and the lecture halls in colleges, clubs and military camps where the stereopticon or



REQUIRES NO AUXILIARY APPARATUS

motion-picture machine may be used for educational and instructional purposes.

The simplicity of the operation of the equipment, the low investment and operating costs and the excellence of the projection obtainable are strong factors in its favor, it is claimed.

Electric Bandage Cutter

An electric bandage and gauze cutter which is particularly adapted to Red Cross work is one of the latest developments of H. Maimin, Inc., 251 West Nineteenth Street, New York City. Accidental contact with the motor-driven knife is prevented by the use of a specially designed guard, which is also a knife sharpener. The capacity of the machine, the manufacturer states, is such that it will cut 100 yd. (91.4 m.) of gauze or 50 yd. (45.7 m.) of muslin in three minutes. The

machine can also be used for cutting out cloth in large quantities. A pilot or guide lamp is mounted so that its rays are cast in front of the cutting edge, eliminating the shadow which might otherwise be cast.

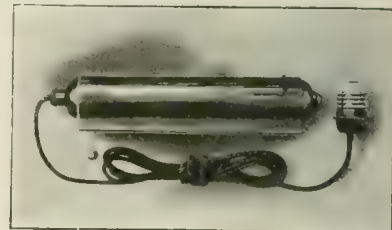
Farm Lighting Set

The Mayhew Company of Milwaukee, Wis., has placed on the market a belted-type farm lighting set which consists of a generator and switchboard made up in one unit and a storage battery, which is shipped separately. The special method used in packing the battery has entirely eliminated the breakage of shipment, it is asserted. The various elements of the plant are of standard makes. The generator is made by the Peerless Electric Company of Akron, Ohio, the batteries by the Globe Electric Company of Milwaukee, Wis. Jewell instruments and Cutler-Hammer rheostat are used on the switchboard, which also includes a Mayhew Electric cut-out of an improved design. Glass inclosed fuses are furnished.

These plants are made in three standard sizes, provided with 60, 90 and 120 amp.-hr. batteries respectively. The generator is rated for 800 watts.

Fixture for Piano Lighting

A piano lamp the hood of which is so constructed that light rays are released only in a downward direction, eliminating objectionable glare, has recently been developed. With this unit, a group about the piano does not have the effect of casting annoying shadows upon the music. Metal construction is used, and the fixture can be supplied in a finish to harmonize with any piano. A pull-chain socket is used, and the outfit is fitted with 9 ft. (2.7 m.) of silk cord and



LIGHT RAYS RELEASED DOWNWARD

a swivel, non-breakable attachment plug. The fixture is manufactured by the Play-O-Lite Company, Buffalo, N. Y., and is being distributed by A. Hall Berry, 717-73 Murray Street, New York City.

Combination Switch and Cut-Out

A type of combination switch and cut-out which embodies features of small size and light weight has been devised by the Connecticut Electric Manufacturing Company of Bridgeport, Conn. The reduction in weight made possible by channeling out the porcelain has been considerable; in fact, the cut-out has been reduced to less than a pound (0.45 kg.) in weight, with a saving of $\frac{1}{2}$ lb. (0.23 kg.) made possible by this new construction. This, it is pointed out, amounts to 500 lb. per thousand, which at the present freight rate to San Francisco, of \$3.75 per hundred, is a saving of \$18.75 on every 1000 lb. (453.5 kg.) of switches shipped to the Pacific Coast.

Another interesting feature of construction pointed out by the maker is the mounting of the knob on the cross-bar of the switch blade so that the pull is at an angle, making the switch convenient and easy to open. These switches are made with either convertible or permanently thin blade, but are furnished permanently thin unless otherwise specified.

Electric Coffee Percolator

A line of electric coffee percolators made in sizes varying in capacity from four to eight cups is being marketed by the Crystal Percolator Company, 44 East Twenty-third Street, New York City. This filter is made in two sections of crystal glass, the lower division being in contact with the electric heating unit in the metal base. The upper portion, or "funnel," holds the pulverized coffee. The manufacturer calls attention to the porcelain strainer through which the coffee passes on its way to the lower container. The coffee does not come in contact with any metal during the process of percolating.

Air Compressor for Office Appliances

The National Regulator Company of Chicago has developed an improved type of motor-operated air compressor made in different sizes for use on commercial circuits. It is especially adapted to the requirements of residences, office appliances, manufacturing plants and doctors' and dentists' offices where the service is not heavy. The compressor is designed for low-speed service, since the special class of work that it does forbids overheating the air. It has also, the manufacturer states, the desirable feature of being practically noiseless in operation.

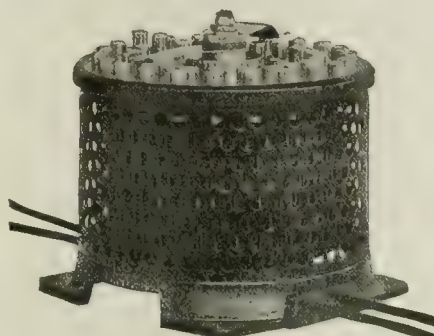
This type generally is controlled automatically to maintain a constant pressure and is driven by a fractional-horsepower motor made by the General Electric Company. This motor is standard equipment. The apparatus is a unit and has a panel on which are mounted the pressure governor, high-pressure and low-pressure gages and the safety

valves. The storage tank has a capacity equal to about 10 gal. (37.91.) of liquid.

Line-Drop Compensator

The General Electric Company of Schenectady, N. Y., has recently developed a line-drop compensator which when used in connection with any contact-making voltmeter will enable the regulator to provide correct voltage compensation to any given point on the feeder regardless of the load or the power factor. The compensator consists of a resistance and a reactance, each independently adjustable by means of dial switches, whereby the resistance and the reactance of the line may be reproduced in miniature and the effect of the load on the line reproduced in the feeder regulator control, i.e., in the contact-making voltmeter.

The compensator can be furnished either with or without a one-to-one insulating transformer, the latter design permitting the grounding of both current and potential transformer circuits. It can be connected in circuit with any contact-making voltmeter of General Electric manufacture without any



FOR USE IN CONNECTION WITH CONTACT-MAKING VOLTMETER

change in the meter, regardless of the type or design, and once properly adjusted for the line will cause the regulator to maintain correct voltage within its limits of range and capacity.

The units of the compensator are assembled in a neat, compact case suitable for mounting on the switchboard if desired. It is easily adjusted and after correct conditions are obtained for a given feeder requires no further attention.

Electric Manifold Plug

A plug for insertion in the intake manifold of gasoline automobile engines which is provided with an electric heating element is being manufactured by the Interstate Electric Company of New Orleans, La. The heating device is controlled from a dash switch and operates on the motor-car battery or on dry cells, as convenience may dictate. The plug also provides a ready means of priming and is piped to a sizable priming cup mounted on the dash. The combination of the two functions furnishes heated vapor to the cylinders, making starting in cold weather an easy matter, as the manufacturer points out.

Bullet-Shaped Flashlight

A new battery flashlight in the form of a cartridge is being manufactured by the Interstate Electric Novelty Company of New York City. The complete lamp measures 6 in. by $1\frac{1}{2}$ in. (15.2 cm. by 4.1 cm.). Heavy brass is used in the case. The battery is a "Franco Radio," and supplies energy to a tungsten lamp mounted in the "projectile."

Chain-Pull Candle Socket

A straight chain-pull socket for use in candle fixtures is being made by Pass & Seymour, Solvay, N. Y. Large binding screws are provided and the raceways for wires are conveniently deep. The combination of candle-socket and switch provides a practical economy, the manufacturer points out, in individual control of the lamps. The fitting complete is $3\frac{1}{4}$ in. (8.2 cm.) long and has a diameter of $1\frac{5}{32}$ in. (2.94 cm.).

Current Limiter

The Railway & Industrial Engineering Company of Pittsburgh, Pa., has recently brought out a protective device for portable electric drills, etc. This device is known as a current limiter. The device opens the circuit instantly on heavy overloads and recloses the circuit as soon as the overload is removed, so that the use of these limiters in electric drill circuits will cut down fuse renewals and avoid the loss of time in making these renewals, it is claimed. Also, by instantly cutting off the motor circuit, it will prevent drill breakages and save the motor from overheating.

Porcelain Locking Sockets and Receptacles

The General Electric Company has brought out an improved line of porcelain locking sockets and receptacles for use in places where the socket is exposed to corroding influences such as acid, fumes, moisture, etc. A lamp installed out of doors, in the cellar or some similar place is most likely to be stolen, hence the need of the locking socket. Sockets installed in such places are most likely to be subjected to corroding influences, necessitating the use of porcelain locking sockets. These sockets take the standard G-E locking socket interiors and are therefore interchangeable in porcelain and metal shells.

The principle of the design is such that when the key is removed the lamp swivels freely, preventing injury to either the lamp base or the socket if an attempt is made to remove the lamp without the key. The receptacles are furnished in both key and keyless types, with bases for cleat, concealed and molding work, as well as bases for $3\frac{1}{4}$ -in. and 4-in. (8.2-cm. and 10.2-cm.) outlet boxes. Caps, bodies and bases are interchangeable.

Trade Notes

E. L. LINCOLN, INC., has removed its plant from Waterville, Me., to 534 Congress Street, Portland, Me.

S. ORRICK has been appointed assistant manager of the Western Electric Company at San Francisco, Cal.

EDWARD MOSER, Lehigh, Pa., connected with the municipal electric light plant as superintendent, died Nov. 8, at the age of fifty years.

LLOYD P. JONES, recently made vice-president and general manager of the Federal Brass Works, Detroit, was formerly sales manager.

A. S. LINDSTROM, formerly with the Western Electric Company, is now general manager of the Thordarson Electric Manufacturing Company, Chicago.

THE GENERAL ELECTRIC COMPANY, Boyd Street, Newark, N. J., has acquired property opposite its present plant, from Boyd to Lillie Street, and is said to be planning for plant extensions.

THE RAILWAY & POWER ENGINEERING CORPORATION, LTD., Toronto, Canada, has opened, temporarily, a "used-equipment department," where all equipment sold is subject to the customer's inspection.

C. H. FELKER, who for several months has been conducting the commercial work for the Columbus (Ohio) Railway, Power & Light Company, has resigned to become sales manager of the Home Specialty Company, Cleveland.

RAYMOND W. MURPHY, for the last nine years connected with the San Francisco and Los Angeles offices of the Westinghouse Lamp Company, has been transferred to the Philadelphia office in the capacity of assistant manager of that district.

ARTHUR H. D. ALTREE, branch manager of the Bosch Magneto Company, Chicago, Ill., for several years, and who in the early part of 1914 was transferred to the main office in New York as vice-president, has resigned, to take effect Jan. 15 next.

THE A. H. PETERSON MANUFACTURING COMPANY, Milwaukee, Wis., succeeds the P. & B. Manufacturing Company. It will continue to manufacture the "P. & B." products, and a substantial expansion along these lines will be announced in the near future.

W. F. TRENARY, JR., with headquarters in the Brown-Marx Building, Birmingham, Ala., now represents the Harrison Safety Boiler Works of Philadelphia, manufacturer of the Cochrane heaters and other steam-plant appliances, succeeding W. R. Jennison.

J. S. VEATCH has been appointed district sales agent of the Ohio Brass Company, Mansfield, Ohio, for the territory surrounding Denver, Col., where he will make his headquarters. C. A. Veatch, father of the new appointee, has for some years traveled a mid-West field.

SAMUEL L. MORSE & SONS CORPORATION, manufacturer of electric industrial trucks, has been absorbed by the Bethlehem Shipbuilding Corporation, Ltd., South Bethlehem, Pa. The new concern also acquires and leases several other companies at Eastern tidewater points and on the Pacific Coast.

THE PHILADELPHIA STORAGE BATTERY COMPANY, Philadelphia, has acquired the services of Walter E. Holland to take charge of special research work. For ten years he was connected with the Edison Storage Battery Company of Orange, N. J., in the position of chief electrical engineer.

THE SOUTHERN FERRO ALLOYS COMPANY, Chattanooga, Tenn., has its plant completed and in successful operation. It is considered a model of its kind. The Canada Carlide Sales Company, 30 Church Street, New York City, has been appointed the Southern company's exclusive sales agent.

J. W. WHITE has been appointed manager of the power and railways divisions of the Detroit office of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Mr. White, who was formerly connected with the Pittsburgh office of the company, subsequently being associated with the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has now returned to the Westinghouse service.

DR. MILTON W. FRANKLIN, Philadelphia, formerly engineer of the ozonator department of the General Electric Company, has resigned to become connected with the E. F. Houghton Company, 240 West Somerset Street, Philadelphia, as consulting en-

gineer. Dr. Franklin will be a member of the board of directors of the company, chairman of the sales committee, and will have charge of plants, manufacturing processes and equipment.

THE UNIVERSAL MOTOR COMPANY of Oshkosh, Wis., has just completed a two-story addition to its plant, 40 ft. by 180 ft., which is now occupied. The addition is of concrete construction and has a modern testing department built in, with all facilities for testing marine motors and generating sets. The machine department has been extended, many new machine tools being added, some of special design. The assembly department is also enlarged with many improved handling devices and equipment for the handling of the motors in process.

New Incorporations

THE ASHDOWN (ARK.) LIGHT & ICE COMPANY has been incorporated with a capital stock of \$50,000 by M. B. Morgan, S. R. Morgan and J. D. Tatum.

THE PREMIER RUBBER & INSULATION COMPANY of Dayton, Ohio, has been incorporated with a capital stock of \$100,000 by Henry M. Granzow and others.

THE GAS & ELECTRIC SCALES COMPANY of San Francisco, Cal., has been incorporated with a capital stock of \$40,000 by Thomas Steel, M. J. Purcell, V. A. Kuehn, L. M. Olds and A. C. Duerr.

THE INDUSTRIAL ELECTRIC LIGHT & POWER COMPANY of Upper Milford, Allentown, Pa., has been chartered with a capital stock of \$5,000. Charles M. Wagner is among the incorporators.

THE NATIONAL ELECTROPURE WATER COMPANY of Buffalo, N. Y., has been incorporated with a capital stock of \$10,000 by Urban W. Hubertus, G. Lucene Fullington and Paul G. Stuart.

THE DORRITTE INSULATION COMPANY of New York, N. Y., has been chartered with a capital stock of \$200,000 by H. A. Dorrit, C. O. Hall and R. D. Adams, 176 Broadway, New York, N. Y.

THE CECILTON (MD.) ELECTRIC LIGHT & POWER COMPANY has been incorporated by William H. Anderson, Enoch S. Short, William Luthringer, William H. Brown and B. Markley Black.

THE BRISTOL ELECTRIC COMPANY of Taunton, Mass., has been incorporated with a capital stock of \$5,000. The officers are Leo E. Beauchamp, president; Albert E. Downey, treasurer, and Helen P. Hickey.

THE HAMMOND ELECTRIC BANK PROTECTION COMPANY of Los Angeles, Cal., has been incorporated with a capital stock of \$250,000 by W. D. Hammond, C. E. Rees, W. I. Gilbert, F. C. Mason and B. N. Hammond.

THE ELECTRO-INDUSTRIAL TRACTOR COMPANY of Vernon, Los Angeles, Cal., has been chartered with a capital stock of \$50,000, to manufacture tractors. Richard H. Norton, 335 West Twenty-seventh Street, is interested.

FIRTH & MARSHALL of New York, N. Y., have filed articles of incorporation with a capital stock of \$100,000 to manufacture electrical appliances. The incorporators are: J. Firth, C. Marshall and H. Freece, 35 Wall Street, New York, N. Y.

THE MILWAUKEE (WIS.) ICE MACHINE COMPANY has been chartered with a capital stock of \$50,000 to manufacture a new line of refrigerating machinery and equipment. The incorporators are: Edwin Olsen, Fred Marggraff and Fred Ferko.

THE NEW YORK ROTARY MOTOR COMPANY of New York, N. Y., has been incorporated by A. M. Sullivan and A. S. Meyers, 60 Wall Street, New York, N. Y. The company is capitalized at \$1,700,000 and proposes to manufacture motors, etc.

THE INTERNATIONAL SIGNAL COMPANY of Wilmington, Del., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$2,500,000. The company proposes to manufacture and deal in electrical devices for messages and signaling.

THE MAZDA ELECTRIC MANUFACTURING COMPANY of St. Louis, Mo., has been incorporated by J. M. McKernan, D. W. Hutchinson, Maude McKernan and M. Hutchinson. The company is capitalized at \$2,000 and proposes to do a general manufacturing business.

ELLIOTT RAPPAPORT of New York, N. Y., has filed articles of incorporation, with a capital stock of \$10,000, to do a general electrical and mechanical engineering and contracting business. The incorpora-

tors are: A. J. Rosenthal, S. Elliott and A. Rappaport, 200 West Twenty-first Street, New York, N. Y.

THE BROWN'S MILLS ELECTRIC LIGHT & POWER COMPANY of Jersey City, N. J., has been incorporated by J. Haviland Tompkins, John R. Turner and C. H. Jarvis of Jersey City. The company is capitalized at \$50,000. The office of the company is located at 15 Exchange Place, Jersey City, N. J.

THE GENERAL GAS-ELECTRIC PLANT COMPANY of Fargo, N. D., has been incorporated with a capital stock of \$25,000 to manufacture and install gas and electric plants; also to generate and distribute electricity and gas for lamps and motors. Fred Schulze and A. L. Costello of Bismarck are interested in the project.

THE BOWEN PRODUCTS CORPORATION of Auburn, N. Y., has been chartered with a capital stock of \$2,500,000 to manufacture machinery, engines, motors, etc. The incorporators are: W. B. Reynolds, 240 West 102d Street, New York; A. F. Dillman of Maplewood, N. J., and E. T. Williams, 216 Brooklyn Avenue, Brooklyn, N. Y.

HAMILTON & HANSELL, INC., of New York, N. Y., has filed articles of incorporation with a capital stock of \$100,000 to do a general surveying and electrical engineering business, also to act as commission merchants in oil, coal and gas enterprises. The incorporators are: R. S. O'Connell, J. G. Waldron and R. Elliott, 26 Park Row, New York, N. Y.

THE RECIPROCATING ELECTRIC TOOL COMPANY of Louisville, Ky., has been incorporated by J. J. Roberts, 412 Courier-Journal Office Building, Louisville, Ky.; James K. Jarvis, F. L. Robinson and J. D. Kean. The company is capitalized at \$100,000 and proposes to buy parts for electrical drilling and riveting tools to be made in all sizes and assemble them in Louisville. Later a plant will be constructed to manufacture the parts.

Trade Publications

FUSES.—The Killark Electric Manufacturing Company of St. Louis, Mo., has prepared a leaflet descriptive of its automobile fuses.

SOOT CLEANERS.—The Vulcan Soot Cleaner Company of Dubois, Pa., has prepared a folder descriptive of its Vulcan soot cleaner.

TELEPHONES.—The Stromberg-Carlson Manufacturing Company of Rochester, N. Y., is mailing a folder announcing its new No. 896 wall telephone.

HEATING APPLIANCES.—The Rutember Electric Company of Marion, Ind., has prepared a catalog descriptive of its electric ranges, irons, grills, radiators, etc.

HORN-GAP SWITCHES.—The Railway & Industrial Engineering Company of Pittsburgh, Pa., has issued a folder descriptive of its type "B" Burke horn-gap switches.

ELECTRICAL APPLIANCES.—The Hotpoint Electric Heating Company of Ontario, Cal., is distributing a folder descriptive of its popular magazine advertising campaign.

OUTDOOR CABLE TERMINALS.—The Standard Underground Cable Company of Pittsburgh, Pa., has prepared bulletin No. 700-2, descriptive of its type D. O. A. patented outdoor cable terminal.

INSULATING MATERIAL.—The Condensite Company of America, Bloomfield, N. J., has prepared a catalog descriptive of its insulating material known as condensite. This catalog outlines the many uses of the material and tells what it is.

PRIMARY CUT-OUT.—The G. & W. Electric Specialty Company, Chicago, is issuing a bulletin illustrating and describing the operation of the S. & H. oil-submerged compression cut-out. This is a primary cut-out, taking advantage of both compression and oil submersion in its operation.

ELECTRICAL APPARATUS.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has prepared several bulletins descriptive of electrical apparatus. One of these bulletins is descriptive of its four-frame motors, type CS; another of its magnetic brakes for alternating-current motors, type A; a third of Cutter universal floodlighting projectors; a fourth of its type C induction feeder-voltage regulator for outdoor service, and the fifth is a leaflet, or catalog 4-A, on distributing transformers. The last-named bulletin includes information on its single-phase, 60-cycle transformers.

New England States

BOSTON, MASS.—The Edison Electric Illuminating Company, 39 Boylston Street, has filed plans for the erection of a new five-story substation on Chauncey Street. Contract has been awarded to the George E. Macomber Company, 44 Bromfield Street, Boston.

SOMERVILLE, MASS.—The Springfield Provision Company has awarded a contract to the Casper Ranger Company, 20 Bond Street, Holyoke, for extensions and alterations in its local power house.

NEWPORT, R. I.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., to Westinghouse, Church, Kerr & Company of New York, N. Y., for the construction of a power plant at Newport, to cost about \$900,000.

NORWICH, CONN.—A certificate of organization has been filed in the office of the Secretary of State by the Eastern Connecticut Power Company of Norwich. The company, which is capitalized at \$1,000,000, is owner of what is known as the air power hydraulic privilege on the Quinnebaug River and also of the Bunday Hill water privilege on the same river. The company proposes to develop these two privileges as soon as conditions are such as to warrant the expenditure. The present plans provide for the construction, in the immediate future, of a large steam-driven power plant at Thamesville, which will furnish energy to operate the new shipyard in Groton known as the Groton Iron Works, to be supplied through the Shore Line Electric Railway Company, which will distribute electricity generated by the Eastern Connecticut Power Company.

PUTNAM, CONN.—Contract has been awarded by Otto Heineman Phone Supply Company, 25 West Forty-fifth Street, New York, N. Y., for the construction of a two-story addition, about 40 ft. by 140 ft., to its local plant.

WATERBURY, CONN.—The Connecticut Light & Power Company, 111 West Main Street, has commenced the erection of a new power house and dam at Stevenson, Conn. The J. A. P. Crisfield Contracting company, corner of Broad and Arch Streets, Philadelphia, Pa., is in charge of the work.

Middle Atlantic States

BROOKLYN, N. Y.—Plans have been prepared for the erection of a new machine shop, 35 ft. by 70 ft., one story, at the foot of Court Street, for the Electric Welding Company, 801 Vernon Avenue, Brooklyn.

BROOKLYN, N. Y.—Contract for the construction of two new intake tunnels on Sixty-sixth Street has been awarded by the Edison Electric Illuminating Company, 13 Willoughby Avenue, to the General Contracting & Engineering Company, 29 Broadway, New York.

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, until Dec. 10, for repairs and alterations made necessary by recent fire at the Commercial High School, Albany Avenue, Bergen and Dean Streets, Brooklyn, as follows: (1) Repairs and electrical work, etc.; (2) sanitary work, etc. Bids will also be received at the same time and place for a portable school building to be erected on Mermaid Avenue between West Thirty-first and West Thirty-second Streets, as an annex to Public School 80, borough of Brooklyn, as follows: (1) General construction; (2) plumbing and draining; (3) heating and ventilating; (4) electrical work. Blank forms, plans and specifications may be seen or obtained at the above office and also at branch office, 131 Livingston Street, Brooklyn.

BUFFALO, N. Y.—The Donner Steel Company, 475 Abbott Road, is considering the construction of an addition to its power house.

BUFFALO, N. Y.—The Buffalo Union Furnace Company, Katherine Street, is considering alterations in its power house, to cost about \$14,000.

BUFFALO, N. Y.—Contract has been awarded by the Delaware, Lackawanna & Western Railroad Company, 90 West Street, New York, to the Durolithic Construction Company, Ellicott Square, Buffalo, for the erection of a new one-story power house at its East Buffalo works.

BUFFALO, N. Y.—The Kellogg Products Company, 98 Delaware Avenue, has awarded a contract to B. I. Crooker, 57 Builders' Exchange, Buffalo, for the construction of two new additions to its plant at 1317 Elk Street, to consist of a two-story power

Construction

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house, 30 ft. by 112 ft., and a two-story transformer house, about 35 ft. by 65 ft.

CENTRAL ISLIP, N. Y.—Contract for the proposed new power plant at the Central Islip State Hospital has been awarded by the State Hospital Commission to Benjamin Raynor, Locust Avenue, Islip, at about \$150,000.

EAST UTICA, N. Y.—The Utica Gas & Electric Company has filed plans for the erection of a new one-story substation at its plant, to cost about \$12,000. Contract has been awarded.

LE ROY, N. Y.—The property of the Le Roy Power & Milling Company is to be absorbed by the Le Roy Hydraulic Electric Gas Company, and the present flour and feed mill on Mill Street will be discontinued. The electric company expects to dismantle the mills and convert the building into a substation, utilizing water power from Oakta Creek.

LOCKPORT, N. Y.—The Niagara County Commissioners are considering the construction of a new electric lighting plant on the old almshouse site. Frederick H. Krull, clerk.

MACEDON, N. Y.—A committee has been appointed to investigate the feasibility of the town purchasing the electric plant of the Macedon Milling Company. Should the plant be purchased, an expenditure of considerable money would be required for improvements. The plant now furnishes electricity for operating the municipal street-lighting system.

NEW YORK, N. Y.—The New York Edison Company will build a new one-story brick addition, 40 ft. by 65 ft., to its transformer station, at Park Avenue and One Hundred and Eighty-ninth Street, at a cost of \$15,000. Plans are being prepared by George F. Kiess, 130 East Fifteenth Street.

TROY, N. Y.—The water rights of the Troy Knitting Company have been purchased by the Fuld & Hatch Knitting Company, which will have the same transferred to the Ogen Mill, which the company has leased from the Harmony Mills.

UTICA, N. Y.—The City Council has adopted an ordinance directing the Utica Gas & Electric Company to erect 50 additional electric lamps in different locations directed by the commissioner of public works and the committee on street lighting.

UTICA, N. Y.—The Bossert Company, Hickory Street, Utica, manufacturer of stamped metal goods, electrical switch boxes, etc., is contemplating the construction of an addition to its plant, about 40 ft. by 70 ft., and a boiler house, 20 ft. by 80 ft.

WATERTOWN, N. Y.—Preliminary plans are being prepared by the S. M. Greene Company of Springfield, Mass., architect and engineer, for the construction of a municipal power plant about 1½ miles from the city, to cost about \$300,000. J. W. Knowlton is president of the water board.

WINGDALE, N. Y.—Bids will be received by the Commission on New Prisons, Room 18, Hall of Records Building, Center and Chambers Streets, New York City, until Dec. 20, for construction, heating, sanitary and electric work for cell house, interlocking building, mess hall and central heating and lighting plant, and underground piping and conduit work, underground sewer and water construction and underground electric service connections, at Wingdale Prison, Wingdale. Drawings and specifications may be consulted at the office of the Commission on New Prisons, Room 618, Hall of Records, New York City; New York office of the Department of Architecture, Room 1224, Woolworth Building, and Department of Architecture, Capitol, Albany, N. Y. Drawings and specifications may be obtained at the Department of Architecture, Capitol, Albany, upon deposit of \$10.

WORCESTER, N. Y.—The local electric-light plant, owned by Harry Shafer, has been purchased by the Schoharie Light & Power Company of Esperance. The new owners will take possession of the system next spring and will establish a 24-hour service.

YONKERS, N. Y.—Contract has been awarded by the Single Service Packing Company of America, 326 Hudson Street, New York City, to Michael Doherty, 13 Rose Street, New Rochelle, for the con-

struction of a one-story power house on the Saw Mill River Road, Yonkers, which, with the erection of another building, will cost about \$30,000.

ATLANTIC CITY, N. J.—The Public Utility Commission has given its approval of the petition of the Pleasantville Heat, Light & Power Company to surrender its lease to the Atlantic City (N. J.) Suburban Gas & Fuel Company on condition that the latter company will immediately operate both the gas and electric plants to supply consumers of the Pleasantville company.

BAYONNE, N. J.—The Bayonne Steel Casting Company is contemplating the construction of a new one-story brick substation at its plant at Oak Street and Ingham Avenue.

BURLINGTON, N. J.—Plans have been prepared by Haines & Sherman, 415 Market Street, Camden, engineers, for the construction of a new municipal electric-light plant in Burlington, for which bids will be asked in the near future.

JERSEY CITY, N. J.—Bids will be received until Dec. 13 by the County Park Commission for the lighting of Bayonne Park, Bayonne, N. J. Walter G. Muirheid, secretary.

JERSEY CITY, N. J.—The Boulevard Commission has petitioned the Board of Freeholders for an appropriation of \$150,000 for the purpose of rebuilding the commission's lighting plant at Snake Hill.

JERSEY CITY, N. J.—Contract has been awarded by the city officials for alterations and additions to the power house at the City Hospital to W. H. & F. W. Cane, Woolworth Building, New York City.

JERSEY CITY, N. J.—The Central Railroad of New Jersey, Communipaw Avenue, has filed plans for the construction of its proposed new one-story power plant, to cost about \$150,000. Contract has been awarded to the Westinghouse, Church, Kerr Company, 37 Wall Street, New York.

LINDEN, N. J.—A petition has been presented to the Township Committee by the citizens and taxpayers asking that electric lamps be placed on Eleventh Street.

NEWARK, N. J.—The Butterworth-Judson Company has taken out a permit for the construction of a new one-story boiler plant addition to its work on Avenue R, to cost about \$15,000.

NEWTON, N. J.—Contract has been awarded by the Town Council to the Newton Electric & Gas Company for furnishing service for street lighting for a period of one year, effective Jan. 1.

RED BANK, N. J.—Plans are being prepared for extensions and alterations in the power plant at the works of the Roberts Safety Tube Boiler Company. The H. D. Best Company, 52 Vanderbilt Avenue, New York, N. Y., is architect.

TRENTON, N. J.—Plans have been filed by the Delion Tire & Rubber Company for the construction of a two-story power house addition, about 35 ft. by 55 ft., to its plant on Whitehouse Road. Contract has been awarded to J. H. Morris, Broad Street Bank Building, Trenton.

ALLENPORT, PA.—Work has begun on the erection of a one-story, 32-ft. by 83-ft. substation at the plant of the Pittsburgh Steel Products Company, Frick Annex Building, Pittsburgh. The cost of the building is estimated at \$15,000.

ALTOONA, PA.—Work has begun on the construction of a large plant in which the Pennsylvania Railroad Company will mix all its own lubricating oils, greases and signal oils for the lines east of Pittsburgh and Erie. Thirty-one steel storage tanks, ranging from 1000 to 125,000 gallons each, will be erected. The plant will be equipped for electrical operation.

BENSON, PA.—Application has been made to the Public Service Commission by the borough officials for permission to acquire and operate the electric plant of the White Oak Electric Company.

BENTLEYVILLE, PA.—The Borough Council is considering the installation of a new street-lighting system, the cost not to exceed \$1,000. The plans call for six 250-cp. incandescent lamps on the main thoroughfare and a large number of 80-cp. lamps on the avenues and alleys. The West Penn Electric Company (Charleroi division) furnishes electrical service in Bentleyville.

BETHLEHEM, PA.—The Bethlehem Silk Company is planning to equip its plant, at 15 Goepf Street, for electrical operation throughout.

CARNEGIE, PA.—The Aetna Chemical Company has awarded contract to the W. W. Lindsay Company, Harrison Building, Philadelphia, for a new power house and 100-ft. radial brick stack at its works.

HAMBURG, PA.—D. J. Criscoli, of Reading, is planning for the installation of an

electrical smelting system for the production of ingots in the new foundry now being erected at Hamburg.

JOHNSTOWN, PA.—Plans for the extension of the car line of the Johnstown Traction Company through the Seventeenth Ward to Constable Hollow have been approved by the Public Service Commission.

JOHNSTOWN, PA.—The plant and holdings of the Dale Light, Heat & Power Company of Johnstown will be sold on Dec. 15 at the court house, Ebensburg. The sale will include a piece of land in Stonycreek, all rights, franchises, etc. The company supplies electricity for street-lighting and domestic purposes in the borough of Dale, Walnut Grove and in portions of the city of Johnstown and also to several industrial concerns in this district.

LANCASTER, PA.—The auxiliary electric power plant of the Lancaster Electric Light, Heat & Power Company, located at Wabank, about 5 miles from Lancaster, was recently destroyed by fire, causing a loss of about \$30,000.

MILLERSBURG, PA.—Governor Brumbaugh has approved the consolidation of seven electric companies, incorporated to operate in Dauphin, Juniata and other counties into the Juniata Public Service Company of Clearfield. The company is capitalized at \$346,000, and will operate from Millersburg.

PHILADELPHIA, PA.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., to the Commercial Engineering Company, 1527 Sansom Street, Philadelphia, for the installation of an electric system at the local navy yards, to cost about \$25,000.

PHILADELPHIA, PA.—The DeLong Hook & Eye Company, Broad and Wallace Streets, has filed plans for the erection of a new one-story power house at Twenty-first and Clearfield Streets. The company will also build a new factory building at the same location, and the entire work will cost \$250,000. Contract for construction has been awarded to William Steele & Son, 30 South Fifteenth Street, Philadelphia.

PITTSBURGH, PA.—The Miller-Owen Electric Company, 217-19 First Avenue, will build a new one-story addition, about 40 ft. by 200 ft., to its plant, to cost about \$40,000. Plans have been prepared by the C. D. Cooley Company, Century Building, Pittsburgh.

TROY, PA.—The John Waldo Evaporated Milk Company has awarded a contract to Pulford & Pompsey, 157 Falck Street, Elmira, N. Y., for construction of an addition to its power house.

ANNAPOLIS, MD.—The Bureau of Yards & Docks, Navy Department, will make extensions to its electric power, water and heating systems at the Naval Academy. Plans for the work, which will cost about \$500,000, are being prepared. F. R. Harris is chief.

BALTIMORE, MD.—Contract has been awarded by the Poole Engineering Company to the H. D. Watts Company, Garrett Building, Baltimore, for the construction of a two-story reinforced concrete and brick electric substation, 35 ft. by 55 ft.

CAMERON, W. VA.—A franchise has been granted to W. V. Smith to furnish electricity in Cameron.

CHARLESTON, W. VA.—The Charleston-Dunbar Traction Co. is planning to extend its lines from Dunbar, the present terminus, to Sattes, the new town to be constructed by the E. I. DuPont de Nemours Powder Company on 1200-acre site, in connection with a large plant for the manufacture of powder and munitions. The plant and the surrounding town will require a large amount of electrical energy.

CLUTE, W. VA.—The Hawley Coal Company is considering the erection of a large new power house at its plant. W. P. Hawley, Bluefield, is president of the company.

MORGANTOWN, W. VA.—Arrangements have been completed whereby the West Virginia Traction & Electric Company will purchase energy from the Monongahela Valley Traction Company. The erection of an electric transmission line between Fairmont and Morgantown is under way.

ST. MARYS, W. VA.—The St. Marys Light & Power Company will build a new one-story electric lighting plant, about 50 ft. by 65 ft. Plans have been prepared by R. H. Adair, 501½ Juliana Street, Parkersburg.

RICHMOND, VA.—A special meeting of the stockholders of the Virginia Railway & Power Company has been called for Dec. 29 for the purpose of ratifying the action of the directors authorizing the expenditure of \$1,000,000 for the erection of additional electric transmission lines.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington,

D. C., for furnishing at the various navy yards and naval stations supplies as follows: Various, Schedule 1581—72 motor-generator sets. Brooklyn, N. Y., Schedule 1572—15 motor-driven sounding navigating machines; Schedule 1575—2000 boiler tubes, 4 in. (outside diameter) by 18 in. long. Portsmouth, N. H., Schedule 1580—six portable ventilating sets. Washington, D. C., Schedule 1573—miscellaneous brass seamless-drawn tubing. Application for proposals should give the schedule desired by number.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, for furnishing at the various navy yards and naval stations supplies as follows: Puget Sound, Wash., Schedule 1591—2000 ft. single-conductor copper cable, 15,000 ft. incandescent lamp cord, 6000 ft. lighting and power wire, 400 ft. three-conductor, rubber-covered wire; Schedule 1592—1500 ft. two-conductor electric wire; Schedule 1593—62,000 ft. lighting and power wire, miscellaneous single-conductor lighting and power wire, 20 lb. nickel chromium resistance wire, 550 lb. magnet wire. Various, Schedule 1593—27,500 ft. interior communication wire; Schedule 1604—miscellaneous dry cells. Brooklyn, N. Y., Schedule 1591—400,000 ft. ship lighting cable, 225,500 ft. rubber-insulated, single, lead-covered wire, 350,000 ft. duplex, rubber-covered wire; Schedule 1593—70,000 ft. fire-control telephone cord, 12,000 ft. high-tension wire, 250,000 ft. plain, single-conductor wire, 45,000 ft. plain, single-conductor wire; Schedule 1598—motor generator sets; Schedule 1592—750,000 ft. bronze silicon antenna wire. New Orleans, La., Schedule 1593—60,000 ft. armored and leaded wire, 50,000 ft. double-conductor portable wire, 20,000 ft. two-conductor wire. Application for proposal blanks should designate the schedule desired by number.

North Central States

IRON RIVER, MICH.—The erection of a power house and car barn is contemplated by the Iron River, Stambaugh & Crystal Falls Street Railway Company.

PORT HURON, MICH.—Plans are being prepared by the Mueller Manufacturing Company of Sarnia, Ont., for the construction of a power house, 60 ft. by 100 ft., in connection with its new plant being erected in Port Huron. The cost of the plant complete is estimated at about \$400,000. James, Loudon & Hertzberg of Toronto, Ont., are consulting engineers.

CALEDONIA, OHIO.—Bonds to the amount of \$10,000 have been sold, the proceeds to be used for the establishment of a municipal electric light and power plant.

CANTON, OHIO.—The Republic Stamping & Enameling Company is installing an electric power plant of sufficient capacity to operate its entire plant. Heretofore electricity has been secured from the Central Power Company of Canton.

CHARDON, OHIO.—Bonds to the amount of \$25,000 have been voted for the installation of a new electric-light plant. The machinery in the present plant, which has been in use 20 years, is worn out. Plans have been prepared by E. C. Thompson, engineer.

CINCINNATI, OHIO.—The Central Avenue Improvement Association has petitioned the city authorities to install ornamental lamps on Central Avenue.

CINCINNATI, OHIO.—A permit has been filed by the P. W. Drackett Sons Company for the erection of a power house on Spring Grove Avenue, north of Mitchell, to cost about \$7,000.

CINCINNATI, OHIO.—The New Courthouse Building Commission of Hamilton County, Cincinnati, will receive bids until Dec. 18 for the installation of lighting fixtures in the new courthouse and jail now under construction in Cincinnati. Plans and specifications are on file at the office of Rankin, Kellogg & Crane, architects, 1012 Walnut Street, Philadelphia, Pa., and at the office of the auditor of Hamilton County, Cincinnati.

CLEVELAND, OHIO.—Extensions, involving an expenditure of \$700,000 will be made to the municipal electric light plant. New equipment, including switchboard, generator, boilers, engines, etc., will be installed.

CLEVELAND, OHIO.—Property purchased at East Fifty-fifth Street by the Pennsylvania Railroad Company will be used as a terminal. Two electrically operated cranes will be installed for handling freight. B. K. Rochester is superintendent of the Cleveland division.

CLEVELAND, OHIO.—Bids will be re-

ceived at the office of the Commissioner of Purchases and Supplies, City Hall, Cleveland, until Dec. 14, for structural steel work for the division of light and heat. Specifications may be obtained at the office of the division of light and heat.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, Cleveland, until Dec. 14, for furnishing, lighting, extinguishing, repairing and maintaining electricity for electric lamps for street lighting in the city of Cleveland for one year beginning Jan. 1, 1918. Specifications may be obtained at the office of the superintendent of street lighting.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, Cleveland, until Dec. 14 for 14-in. and 16-in. boulevard glass globes for street lamps for the street-lighting division. Bids will also be received at the same time and place for ornamental glass globes for park and boulevard lamps for the street-lighting division. Specifications may be obtained at the office of the superintendent of street lighting, room 122, City Hall.

COLUMBUS, OHIO.—Plans are being prepared by Joseph N. Bradford, architect, Ohio State University, for six large agricultural buildings, to be erected on the campus, west of the Olentangy River, which will include a number of barns and administration buildings and a power plant.

DAYTON, OHIO.—The Dayton Metal Products Company is planning to build an addition to its plant on Taylor Avenue, to cost about \$7,000. It will also install additional equipment to its electrical plant on Ludlow Avenue.

HAMILTON, OHIO.—Estimates have been prepared by Mead & Seaton, engineers, for enlarging the municipal electric-light plant. The plans provide for the installation of two new boilers; changing the ash and coal-handling apparatus; installing new gas grates under present boilers, and that a new steam-driven generator of at least 1250 kva. should be installed immediately. The substitution of Mazda type of lamp for the arc lamps now in use is recommended.

TOLEDO, OHIO.—The Northwestern Ohio Railway & Power Company is planning to erect a new transmission line from Danbury Stop to Danbury, a distance of 1½ miles, to supply electricity to a large pumping station of the New York Central Railroad Company. The company will also install an additional transformer at its station. The New York Central Railroad will pay the entire cost of erection of the transmission line and the cost of one-third of the wire from Danbury Stop to Danbury, and will also pay one-half of the cost of the transformer.

COVINGTON, KY.—The proposed contract for installing electrical machinery at the water-works pumping station has been submitted to the City Commission. The Union Light, Heat & Power Company will install the new pumping machinery and electric motor at a cost of \$36,000 and will take payment in installments in the way of water rental. The company uses a large amount of water in supplying the citizens of Dayton and Bellevue, which is purchased from the Covington plant.

CYNTHIANA, KY.—The Kentucky Traction & Terminal Company of Lexington is erecting an electric transmission line from Georgetown to Cynthiana, which it is expected, will be completed about Feb. 1, 1918. The local plant will be closed down upon completion of the line.

FAIRFIELD, KY.—The electric plant of the Fairfield Electric Company was recently destroyed by fire.

LEXINGTON, KY.—The American Metallic Packing Company would like to receive prices on a second-hand generator, 100 to 150 kw., 250 or 500 volts, complete; must be in first-class condition.

CROMWELL, IND.—The local electric-light plant and sawmill, owned by W. Moore & Company, was recently destroyed by fire, causing a loss of about \$7,000.

MARTINSVILLE, IND.—The capital stock of the Martinsville Gas & Electric Company has been increased from \$150,000 to \$200,000.

STEBENVILLE, IND.—The capital stock of the Buckeye Power Company has been increased from \$9,000 to \$2,241,000.

CHICAGO, ILL.—Preparations are being made by Marshall Field & Company for the erection of a garage, for which bids are now being received by Graham, Anderson, Probst & White, 80 East Jackson Boulevard, Chicago. The building will be one and two stories and will cost about \$400,000.

GROVE, ILL.—The Grove & Morton Railway Company has petitioned the Public Utilities Commission for a certificate of

convenience and necessity to construct and operate an electric railway between Grove and Morton.

SAN JOSE, ILL.—The local electric-light plant, owned by S. B. Hullinger, was recently destroyed by fire, causing a loss of about \$30,000.

SHERIDAN, ILL.—Application has been filed with the State Utilities Commission by the Sheridan Electric Light & Power Company for a certificate of necessity and convenience to operate at Sheridan. The company also asks for permission to sell \$3,000 in bonds.

VIENNA, ILL.—Application has been made to the City Council by J. J. Oelrich for a franchise to construct and operate an electric-light and power plant in Vienna.

GLIDDEN, WIS.—The Northern Wood Products Company is planning to erect an addition to its hardwood factories and power plant, to cost about \$40,000. W. A. Thomas is president and general manager.

KANKANNA, WIS.—The Kankanna Electric Light Company is planning to extend its electric transmission lines to Fairview Heights, the new addition of Little Chute.

KIEL, WIS.—Bids, it is reported, are being received by Charles A. Cahill, 1426 Trist National Bank Building, Milwaukee, for a 250-kw. generator and for motors, ranging from 5 hp. to 50 hp., for the Kiel (Wis.) Woodenware Company.

EDGERTON, MINN.—The Northern States Power Company of Chicago, Ill., has been awarded a contract for lighting the streets of the city and for furnishing electricity to operate the city pumping station for a period of ten years.

FORT MADISON, IOWA.—A movement has been started to install an ornamental lighting system on Second Street. It is proposed to have the Fort Madison Electric Company install the lamps.

GARNER, IOWA.—The local plant of the Iowa Falls Electric Company was damaged by fire recently, causing a loss of about \$10,000.

MORNING SUN, IOWA.—The Burlington (Iowa) Railway & Light Company has applied to the City Council for a franchise to supply electricity in Morning Sun. The company is contemplating erecting an electric transmission line north from Burlington, connecting up Mediapolis, Morning Sun, Wapello and Winfield, giving each city a 24-hour service.

VAIL, IOWA.—At an election held recently the proposal to issue \$11,000 in bonds to install an electric-lighting system in Vail was carried. Energy to operate the system will be secured from the municipal plant at Denison.

GRANT CITY, MO.—The local electric-light plant, owned by W. C. Childers, has been purchased by the Maryville (Mo.) Electric Light & Power Company, which has taken possession of the plant. Electricity, it is reported, will be supplied by the Maryville plant as soon as the right of way can be secured and the transmission line erected, which will probably take about 12 months.

ST. JOSEPH, MO.—That an expenditure of \$31,000 for improvements to the municipal electric-light plant would enable the plant to take care of the ornamental lighting system, consisting of 247 lamp standards, the lamps in the boulevards and parks and between 75 and 100 lamps additional, was claimed in a statement made by Mayor Elliot Marshall recently. The boiler capacity of the plant is 850 hp. and the engine capacity only 350 hp.

SCRANTON, N. D.—The Johnson Fuel Company of Fairfax, S. D., which operates a briquetting plant in Scranton for the consumption of lignite, is contemplating the installation of an electric-light and power plant at its mine to utilize waste in the briquetting process. Electricity for lamps and motors will be supplied to Bowman, Marmarth, Rhame and Scranton.

AURORA, NEB.—The city of Aurora is in the market for a new pumping head and working barrel to be installed in a well in the city water-works plant. Pump to supply about 200 gal. per minute and to be motor-driven. Details of the well may be obtained from the city clerk or from the Aurora Electric Company. A. L. Hickman is manager of the Aurora Electric Company.

BAYARD, NEB.—Bonds to the amount of \$4,500 have been voted for the installation of an ornamental street-lighting system.

CALDWELL, KAN.—The Council has adopted a resolution providing for the extension to the street-lighting system.

EL DORADO, KAN.—The property of the El Dorado Electric & Refrigerating Company has been purchased by the E. B. Lawson interests. The plant, it is understood, is to be enlarged.

TIPTON, KAN.—A company recently organized by local capitalists has installed an electric-light plant in Tipton. The plant has been placed in operation and a 24-hour service established.

Southern States

PARKTON, N. C.—The City Council is considering an issue of \$5,000 in bonds for the installation of an electric-lighting system. F. N. Fisher is Mayor.

SOUTHPORT, N. C.—Contract has been awarded by the city of Southport to Price Furpless and Robert T. Woodside for the erection of an addition to the municipal power plant at the water-works. Orders have been placed for an engine, etc.

CHARLESTON, S. C.—The Charleston Consolidated Railway & Lighting Company is planning to erect a rotary converter substation on Clement's Ferry Road, between Five-Mile House Curve and Oaks Curve. The proposed building will cost about \$30,000 and it will have a capacity of 700 hp. and will supply electricity to the suburban railway. Energy will be delivered to the station at three-phase, 13,200 volts, and converted to 440 volts, direct current. Later it is proposed to change it to an automatic station throughout.

COLLINWOOD, TENN.—The Tennessee Valley Iron & Railroad Company is planning to build a furnace with a daily output of 100 tons of charcoal iron. The plans provide for the erection of furnace stock and hoist, 50 ft. by 80 ft.; cast house, 50 ft. by 130 ft.; engine house, 40 ft. by 80 ft., and boiler house, 40 ft. by 80 ft., to be equipped with six boilers. The company will erect 30 dwellings equipped with water supply, electric lights and steam heat. D. E. Teed of Collinwood is engineer. C. N. Brady is president.

COLUMBIA, ALA.—The Houston Power Company, recently organized, proposes to build a hydroelectric plant in Columbia. H. F. Deal is president.

MARION, ALA.—Preparations, it is reported, are being made by the Alabama Power Company of Birmingham for installing a permanent plant on the site of the Marion Electric Company's plant, recently destroyed by fire.

VIDALIA, MISS.—The Southern Railway & Light Company of Natchez is planning to furnish electrical service (24 hours) for lamps and motors, etc., in Vidalia.

AMARILLO, TEX.—The City Commission has under consideration plans for the construction of a municipal electric light plant here. The proposition of voting \$200,000 bonds for the purpose will probably be submitted to the taxpayers soon.

DALLAS, TEX.—The City Commission has authorized the Dallas Power & Light Company to borrow \$4,000,000 and to issue 18,500 shares of stock with a par value of \$100 each. It is stated that 6 per cent. notes will be issued for the loan.

Pacific and Mountain States

AUBURN, WASH.—The City Council has granted a franchise to the Valley Gas Company to furnish electricity in Auburn.

BELLINGHAM, WASH.—The Lone Jack Mining Company contemplates the construction of a power plant, to cost about \$20,000, at its properties near Glacier, Wash.

BELLINGHAM, WASH.—The City Council has awarded the contract for building a dam flume, consisting of 280 ft. of 42-in. creosoted wooden stave pipe, running from Prospect Street Bridge to the city power plant near the Bellingham Sash & Door Company's plant, at \$4,339. The plant which it serves has been leased to the Bellingham Sash & Door Company and provides power for both that company's plant and the municipal pumping station on Maple Street.

BELLINGHAM, WASH.—Arrangements are being made to open the Cokedale Mines in Skagit County in the near future, and a contract has been awarded for the construction of a railroad to the property. The mine will be equipped with electrically operated machinery, contract for which has been awarded to the Puget Sound Traction, Light & Power Company of Bellingham, which will erect a transmission line to the mine as soon as material can be secured. A substation will also be erected at the mine.

COLVILLE, WASH.—H. R. Williams, manager of the Stevens County Power & Light Company, is authority for the statement that power will be furnished to the

Valley magnesite fields in the early spring. The Stevens County Company is to supply electricity for lamps and motors to the Chewelah Magnesite Works, and is within half a mile of the Northwest Magnesite & American Mineral quarries. The Stevens County plant at Meyers Falls, on the Colville River, will be increased to its full capacity during the winter.

NEWPORT, WASH.—The properties of the Northern Idaho & Montana Power Company, including those at Newport, Wash., and Sandpoint, Idaho, and of the Oregon Power Company at Eugene, Ore., were sold on Nov. 13 by order of the Federal Court in Newport to John H. Roemer of Chicago, Ill., representing the reorganized companies. The total involved in the sale was \$5,016,773.

TACOMA, WASH.—The City Light Department has been requested to arrange a petition for lighting a section of the North End, including the district on Cliff Avenue to the north line of North D Street, to the intersection of North First and Cliff through the alley and down by the Stadium High School, between I and J Streets, to the center of North Sixth Street and back to Yakima Avenue.

WALLA WALLA, WASH.—The Board of Commissioners of Walla Walla County has received an application from the Pacific Power & Light Company for a 50-year franchise to construct and operate transmission lines in Walla Walla County. The company plans to furnish light and power to a number of unincorporated towns in the county.

KLAMATH FALLS, ORE.—The large dam of the California-Oregon Power Company across the Klamath River at Copco, 45 miles from Klamath Falls, has been completed. The company plans to generate 26,000 hp. under the present development. An equal amount can be developed by the installation of additional units to the power plant. The construction of a smaller dam below the present one, which will bring the total development to 103,000 hp., is contemplated by the company. Electricity generated at the plant will be distributed throughout northern California and southern Oregon.

COPPERPOLIS, CAL.—The local power station of the Sierra & San Francisco Power Company of San Francisco was recently destroyed by fire, causing a loss of about \$35,000.

FRESNO, CAL.—Plans have been announced by A. G. Wishon, general manager of the San Joaquin Light & Power Corporation, for the development of the water power of the upper Kings River. The first power plant, which will be built as a unit, will be erected on the banks of Kings River, about 15 miles above Trimmer. Each plant will provide for at least three units, and the first plant will cost approximately from \$1,500,000 to \$2,500,000. The power plant will be 1100 ft. above sea level and will be located just above the far end of the Pine Flat reservoir as planned by the Kings River conservation district.

GRASS VALLEY, CAL.—Work has begun on the construction of a cold-storage plant that will have a daily capacity of 50 tons of ice per day, with 75,000 cu. ft. of storage space. The refrigerating plant will be operated by a large electric motor, which will be augmented by a steam plant, to be used as an auxiliary power. The plant is being built by local capital, and J. C. Jones of San Francisco, a refrigerating engineer, will have charge of construction.

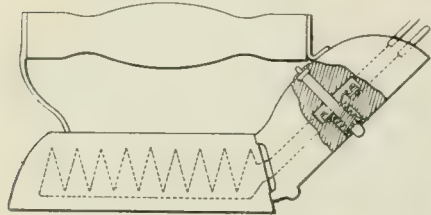
LIVINGSTON, CAL.—The Livingston Farm Center has approved the resolution favoring the irrigation district plan recently indorsed by the directors of the County Farm Bureau, which provides that the drawings of the irrigated district be done by the electricity generated by power from the Merced River and from storage water, and also that the irrigation district have its own power and telephone system.

PALO ALTO, CAL.—The City Council is considering the question of increasing the output of the municipal electric-light plant. It will be necessary either to install new engines or purchase energy.

BISBEE, ARIZ.—The City Council, we are informed, does not contemplate calling an election to vote on the proposal to issue \$375,000 in bonds for the construction of a new electric-light plant, water-works system and a gas-generating system as reported in the issue of Nov. 17. The Bisbee Improvement Company furnishes electrical service in Bisbee.

HOT SPRINGS, MONT.—Conrad Smith and F. E. Campbell, it is reported, are making arrangements to install a lighting and power plant in Hot Springs to serve the town and contiguous territory. The Town Council, it is understood, has agreed to grant them a franchise, and work will begin soon after the first of the year.

- 1,247,613. **ELECTRIC METER**; John L. Axen, Detroit, Mich. App. filed Feb. 13, 1917. Provides a depolarizable instrument so constructed that the anomalous magnetic polarity produced by an excessive flow of current, as when the instrument is in a short circuit, will not have any permanent effect or influence on the normal resident polarity of the interrelated parts.
- 1,247,649. **ELECTRIC STARTING AND LIGHTING SYSTEM FOR MOTOR VEHICLES**; Albert E. Doman, Elbridge, N. Y. App. filed June 23, 1914. Involving the use of a compound-wound dynamo or motor and a storage battery as the sources of energy for such systems.



1,247,907—Flatiron

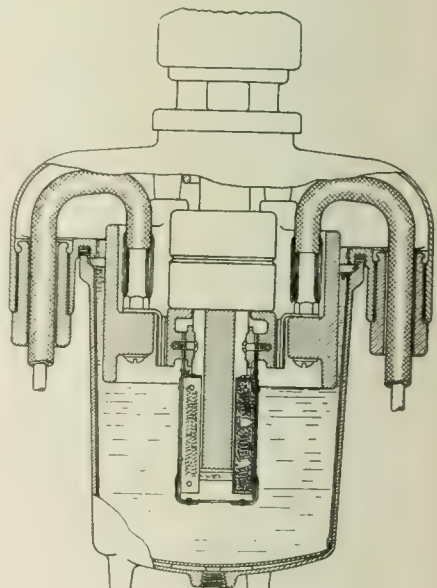
- 1,247,650. **MOTOR-GENERATOR**; Albert E. Doman, Elbridge, N. Y. App. filed July 27, 1914. Reduces the weight and at the same time increases the strength and durability of the case or housing, without sacrificing its magnetic efficiency.
- 1,247,656. **TERMINAL FOR CONDUCTORS**; William Gadke, Philadelphia, Pa. App. filed Jan. 22, 1916. Cannot easily be detached.
- 1,247,660. **SWIVEL CONTACT FOR ELECTRICAL CONDUCTORS**; Flint Garrison, St. Louis, Mo. App. filed Dec. 6, 1916. Improvement.
- 1,247,669. **TELEPHONE-EXCHANGE SYSTEM**; Charles L. Goodrum, New York City, N. Y. App. filed July 15, 1915. Applies particularly to circuit arrangements for selector switches employed in automatic telephone systems.
- 1,247,672. **TELEPHONE CONDUCTOR**; Claus W. Hallberg, Chicago, Ill. App. filed March 29, 1913. Particularly designed for conductors leading to a portable telephone set (transmitter and receiver).
- 1,247,676. **FIRE-ALARM SIGNALING APPARATUS**; Charles A. Harsch, New York City, N. Y. App. filed April 30, 1917. Useful in large buildings having several stories or floors, one above another.
- 1,247,689. **REEF ALARM FOR SHIPS**; John L. Kerchey, Schaghticoke, N. Y. App. filed Feb. 26, 1917. Attachment for ships.
- 1,247,690. **ELECTRIC SWITCH**; Charles J. Klein, Milwaukee, Wis. App. filed April 28, 1911. Push-button flush.
- 1,247,694. **ELECTROLYTIC APPARATUS**; Isaac H. Levin, Newark, N. J. App. filed Oct. 25, 1915. Improvements in apparatus of the filter-press type.
- 1,247,741. **ELECTRIC WELDING APPARATUS**; Albert C. Taylor, Warren, Ohio. App. filed July 23, 1917. Transformer having two independent secondary coils or bands and a single primary coil, whereby two independent secondary welding currents may be obtained with a single primary current.
- 1,247,751. **SWITCH**; John A. Van Alstyne, Sacramento, Cal. App. filed May 5, 1917. Electric starting.
- 1,247,753. **TABLE LEVER FOR ELECTRIC SIGNALING APPARATUS**; Eugene W. Vogel, Oak Park, Ill. App. filed July 18, 1914. Improvements.
- 1,247,759. **RECTIFIER**; Albert Wehmeier, St. Louis, Mo. App. filed Aug. 16, 1916. For deriving from an alternating current a direct form of current suitable for the charging of storage batteries and the like.
- 1,247,770. **AUTOMATIC TELEPHONE SYSTEM**; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed Jan. 31, 1916. Type in which switching apparatus at the central office acts automatically to find and make connection with a calling subscriber's line.
- 1,247,771. **AUTOMATIC TELEPHONE SYSTEM**; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed Jan. 31, 1916. Switch mechanism first selects a group in which the calling line is located and then finds the particular line in that group that is calling.
- 1,247,796. **TELEPHONE SWITCH**; William W. Dean, Rochester, N. Y. App. filed April 13, 1916. Improvements.
- 1,247,800. **ELECTRODE GRIP HANDLE**; Walter H. Earnest, Meadville, Pa. App. filed April 18, 1917. Permits the electrode to be held in various positions in an easy and efficient manner.

Record of Electrical Patents

Notes on United States Patents
issued on November 27, 1917

- 1,247,820. **ELECTRIC SOCKET**; David D. Gordon, Chicago, Ill. App. filed Nov. 6, 1915. Two-part insulating construction the parts of which are locked together in assembled relation by the attaching of an incandescent lamp, a connecting plug or other device thereto.
- 1,247,825. **MOISTURE AND GAS PROOF TELEPHONE CASE**; Charles E. Hague, Rochester, N. Y. App. filed July 8, 1914. For use in mines.
- 1,247,831. **TELEPHONE SYSTEM**; Harvey L. Harris, Rochester, N. Y. App. filed March 20, 1917. Initiates a characteristic signal, individual to the operator's attention, to recall.
- 1,247,842. **SWITCH MECHANISM**; Bertrand G. Jamieson, Chicago, Ill. App. filed Aug. 5, 1915. Remote control.
- 1,247,887. **TELEPHONE SYSTEM**; Frank M. Slough, Rochester, N. Y. App. filed Feb. 3, 1917. Improvements.
- 1,247,907. **FLATIRON**; Francis W. Tully, Brookline, Mass. App. filed April 9, 1917. Improvements.
- 1,247,916. **CONNECTION TERMINAL**; Alfred H. Weiss, Wilmette, Ill. App. filed Sept. 30, 1915. Locking means.
- 1,247,946. **AUTOMATIC SWITCH**; Ervin M. Fitz, Worthington, Ohio. App. filed July 11, 1916. Maintains constant polarity of current at the brushes of generators having armatures driven in reverse directions.
- 1,247,956. **INCANDESCENT ELECTRIC LAMP**; Clara A. Harrison, London, England. App. filed March 24, 1914. Relates to the renewing or refilling of electric incandescent lamps with wire or like filaments.
- 1,247,976. **LINE-FINDER SYSTEM**; Alben E. Lundell, New York, N. Y. App. filed June 27, 1916. Telephone.
- 1,247,981. **INDICATOR**; George F. McLaughlin, San Francisco, Cal. App. filed Jan. 31, 1916. Passenger vehicles.
- 1,248,021. **AUTOMATIC SWITCH**; Walter Scribner, Columbus, Ohio. App. filed Dec. 14, 1915. Improvements.
- 1,248,059. **ELECTRIC-LIGHT BULB AND THE FITTINGS THEREIN**; Delbert R. Baity, Melbourne, Victoria, Australia. App. filed July 18, 1916. Improvements.
- 1,248,074. **COMBINED SWITCHBOARD AND RHEOSTAT FOR CONTROLLING THE CHARGING OF ELECTRIC STORAGE BATTERIES**; William C. Carr, Buffalo, N. Y. App. filed June 12, 1912. Improvement.
- 1,248,084. **MAGNETIC APPARATUS**; Kenneth L. Curtis, Boston, Mass. App. filed Feb. 12, 1915. For safeguarding electric circuits.
- 1,248,090. **FUSE**; Louis W. Downes and Ralph C. Patton, Providence, R. I. App. filed Feb. 26, 1917. Two or more fusible elements are connected together.
- 1,248,091. **FUSE**; Louis W. Downes and Ralph C. Patton, Providence, R. I. App. filed May 23, 1917. Refillable.
- 1,248,122. **ELECTRIC SOLDERING IRON**; William F. Hosford, Oak Park, Ill. App. filed Aug. 29, 1916. Heating element is cored out to receive a non-oxidizing, heat-conducting core.
- 1,248,130. **ELECTRICALLY OPERATED SPEED-LIMITING DEVICE FOR MOTOR VEHICLES**; Heinrich M. Kammerhoff, Orange, N. J. App. filed April 17, 1916. Improved.
- 1,248,135. **LAMP SOCKET**; Charles J. Klein, Milwaukee, Wis. App. filed Nov. 9, 1914. Means for interlocking the sections of casings for lamp sockets, pendant switches and the like.
- 1,248,158. **TELEPHONE RECEIVER**; Alexander Poloumordvinoff, Petrograd, Russia. App. filed June 3, 1912. Improvements.
- 1,248,159. **TELEGRAPH APPARATUS**; Edwin Pope, Quebec, P. Q., Canada. App. filed June 14, 1915. For sending and recording telegraph messages.
- 1,248,161. **ELECTRIC FIXTURES**; Roy W. Purcell, St. Paul, Minn. App. filed Feb. 1, 1917. Pilot light.

- 1,248,176. **ALTERNATING-CURRENT MAGNET AND THE LIKE**; Harry A. Sedgwick, Milwaukee, Wis. App. filed Feb. 20, 1915. Reduces the vibration of the attracted parts of alternating-current devices at the pivotal points thereof.
- 1,248,187. **LIGHTING FIXTURE**; Esmond M. Smith, New York, N. Y. App. filed Jan. 20, 1917. Globe bowl supported below a ceiling or other reflecting surface in such a manner that the supporting means are inconspicuous.
- 1,248,202. **ELECTRICAL RECEPTACLE**; George B. Thomas, Bridgeport, Conn. App. filed Jan. 27, 1917. Molding receptacle adapted to receive attachment plugs of the jack-blade type.
- 1,248,203. **ELECTRIC SWITCH**; George H. Thomas, Bridgeport, Conn. App. filed May 16, 1917. Three-point type.
- 1,248,219. **IGNITER FOR INTERNAL-COMBUSTION ENGINES**; Edmund G. Wayman, Swissvale, Pa. App. filed Jan. 31, 1916. Improvements.
- 1,248,246. **CIRCUIT INDICATOR**; Walter E. Beede, New York City, N. Y. App. filed Jan. 17, 1914. Automobile.
- 1,248,255. **RELATING TO ALTERNATING-CURRENT DYNAMOS**; Max Breslauer, Hoppegarten, near Berlin, Germany. App. filed March 9, 1914. Adapted for use in connection with wireless telegraphy and other like purposes.
- 1,248,260. **METER PROTECTIVE DEVICE**; James F. Burns, Philadelphia, Pa. App. filed Jan. 19, 1916. Meter may be adjusted in two planes at right angles to each other.
- 1,248,272. **ELECTRICAL CONNECTOR**; Samuel G. Crane, Toledo, Ohio. App. filed Jan. 27, 1915. Novel arrangement of multiple contacts and wiring connections.
- 1,248,344. **INTERLOCKING DEVICE FOR MAGNET ARMATURES**; Frederick W. Kulicke, Philadelphia, Pa. App. filed April 14, 1916. Improvements.
- 1,248,380. **METHOD OF AND APPARATUS FOR DETECTING THE PRESENCE OF ORE DEPOSITS IN THE EARTH**; Rupert Nelson, San Francisco, Cal. App. filed April 3, 1915. Improvements.
- 1,248,384. **ELECTRIC WALL SWITCH**; William J. Newton, Lynbrook, and Morris Goldberg, Brooklyn, N. Y. App. filed July 13, 1916. Means for securing the customary face plate to the switch-supporting means.
- 1,248,415. **SWITCHBOARD**; Hubert F. Krantz, Brooklyn, N. Y. App. filed April 11, 1916. Various elements thereof so arranged



1,248,090—Fuse

that a maximum number of switch-controlled connections may be safely made in a minimum of space and in a simple, efficient and practical manner.

- 1,248,421. **ATTACHMENT PLUG FOR ELECTRIC WIRES**; Charles F. Toren, Springfield, Mass. App. filed Sept. 13, 1916. Improved.
- 1,248,431. **SELF-ACTUATING SAFETY PANEL**; Hubert F. Krantz, Brooklyn, N. Y. App. filed Feb. 18, 1916. Door cannot be either opened or closed save when the switch blade is in open-circuit position such that an attempt to either open or close the door will throw the blade in set position.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN
Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, DECEMBER 15, 1917

No. 24

The Electrically Controlled Torpedo Boat

THERE has been notice of late that the Germans were using off the Belgian coast electrically controlled torpedo boats with which one or more attacks have been made on the British patrols. Enough definite information has now leaked out to authenticate the rumors and to give a rather clear idea as to what the craft actually are. As developed by the Germans the electrically controlled torpedo boat is simply a very fast twin-screw motor launch, well housed in and carrying a very heavy charge of high explosives in the bow. This boat is not manned in any way and is guided from the shore by means of a single-core insulated cable paid out from a drum on the boat, said to carry 30 miles (48.2 km.) or more. Except for the fact that gasoline engines are used for motive power, the scheme is essentially the same as that of the old Sims-Edison torpedo, and even prior devices running back more than thirty years.

The practical difficulty of all such dirigible torpedoes or torpedo boats, whether controlled by a cable or by wireless, is inability to see the course of the boat well enough from the shore to permit effective steering over any considerable distance unless the steering masts are very conspicuous, in which case they are only too obvious to the enemy. Even if equipped, as has been often suggested, with hooded steering lights shining to the rear, the case is not much improved, for the glow from these lights is easily visible to the party attacked and is at best a very uncertain guide in a choppy sea. It is for this reason more than for any other that such dirigible craft have not been to any extent used. In the new German boat, intended to operate over a long radius, steering by shore observation is utterly impracticable, and the direction of the attack lies in a well-guarded hydroplane, which follows up the boat and directs the steering by wireless to the shore station. In this way the observer can keep near enough to the boat and in a sufficiently advantageous position above her to guide her motions with some degree of precision. Thus far the boats have steered a zigzag course either intentionally or accidentally and have not achieved any success whatever. It is one thing to send out a launch on the surface of the water, even well guided from above, and quite another to explode her by contact with a hostile vessel whose rapid-fire guns are going like a pack of firecrackers. The German boat is certainly an ingenious modification of an old idea, but there is little reason to think that the results will have any particular importance. The only really interesting feature of the novelty is the guidance furnished by an aerial observer.

The Engineer as Citizen

DR. IRA N. HOLLIS' presidential address before the American Society of Mechanical Engineers is an inspiring statement of the ideals and duties of citizenship and the relation of the engineer to the state. At the very root of success in democratic government lies the existence of trained administrators, men who are capable of taking up the infinitely varied tasks of governing a nation of 100,000,000 people and of executing them with single-hearted fidelity to country and to conscience. The working out of a democracy to the highest type of government requires for its full development righteousness and intelligence in each and the instinct for team play in all. Unless these qualities are at the front in state and nation, democracy is a hollow sham, a futile imitation of efficient government. Unhappily, highly trained men too often neglect their duties as citizens and keep out of politics, leaving the administration of the nation in the hands of those whose business it is to make politics pay. The engineering professions, however patriotic in spirit, cannot be held entirely blameless in their inclination to retire to the background of political activities. The time has now come, however, when our democracy, grown somewhat careless through long years of peace and smug prosperity, is to be tried in the fire, and unless it is to fail every man who is in any measure inspired by righteousness and intelligence needs without reserve to bend his energies to promoting the common good.

We cannot now do much to repair the failures of the past in providing suitable education for citizenship. We cannot make good the mischief done by the growth of evil precedents in political life, by lax morals in public policies, and by perversion of the rights of the many to add to the gains of the few. This much, however, we can do. From now on we can turn courageously to the task of curing the evils that have sprung up, of setting the nation's house in order for the struggle before it, and of keeping the government unswerving in its purpose to "make the world safe for democracy." Dr. Hollis sets the relation of right-minded men to government under four heads, the routine of business, the organization of research for the benefit of all, the training of men for their country's defense in time of peace, and that grimmer defense duty of training them in time of war. He holds, and very properly, that any ordinary business would be wrecked if as carelessly officered and loosely managed as is the great mechanism of our central government. When a few out of the whole responsible group are found by intellect or by training equal to the demands of their positions we may consider ourselves lucky. Even great

departments, requiring the highest kind of trained skill for their efficient administration, fall into the hands of men well intentioned and patriotic but chosen for political expediency entirely irrespective of their personal abilities. That some of them succeed measurably well despite their lack of qualifications speaks highly for their native ability and is a thing for which to be profoundly thankful. In the legislative branch, as Dr. Hollis notes, the situation is even worse, since for the most part both houses of Congress operate on the lines of petty politics and it is only in some great crisis like the present that they rise out of the mire of small interests and act with larger things in view. There is no such intelligent organization in government as would be found in the conduct of any great business. Improvement in this respect may perhaps be one of the incidental blessings brought on by the curses of war.

The organized research of the government up to the outbreak of hostilities was efficient to the best of its ability and appropriations but smothering in the general atmosphere of apathy toward the higher interests of the nation as a whole. One of the most marked results of the present situation is that at last an emergency organization has been brought together which has done and is doing great things for the national defense. What has been accomplished in the last few months gives some notion of the possibilities of efficiency when the intellectual and executive forces of the people are really mustered into service. As intelligence and righteousness are necessary in the business and technical administration of government affairs, so is that principle of team work which sets the result above the individual, and the highest conception of team work on a vast and vital scale is the organization of the nation's defense by military training. That which can be done in the ordinary routine of the government's business is only what is done every day in any great engineering work. That which must be accomplished for the country's salvation is the team work of armed men, the most perfect example of co-operation that humankind has discovered. In peace, as Dr. Hollis shows, we have been lax to the verge of criminality. The old high principle of the founders of the Republic by which every citizen of military age was to be armed and ready fell into neglect while yet the memory of the War of Independence was fresh. It had passed into a mockery in the days of our grandfathers. The terrible lesson of the Civil War was soon forgotten; that of the Spanish War was never properly learned and was fading from memory, when the world struggle came upon us like a bolt from the blue.

The hope of the nation now is in the fierce and intense efforts at military training to-day to make up for its lack in the yesterdays. The million men who were to spring to arms had neither arms nor leaders for lack of preparation in time of peace. The great question which is coming in the future is how such preparation may be initiated and continued, to the end that we may not again be found unready. That the temper of the people calls for general military training the swift pass-

age of the draft bill through Congress and the ease with which it has been put into effect make clear. The engineering profession, more than any other perhaps, realizes the importance of intelligent team work, and every effort made toward its promotion on a gigantic scale will find the engineers of the country ready to help anywhere from the munition factory to the firing line. Now, when the training neglected in peace has to be applied, the profession must push with the utmost activity along every line that can bring help. Its effect has already been felt on the battle front, on the sea, in the training camp, in the workshop, and the engineer's hand must never slacken in the good work. He must bring all his energies and all his influence to help the nation make up for lost time and to drive home to it the realization that we are in the greatest war of all the ages, wherein all the technical skill of man has been brought to man's destruction and must be fought in kind. This lesson the people at large have not yet learned, and it is the duty of those whose trained intelligence grasps the situation to drive the terrible facts home, to the end that disaster shall not come upon our common country.

The Design of Feeders

IT IS a perfectly simple matter to lay out a feeding system with respect to the fundamental requirements of proper regulation and suitable current-carrying capacity. To meet these demands and at the same time fulfill the requirement of maximum economy is quite a different matter. P. O. Reyneau's paper in the current issue gives some very practical information as to the working methods to be followed in the solution of this problem. It is obvious at the start that in working out feeders for maximum economy the two basic factors, cost of energy and price of copper, are the most troublesome items of the calculation. Indeed, these, particularly the latter, are intrinsically variables, having determinate values only at some particular epoch, so that in laying out a system the best that can be done is to take account of these costs with as much foresight as conditions permit. Mr. Reyneau's efforts are devoted to an approximate solution of the general problem, taking these difficult factors as independent variables. The base of his line of attack is to reduce from tabulated data the year's output over the required feeders to an equivalent current in terms of the yearly peak, producing the same energy loss as the currents in their actual time distribution.

By tabulating the observed data from typical lighting circuits it is possible to arrive at average results which fairly represent the existing state of things, and from this the equivalent daily period with respect to the peak load of the year. This done, a simple graphical representation taking account of variations in cost of energy and of copper enables one to obtain a fairly approximate solution of the economy problem. It is interesting to note how well in agreement are the results experimentally obtained from a dozen different lighting circuits. How closely these will be checked by

experience in other cities is a little uncertain, but the indications are that the approximation will be better than at first sight seems probable. At all events, the different results throw light not only on the general situation, but also on the probable effects of increased load, so that one may intelligently forecast something of what is likely to turn up at a later date not too remote. The one limitation that seems apparent in the method is that the circuits are assumed to be homogeneous; that is, carrying as feeders the same current throughout. It is plain that the element of load wandering will introduce another feature into the calculation, but if this in turn is reasonably subject to general average, one can still take account of it. Data on load wandering are very scarce, yet few subjects are of greater interest in the design of a distribution system, with respect both to the requirements of regulation and economy in the distribution of the conductors. Mr. Reyneau's data will be of very material service in their present form, and we hope to see them extended to cover the somewhat more complicated cases which frequently arise in the course of practice.

Dielectric Strength of Varnished Cambric

WHEN a condenser is formed by two parallel opposed conducting surfaces, such as a pair of flat brass disks separated by a film of air, the electric field between them, when the disks are electrically displaced in potential, is theoretically strongest at the center and diminishes radially outward toward the edges. If, however, the air gap or air-film thickness is less than 5 per cent of the disk diameter, and also if the edges of the disks are slightly rounded, the electric field becomes substantially uniform at all points between the disks. Experiment shows that with the disk faces set fairly parallel to each other in air the disruptive discharges of successive electric breakdowns are then distributed substantially according to the ordinary laws of accidental errors, the pattern formed by the marks on the disk surfaces of the successive spark discharges showing no tendency to crowd at any point.

If, then, a uniform electric field is produced, its intensity should be directly proportional to the impressed voltage between the disks and inversely proportional to the air gap, while the area of the disk electrodes should have no appreciable effect on the dielectric strength of the air film, so long as the thickness of the film is less than 5 per cent of the disk diameter. In other words, the dielectric breakdown voltage of an air

film of given thickness, say 0.3 mm., should be the same whether the disk diameters are 2 cm. or 5 cm. The same proposition of dielectric strength independent of the area should likewise apply to flat films of other dielectrics such as oil and varnished cambric.

It was pointed out, however, in a paper by F. M. Farmer, read before the A. I. E. E. in 1913, that the apparent dielectric strength of flat films of air, oil and varnished cambric differed very appreciably with the diameter of the disk electrodes used in the test. The larger the disk the lower the breakdown voltage. There was some difference of opinion expressed, in the discussion following the paper, as to the origin of these variations in apparent dielectric strength; but it was supposed that, at least in the case of varnished cambric, which is necessarily composite in structure and liable to vary somewhat in thickness, the experimental facts might be explained on the basis of accidental weaker spots in the dielectric, so that a large area of electrode would probably cover and include more weak spots and so permit of a lower breakdown voltage.

We are printing this week an interesting article by A. E. Kennelly and R. J. Wiseman on this subject. Their experimental results indicate that in varnished cambric the breakdown voltage diminishes with the diameter in substantially the same manner as Mr. Farmer's original paper showed, but that the diminution in breakdown voltage does not depend upon the area of the electrodes. It appears that the area can be increased over a considerable range without any material diminution in apparent breakdown voltage, provided that the area is electrically broken up into elements separated by wires. This very remarkable experimental result has been checked through tests by other observers, and with other instruments, at the Electrical Testing Laboratories of New York.

The reasons for this experimental result have not yet been cleared up. It is suggested that under the application of an alternating emf. free electric oscillations in the condenser may perhaps be set up from one part to another. If so, the oscillations must have extremely high frequency, with a wave length perhaps measured in decimeters. High-frequency currents are indeed known to possess highly destructive powers on insulating materials, especially in the presence of ionizable gas. However, direct experimental evidence of the presence of such oscillations will be required before we can safely accept this explanation. There is a fine opportunity here for the work of experimental physicists—one of which we hope to see them take advantage.

INDUSTRIAL plants and other users of 220-volt incandescent lamps should be interested in an article entitled "Adapting 220-Volt Circuits to 110-Volt Lamps" which will be presented next week, as it will point out how uneconomical it is to use the higher voltage lamps when 110-volt lamps could be adapted to the circuits and used at considerably less expense. Data will be given on the relative

The Coming Issues

prices of the lamps as well as on the luminous output. Steps which were taken by a large textile mill to provide power for increased production will also be outlined. The eighth installment of Prof. C. E. Clewell's series of articles on industrial motor and control applications will also be included in the Dec. 22 issue, the discussion dealing with the fundamental problems of control for industrial-plant motors.

Apparent Dielectric Strength of Varnished Cambric

Its Diminution with Increase of Electrode Diameter Associated with Metallic Structure of Electrode and Possibly Due to High-Frequency Oscillations—
Necessity of Standardizing Size of Test Electrodes

BY A. E. KENNELLY AND R. J. WISEMAN

USING varnished cambric 0.3 mm. (0.012 in.) thick between flat metallic-disk electrodes, F. M. Farmer¹ has found that the apparent dielectric strength, in volts per unit thickness, diminishes more than 50 per cent in changing from disks of very small diameter to disks of 15 in. (38 cm.) diameter. In other words, increasing the area of the applied disk electrodes without altering the thickness of the insulating material diminishes greatly the apparent dielectric strength. The same phenomenon was also shown to be present, in varying degrees, with insulating films of hard rubber, oil and air.

In the discussion of Mr. Farmer's paper on this subject the consensus of opinion was in favor of attributing the apparent relative weakness of large plates to the probability of weak spots in the cambric. That is, admitting that a cambric sheet cannot have exactly the same dielectric strength at all points, if only on account of accidental variations in thickness, it must follow that a large-disk electrode is more likely to cover a weak spot than a small electrode and thus will break down the dielectric at a lower impressed voltage.

Although the above weak-spot argument cannot be denied, it is difficult to say how much of the observed falling off in the dielectric strength of large sheets is attributable to it. If all of the diminution with increase in electrode size were due to weak spots, then similar tests of oil films or air films should reveal no such diminution, because weak spots can hardly occur in homogeneous fluid media. However, Mr. Farmer's paper showed marked diminutions toward large diameters both with oil and air films.

The problem of diminution in the apparent dielectric strength of cambric between flat-disk electrodes of increasing size was also studied at the Massachusetts Institute of Technology in 1913-14 by L. H. Webber, who repeated a number of Mr. Farmer's observations and confirmed them in essential particulars.

INFLUENCE OF OIL IMMERSION ON CAMBRIC

The subject was further investigated at the Massachusetts Institute of Technology in 1914-15 by G. Y. Fong, who again confirmed Mr. Farmer's observations on varnished cambric. It was further found that when the cambric was first immersed in transformer oil and then placed between opposed parallel disk electrodes the falling off in dielectric strength between 1.3-cm. ($\frac{1}{2}$ -in.) and 10-cm. (4-in.) electrodes was distinctly less than when the cambric was immersed in atmospheric air. When the tests were made on linseed-oil-soaked cambric the apparent dielectric strength was substantially uniform for all sizes of disk electrodes between 1.3 cm. and 25 cm. ($\frac{1}{2}$ in. and 9.8 in.). When the tests were made on castor-oil-soaked cambric the

apparent dielectric strength actually increased slightly when the disk diameter was increased.

Later it was found that the results with linseed oil, and especially with castor-oil-soaked cambric, were not reliable, owing to the viscosity of these oils. That is, when specimens were tested between large disks it was very difficult to squeeze out the excess oil, and the thickness of the test substance was actually increased by the layers of unexpelled oil. All that can be claimed, therefore, is that when air is replaced by oil as the medium immersing the cambric there is less falling off in apparent dielectric strength where larger sizes of electrodes are used.

INVESTIGATIONS OF DIELECTRIC STRENGTH WITH MULTIPLE ELECTRODES

More extensive investigation of the whole subject was permitted in the research division of the M. I. T. electrical engineering department in July, 1915, by an

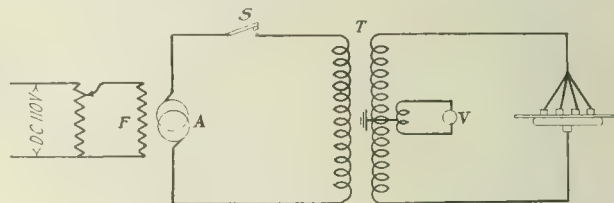


FIG. 1—CONNECTIONS USED IN TESTING DIELECTRIC STRENGTH OF VARNISHED CAMBRIC

A is a motor-driven 220-volt, 20-kva. alternator, operated at constant speed and frequency (60 cycles) by a direct-connected motor not shown. The voltage at the armature terminals is controlled by a drop-wire rheostat connected to 110-volt direct-current mains on one side and to the alternator field magnets on the other. In all of the tests the drop-wire rheostat was so operated as to raise the voltage at the rate of approximately 1000 r.m.s. volts per second. The high-tension transformer T has a rating of 10 kva. at 50,000 r.m.s. volts on the secondary. A tertiary coil in the transformer is connected to a voltmeter calibrated to show the voltage at secondary terminals. The centers of both secondary and tertiary coils are grounded. Short leads extend from the secondary terminals to the horizontal electrodes on the test specimen. The voltmeter V is fairly dead-beat in its indications and is read at the instant of first discharge, which is revealed not only by the sound of the rupture spark but also by the sudden falling of the voltage. A foot switch S, in the primary circuit, is then immediately opened so as to extinguish the arc.

appropriation from the American Telephone & Telegraph Company, the experimental work being conducted by Dr. R. J. Wiseman.

After checking the results obtained by Mr. Farmer with cambric, tests were made with a number of small-disk electrodes of equal size, electrically connected into a "multiple electrode," as is indicated in Fig. 3. The lower electrode consisted of a single metallic disk, as before, and this supported the cambric test sheet. On the test sheet rested the multiple electrode of small metallic disks, all connected by flexible fine copper wires about 40 cm. (15.7 in.) long. Each individual small disk had a length of 1.2 cm. (0.47 in.) and a diameter of 1.2 cm. (0.47 in.), and its edge was slightly rounded. The number of these little disks forming the multiple electrode was varied in different tests from

¹"The Dielectric Strength of Thin Insulating Materials," *Transactions A. I. E. E.*, Vol. 32, p. 2097, December, 1913.

one up to sixteen, corresponding in total active area to that of a single-disk electrode from 1.2 cm. up to 4.8 cm. (0.47 in. to 1.9 in.) in diameter.

The connections used in the tests are shown in Fig. 1. Then observations, made in rapid succession and occupying about ten minutes, constitute a test. After

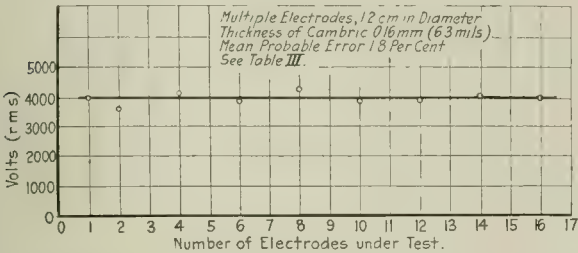


FIG. 2—CHANGE IN PUNCTURING VOLTAGE OF VARNISHED CAMBRIC, WITH NUMBER OF ELECTRODES USED IN MULTIPLE

the series is completed the thickness of each sample is measured by a micrometer close to the point of rupture. The arithmetical mean of the ten thicknesses so measured is taken as the mean thickness of the cambric. The arithmetical mean of the ten breakdown voltages, after each has been corrected for the thickness of the corresponding test piece, is taken as the mean breakdown voltage for the mean thickness of the series. The probable error of both the mean voltage and the mean thickness is recorded² with the test. It is customary to find the probable error of mean voltage to be about 1.5 per cent, and the probable error of mean thickness to be about 1 per cent.

In order to maintain a substantially uniform electric field between opposite disk electrodes it was found that it was necessary to have the gap not exceed 5 per cent of the electrode diameter. This ratio was determined experimentally with films of air by observing the marks left by the discharges on the electrode disks. The

TABLE I—TEN OBSERVATIONS OF THE PUNCTURING VOLTAGE OF VARNISHED CAMBRIC BETWEEN A PARTICULAR SET OF METALLIC ELECTRODES*

No.	Observed R.M.S. Puncturing Emf. (Volts)	Thickness of Sample (Mm.)	Voltage Corrected to Mean Thickness
1	6110	0.155	6360
2	5860	0.162	5840
3	5990	0.163	5920
4	6360	0.155	6610
5	5990	0.161	5990
6	6110	0.164	6030
7	5740	0.169	5450
8	6240	0.162	6210
9	6360	0.153	6720
10	6360	0.169	6050
		Mean 0.1613 (1±0.0075)	6118 (1±0.013)

*Conditions of test: Lower electrode, a solid steel disk 10.2 cm. in diameter; upper electrode, thirteen small brass cylinders each 1.1 cm. in diameter and 1.1 cm. long, held in same manner by a perforated hard-rubber base. Medium surrounding the cambric, air. Temperature, 26 deg. C. Frequency, 60 cycles

marks began to concentrate perceptibly toward the centers of the disks when the gap exceeded 5 per cent of the diameter. Consequently, in order to eliminate effects due to non-uniformity of electric field, all of the observations here presented are limited to electrode diameters which are more than twenty times the thick-

ness of cambric. In fact, diameters of less than 1 cm. (0.39 in.) have not been used. Limiting the minimum diameter to 1 cm. (0.39 in.) has the further advantage of obtaining a more representative sample of the test sheet. Mr. Farmer, as pointed out in his 1913 paper, carried the minimum electrode diameter to much lower

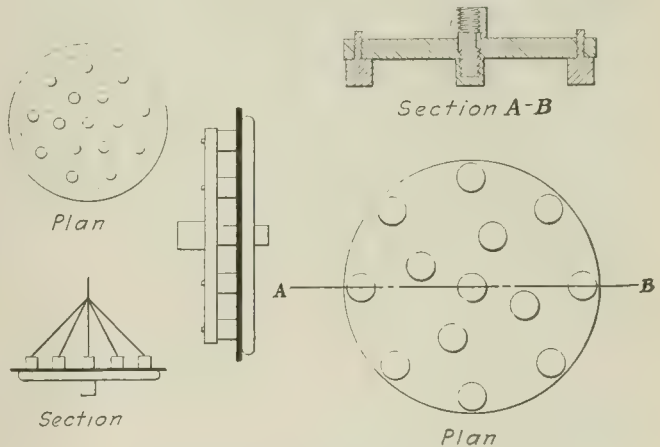
TABLE II—COMPARATIVE MEAN PUNCTURING VOLTAGES WITH SINGLE DISK ELECTRODES
(Diameters between 1.2 cm. and 25.4 cm.; varnished cambric 0.16 mm. thick; surrounding medium, air; ten observations to each series)

DIAMETER		Surface Area (Sq. Cm.)	Mean R.M.S. Puncturing Voltage (V)	Apparent Dielectric Strength Volts per Mm. V/S
(In.)	(Cm.)			
0.47	1.2	1.13	7,350 (1±0.016)	45,900
2.0	5.1	20.4	6,570 (1±0.0074)	41,100
4.0	10.2	81.6	5,620 (1±0.0079)	35,100
6.0	15.2	181.4	5,350 (1±0.020)	33,400
8.0	20.3	324.0	5,500 (1±0.015)	34,400
10.0	25.4	506.0	5,090 (1±0.027)	31,800

values, and even to needle points, for the purpose of more comprehensive comparison. Reducing the limits of diameters in Mr. Farmer's paper to, say, 1.1 cm. and 5.1 cm. (0.47 in. and 2 in.), to permit comparison with results reported here, it appears that the diminution in apparent dielectric strength reported by Mr. Farmer was from 1120 volts per mil to 970 volts per mil, or 13.4 per cent, which agrees very closely with recent results.

RESULTS WITH MULTIPLE ELECTRODES

When multiple electrodes, like the one shown in Fig. 3, replaced solid single-disk electrodes the diminution of apparent dielectric strength with increasing area largely disappeared. That is to say, if the increase in area of the electrodes was from 1.13 sq. cm. to 18.1 sq. cm. (0.175 sq. in. to 2.81 sq. in.), by changing the diameter from 1.2 cm. to 4.8 cm. (0.47 in. to 1.8 in.) the puncturing voltage fell off more than 13 per cent; whereas when the same increase in area was effected



FIGS. 3, 4 AND 5—SECTIONS THROUGH TWO TYPES OF MULTIPLE-DISK ELECTRODES USED IN TESTS

by multiple electrodes (sixteen electrodes each of 1.13 sq. cm.) the puncturing voltage fell off only about 1 per cent. This remarkable result was independently checked both at the M. I. T. laboratory in Cambridge and at the Electrical Testing Laboratories of New York. This result was checked in various ways, and it

²See Tables II and III.

controverts the weak-spot theory of the diminution, because there should be as great a probability of encountering a weak spot under 18 sq. cm. (2.79 sq. in.) of a solid disk as under 18 sq. cm. of a multiple electrode.

The results obtained with a multiple electrode of varying number of disks are shown in Fig. 2, each

TABLE III—COMPARATIVE MEAN PUNCTURING VOLTAGES*
(Lower disk electrode, 25.4 cm. in diameter, and upper electrode, consisting of a selected number of 1.2-cm. disk electrodes in multiple,† for varnished cambric 0.16 mm. thick; surrounding medium, air; ten observations to each series)

Number of Electrodes	Equivalent Diameter of Single Electrode Cm.	Total Surface Area of Multiple Electrode Sq. Cm.	Mean R.M.S. Puncturing Voltage (V)	Apparent Dielectric Strength, Volts per Mm. V, S
1	1.2	1.13	3,920 (1±0.015)	24,500
2	1.7	2.26	3,580 (1±0.033)	22,400
4	2.4	4.52	4,100 (1±0.025)	25,600
6	2.94	6.78	3,810 (1±0.018)	23,800
8	3.39	9.04	4,130 (1±0.010)	25,800
10	3.8	11.3	3,810 (1±0.021)	23,800
12	4.15	13.56	3,860 (1±0.0089)	24,100
14	4.48	15.82	3,920 (1±0.0086)	24,500
16	4.8	18.08	3,890 (1±0.020)	24,300

*See Fig. 2. †See Fig. 3.

circle representing the arithmetical mean value of a series of ten observations of puncture on different samples of the same cambric sheet. Similar results were obtained with multiple electrodes on both sides of the test sheet.

The reasons for the above remarkable disparity between the results with single and multiple electrodes baffled investigation for a long time. A hint toward the solution was found, however, when tests were made with a multiple electrode of thirteen disks, each 1.2 cm. in diameter and 1.2 cm. long (0.47 in. by 0.47 in.) clamped in a perforated brass frame, 10 cm. (3.9 in.) in diameter, so as to form virtual projections from its surface. A section of this electrode, through the axis, is given in Fig. 4. The diminution in puncturing voltage in passing from one disk to sixteen with this multiple electrode was found to be greater than for the single disk of equivalent active surface. This showed that the diminution in apparent dielectric strength with increasing area was associated in some way with the metallic structure of the electrode. The same increase in surface with separated small disks gave very little diminution, whereas when obtained either in a solid disk or in a metallically framed set of small disks the diminution was large. Special series of tests showed that the weight or mechanical pressure on the upper electrode did not appreciably affect the results.

A hard-rubber base or connecting frame was then substituted for the brass base, as shown in section by Fig. 5. The small-disk electrodes were screwed into the rubber base and then ground to a flat testing surface. The disks were connected electrically to a common main terminal by a corresponding number of fine enameled copper wires of 0.25 mm. (0.00985 in.) diameter, each 40 cm. (15.7 in.) long. The tests with this electrode showed a diminution of 5.8 per cent in apparent puncture voltage between one and sixteen electrodes (1.13 sq. cm. to 18.1 sq. cm.).

When the tests were repeated with the disks directly

connected by very short copper wires of the same diameter the diminution mounted to 10.8 per cent. In other words, changing the length of the fine connecting wires between the elements of the multiple electrode from 40 + 40 cm. to 2 cm. changed the diminution from 5.8 to 10.8 per cent. These results, which are presented in the first column of Table IV, were communicated to the Electrical Testing Laboratories, where Mr. Farmer repeated the tests, using the same electrodes. The varnished cambric used for the check tests was, however, not just the same as that which had been employed originally. The results of the check tests are given in columns 2, 3 and 4 of Table IV, and their arithmetical means in the last column. Each entry represents the mean of twenty observations at successive breakdowns made in the same way.

It will be seen that although the numerical values of the percentage reductions of breakdown voltage for the different conditions enumerated are by no means the same, yet there is a general qualitative agreement and check between the results in the two laboratories. Furthermore, there is no difference of opinion as to the main facts, namely, that when the electrode forms an electrically solid mass the dielectric-strength diminution is large, while, on the contrary, as the elements of the multiple electrode are separated electrically, without altering the total active surface, the diminution tends to disappear.

The results suggest that the diminution in apparent dielectric strength may possibly be due to high-frequency electric oscillations set up across the dielectric, with the electrodes forming a pair of parallel oscillators. When the diameter of the disk electrodes is increased the oscillating system becomes enlarged, so that its free oscillations would be lowered in frequency but would be increased in amplitude. Under the influence of such oscillations the air pocketed between

TABLE IV—COMPARATIVE DIMINUTION IN MEAN PUNCTURING VOLTAGE FOR VARNISHED CAMBRIC
(Upper electrode areas from 1.1 sq. cm. to 18 sq. cm. in different arrangements; surrounding medium, air)

	M.I.T.	Electrical Testing Laboratories			Mean
Thickness of cambric, mm.	0.16	0.15	0.15	0.3	....
Thickness of cambric, mils.	6.3	6	6	12	....
Mean breakdown voltage, approximate kv.	7	3	3	13	....
Types of Upper Electrode	Percentage Diminution				
1. Solid disk	13.3	12.2	21.5	10.7	14.8
2. Multiple electrodes held in metallic base	15.4	4.7	20.0	9.4	11.3
3. Multiple electrodes held in hard-rubber base with short connecting wires	10.8	14.2	2.5	8.7	8.5
4. Multiple electrodes held in hard-rubber base with thin connecting wires 40 cm long	5.8	3.1	7.7	5.4	5.4
5. Separated multiple electrodes with long, thin connecting wires and without a connecting frame	1.0	....	....	....	....

the electrodes and the surfaces of the cambric sheet may be ionized and forcibly impelled against the dielectric in such a manner as to weaken it rapidly. Moreover, the larger the area of the single-disk electrodes the more likely are these air pockets to present themselves, owing to slight irregularities in the thickness of the cambric. When multiple electrodes are used,

with the elements spread out and interconnected by long fine wires, less opportunity is offered for the formation of air pockets and for the high-frequency oscillations to develop an appreciable intensity. The disruptive power of high-frequency oscillations in dielectrics, under the influence of ionized air, is well known.

When oil was used as the medium surrounding the electrodes and test cambric the diminution in apparent dielectric strength with increase in area was always less than with air.

INVESTIGATIONS WITH OTHER THAN BRASS ELECTRODES

A further trial was made with electrodes of leadfoil 0.013 mm. (0.000512 in.) thick, both single and multiple. When a single leadfoil sheet was laid on the cambric test piece and pressed down by a glass plate the diminution in apparent dielectric strength with increase in area was considerable, although not so marked as when a single electrode disk of metal 4 mm. (0.157 in.) thick was employed. Slits were then cut in the leadfoil electrode so as to subdivide its surface into parallel strips connected at one end. This subdivision lowered the diminution to about 2 per cent between the limits 1.1 sq. cm. and 18.1 sq. cm. (0.17 and 2.81 sq. in.) total area, thus corroborating the multiple-electrode test. Incidentally, the application of the high-voltage test caused the leadfoil electrode, or electrodes, to adhere to the test sheet of cambric so closely as to make separation without injury difficult. This adhesive property of leadfoil electrodes may have practical applications.

Fluid mercury electrodes about 2 mm. (0.0788 in.) thick have been tried over the cambric test sheet in place of solid single metallic disks, but without material change in the observed results. That is to say, the diminution in break-down voltage with area was substantially the same as with brass disks. The mercury electrodes were kept in the form of circular disks by means of encircling wooden frames.

Although the above-mentioned observations seem to suggest the existence of very high-frequency oscillations, of the order perhaps of many millions per second, as the principal cause of the diminution in the apparent dielectric strength of cambric sheets with increasing area, yet it must be noted that there has been no direct evidence available to indicate the existence of such high-frequency oscillations.

As an inference from the experiments, whatever opinion may be entertained concerning the ultimate cause of the diminution of apparent dielectric strength with increase in size of metallic-disk electrodes, it is evident that the size used should be standardized. If the electrodes are too small, the electric field between them will not be uniform and the sample of the dielectric test piece will not be sufficiently representative. If the electrodes are too large, the apparent dielectric strength will be unduly small. For practical purposes it is suggested that electrode disks 1 cm. (0.4 in.) in diameter may be used, if the thickness of cambric does not exceed 0.5 mm. (0.0197 in.).

The authors desire to acknowledge their indebtedness to the American Telephone & Telegraph Company for the appropriations under which the research has been carried on, and also to Profs. D. C. Jackson and C. A. Adams, as well as to W. I. Middleton, for valued

suggestions. They are especially under obligations to the Electrical Testing Laboratories of New York and F. M. Farmer, the chief engineer, for the execution of the check tests, to which reference has already been made, and for permission to incorporate the results of those tests in this paper.

UNUSUAL STREET-LIGHTING PRACTICE FOR SMALL TOWNS

West Liberty, Iowa, with Population of 1700, Spends \$12,000 on Street Lighting with Ornamental Posts and Underground Service

When the town of West Liberty, Iowa, was planning to pave a large percentage of its streets the consideration of adequate lighting also came up for discussion. The streets at that time were lighted by twenty-six arc lamps, spaced with one lamp at each street intersection. It was decided to dismantle this system entirely and install ornamental posts along the seventy-two blocks of street to be paved on 125-ft. centers staggered. For the business district twenty-four posts of the "Continental" design were purchased, and for the residential district 178 "park view" type standards were bought. All circuits were laid underground. Multiple circuits were used for the downtown lamps and series circuits were used for the others.

From the power house to the business district all leads were laid in fiber conduit. The multiple distribution circuits required 2360 ft. (719.3 m.) of three-conductor cable and the series circuits 35,280 ft. (10,755.0 m.) of single-conductor cable. All the cable was No. 6 and No. 10 lead-covered, jute-insulated, steel-taped. The method of laying this cable to secure minimum expense in connection with the paving was as follows: When the paving contractor had "fine-graded" the street and was ready to pour concrete two laborers dug a 6-in. by 6-in. (15.24-cm. by 15.24 cm.) trench and also tunneled small holes under the curb and gutter. The steel-taped cable was then laid in the trench and covered with earth, which was then rolled down by a steam roller. The concrete paving base was then poured.

In making the change from arc lighting to incandescent lighting it was possible by selecting proper sizes of incandescent lamps to reduce the energy consumption over that required before. This made it possible to use the old power-house equipment. The arc lamps registered 20 amp. at 1100 volts on the power-house instruments, and the total load of the new incandescent lamps, with 100-watt units downtown and 100-cp. units in residential districts, is on 17 amp. at 1100 volts. Moreover, the power factor of the latter load is probably better.

The total cost of the lighting system was \$12,000. This was paid out of the earnings of the plant, which sells energy to consumers on a straight 10-cent basis. The cost of the paving for the seventy-two blocks was \$200,000, so that the lighting seemed inexpensive.

H. L. Dice and George Anderson were the councilmen who fathered the lighting project. Benton R. Anderson was consulting engineer and Louis Ingraham was in charge of electrical construction. The posts were supplied by the George Cutter Company and the other supplies by Chicago jobbers.

Methods of Determining Economical Feeder Sizes

Equations Developed and Curves Plotted to Illustrate How Most Economical Size of Wire May Be Determined When Cost of Energy at Switchboard and Peak Load on Feeder Are Known

BY P. O. REYNEAU*

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WHEN plans are made for building a new line the problem of finding the correct size of wire often does not receive enough attention. Finding the limiting sizes as regards voltage regulation and safe current-carrying capacity is simple, and since these may be the determining factors it is important

be applicable to almost any circuit carrying purely lighting load.

In these days of fluctuating prices it is rather hard for the engineer to keep pace with the changes. Any calculations which use as their basis a specific price of copper or cost of generating energy are likely to be out of date in a few months. On the other hand, the character of some kinds of load, such as a residence lighting load, is subject to very little change from year to year. Load curves taken on the same date in different years will show approximately the same characteristics, though they may vary in amount. For this reason it has seemed desirable to work out a set of curves which will keep the price of copper and the cost of energy as variable quantities and make it possible to determine the most economical size of wire to be used to carry a lighting load of a given amount for the prices prevailing at the time.

The method of obtaining these curves is as follows: Since the annual charges on a line consist of (a) fixed charges and (b) energy losses, the most economical size of wire to use for any given condition will be that for which the sum of the above items is a minimum.

Fixed Charges.—There are many factors entering into the cost of installing circuit feeders and thereby affecting the fixed charges, which are the same for any size of wire used, provided the variation is not too great, such as, for instance, the cost of the pole lines, cross-arms, insulators, tie wires, etc. In finding the comparative economy, therefore, these factors may be eliminated and the problem much simplified. In fact, it seems reasonable to assume that the cost on which the fixed charges are figured is made up simply of the cost of the wire plus the cost of stringing it. The fixed charges will, therefore, consist of the cost of the wire plus the cost of stringing it multiplied by the percentage assumed for interest and depreciation. In the present case we have assumed 6 per cent for interest

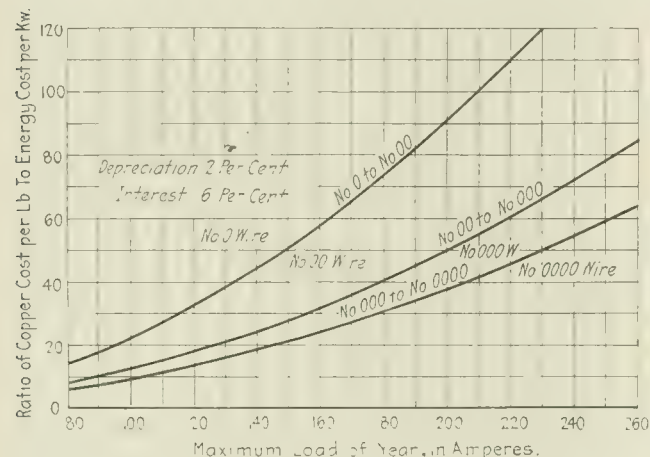


FIG. 1—MOST ECONOMICAL FEEDER FOR ANY RATIO OF COPPER COST TO ENERGY COST, ASSUMING RESIDENCE LIGHTING LOAD

that they should be known. But the consideration which should govern the choice of the wire in most cases is that of economy, and this is not generally so simple of solution. If the problem could always be reduced readily to the classroom form of a definite load at a definite power factor carried continuously for a definite number of hours a day throughout the year, the solution would be simple; but, unfortunately, the actual case is usually somewhat different. The load on a commercial circuit is very seldom of constant value from day to day throughout the year, nor does it continue for the same period each day, and, to make matters worse, the energy loss varies with the square of the load current, which exaggerates any error in approximation.

It is the purpose of this paper to develop a convenient method of determining the most economical size of wire to be used for any given character of load, and incidentally to show a fairly accurate method of approximating a variable load. The example chosen is that of a number of single-phase circuits having feeders which run from a substation to a central distributing point, so that the current in the feeder will be the same throughout its length. The load on these circuits consists almost entirely of residence and store lighting load and is therefore very suitable for bringing out the effect of the variation of load. The data used were taken from an actual case, and since the character of lighting load is nearly the same in all cities, it should

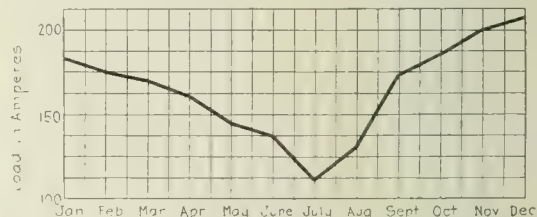


FIG. 2—AVERAGE MONTHLY MAXIMUM LOAD ON LIGHTING-CIRCUIT FEEDERS; PLOTTED FROM OBSERVATIONS OF TWELVE TYPICAL CIRCUITS

and 2 per cent for depreciation, or a total of 8 per cent.

Energy Losses.—The losses in a circuit consist only of the transmission losses or copper losses. These losses will vary with the square of the current carried but will be equal to the sum of all the units lost throughout the year multiplied by the unit cost of the energy at the point of loss. It is the matter of deter-

*The author wishes to express his indebtedness to Harold Cole for his valuable assistance in preparing this article.

mining the amount of this lost energy for a variable load which presents some difficulty, and it is proposed later to show a method of determining it. For the present, however, let us assume that we have reduced the losses to an equivalent loss caused by a certain current carried for a certain number of hours per day throughout the year.

The annual charges may now be represented by the equation:

Annual charges = $(K_1 + K_2)D$,
where K_1 = annual fixed charges per 1000 ft. of line = $(g/100) [(2000 \times W \times Cu) + H]$.

K_2 = annual copper loss per 1000 ft. of line
= $I^2 \times (\rho/A) \times 2000 \times t \times 365 \times$
(ener \div 1000).

D = distance of transmission in thousands of feet.

g = per cent interest and depreciation.

W = weight per foot of wire including insulation.

Cu = price of copper wire (including insulation) per pound.

H = cost of stringing 1000 ft. of line.

I = current carried.

ρ = resistivity of wire in ohms per mil-foot.

A = area of wire in circular mils.

t = hours per day for which current is carried.

Ener = cost of energy per kw.-hr.

The formula for the annual charges then becomes:

Annual charges = $[(g/100) (2000 \times W \times Cu + H) + 730 \times (\rho/A) \times I^2 \times t \times \text{ener}]D$.

Assuming that for one size of wire $W = W_1$ and $A = A_1$, and for the next larger size $W = W_2$ and $A = A_2$, then:

Annual charges (1) = $[(g/100) (2000 \times W_1 \times Cu + H) + 730(\rho/A_1) \times I^2 \times t \times \text{ener}]D$.

Annual charges (2) = $[(g/100) (2000 \times W_2 \times Cu + H) + 730(\rho/A_2) \times I^2 \times t \times \text{ener}]D$.

If from these equations the values of annual charges are plotted against values of ener (energy cost) in the above equation, all of the other variables being given particular values, two straight lines will be obtained whose intersection will show the unit energy cost at which, with a given load, the annual charges become less for the larger wire than for the smaller as the cost of energy increases. The intersection may also be determined analytically by solving the two equations for equal annual charges as follows:

$(g/100) (2000W_1Cu + H) + 730(\rho/A_1) \times I^2 \times t \times \text{ener} = (g/100) (2000W_2Cu + H) + 730(\rho/A_2) \times I^2 \times t \times \text{ener}$.

$\text{Ener} \times 730 \times I^2 \times t \times \rho [(1/A_1) - (1/A_2)] = 2000 (g/100) Cu(W_2 - W_1) + gH - gH$.

$\text{Ener} = \frac{2000gCu(W_2 - W_1)}{730 \times I^2 \times t \times \rho [(1/A_1) - (1/A_2)]}$

The same thing which was done for energy cost may also be done for copper cost and the following equation will result:

$Cu = \frac{730 \times I^2 \times t \times \rho [(1/A_1) - (1/A_2)] \text{ener}}{20g(W_2 - W_1)}$

In the above equation ρ , A and W are fixed for the

different sizes of wire, g is assumed, and t is determined by the character of the load. Therefore for any particular kind of load the only variables to be considered are the price of copper, the cost of energy and the amount of the load (Cu , ener and I).

If I is given particular values in this equation, the equation becomes that of a straight line which is the

TABLE I—MAXIMUM MONTHLY CURRENT READINGS ON TWELVE TYPICAL CIRCUITS

Circuit	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
1	190	180	180	175	160	135	120	125	160	175	180	195
2	200	180	180	175	165	145	110	130	200	195	205	210
3	175	165	150	140	120	125	90	115	160	165	180	185
4	185	175	180	150	140	140	105	130	175	185	200	210
5	155	155	155	150	135	130	100	130	160	175	180	195
6	150	140	135	125	110	100	90	80	120	135	150	150
7	245	225	210	200	190	180	120	140	225	245	285	285
8	235	225	225	210	200	185	150	205	250	280	280	280
9	225	225	215	225	175	175	135	170	215	235	240	250
10	185	185	185	175	150	140	130	140	170	185	225	240
11	125	120	115	110	105	105	90	100	120	125	135	150
12	130	120	110	105	100	100	85	100	125	135	145	130
Total.....	2200	2095	2035	1930	1730	1645	1325	1565	2080	2235	2405	2480
Average of the twelve.....	183	175	170	161	144	137	111	130	173	186	200	207

locus of the intersections as described above for various prices of copper and of energy. All points above the line indicate that the smaller wire is the most economical and all points below indicate the larger. Since for any value of I then the equation between Cu and ener is a straight line, the slope of that line is constant for any value of I . Hence the slope of these lines which is Cu/ener may be plotted against values of I . Rearranging the last equation, therefore,

$$\frac{Cu}{\text{ener}} = \frac{730 \times t \times \rho (A_2 - A_1)}{20g \times A_1 \times A_2 (W_2 - W_1)} \times I.$$

The curves for the specific case chosen for this example have been plotted from the preceding equation for four different sizes of wire in Fig. 1. Each curve is the locus of points at which, for different ratios of copper cost to energy cost, the economy changes from the smaller to the larger as the current is increased. Any point above the curve indicates that the smaller wire is the more economical; any point below, the

TABLE II—EQUIVALENT HOURS PER DAY AT PEAK LOAD

Month	(1) Equivalent Hours at Peak Load	(2) (Peak for Month) (Peak for Year)	(3) (Peak for Month) ² (Peak for Year)	(1 × 3)
January.....	5¼	0.884	0.781	4.10
February.....	4½	0.845	0.714	3.21
March.....	3¼	0.820	0.672	2.185
April.....	2¾	0.778	0.606	1.67
May.....	2¼	0.695	0.483	1.088
June.....	1¾	0.662	0.438	0.767
July.....	2	0.536	0.287	0.574
August.....	2½	0.628	0.395	0.987
September....	3¼	0.835	0.697	2.263
October.....	4	0.898	0.806	3.224
November.....	5	0.965	0.931	4.655
December....	5½	1.000	1.000	5.500
Total.....				30.223
Average....				2.519

$t = 2.519 \times (0.95)^2 = 2.27$ equivalent hours per day at peak load.

larger. The areas between lines therefore show the range of values for which any one size of wire is the most economical.

The I^2R loss in a circuit is due to a certain current I flowing through a certain resistance R for a certain

length of time. In this case R is fixed by the size of the wire under consideration, but I is variable. It is more convenient, however, to assume a constant value for I which, flowing for a certain number of hours, would cause an equivalent loss to that due to the variable I on a typical circuit throughout the year. Any value might be assumed for I and the equivalent number of hours could be computed accordingly, but it is most convenient to assume I as the maximum value of the current for the year or yearly peak, since this is a critical value which must not rise above a certain limit and should be carefully recorded for any circuit.

The equivalent number of hours which may be used with this maximum current is obtained as follows: The characteristic variation of the load on any circuit from month to month can be obtained from Table I, giving maximum current readings for each month during one year on twelve typical circuits in various districts and with various loads.

The curve (Fig. 2) plotted from the preceding average values indicates clearly the variation of the monthly peak loads on a typical circuit. Since the peak for the year occurs in December, the peak for any month may be expressed as a fraction of this yearly peak as follows: January, 0.884; February, 0.845; March, 0.820; April, 0.778; May, 0.695; June, 0.662; July, 0.536; August, 0.628; September, 0.835; October, 0.898; November, 0.965; December, 1.00. Hence, for example, the maximum current for February equals 0.845 multiplied by the maximum current for the year, etc.

For convenience the I^2R loss for any month may be considered equal to the loss for a typical day in the month times the number of days in the month, since the variation of load from one month to the next is not enough to warrant more detailed computation.

The I^2R loss in a feeder for any one day would be very nearly equal to the sum of the squares of the current readings for each hour during the day multiplied by R . For a great part of the day, however, the load on a lighting circuit is very light, the heavy load and hence most of the loss occurring within a few hours in the evening. By adding the squares of the hourly current readings throughout a day and dividing by the square of the maximum current for the day a figure is obtained which represents the number of hours for which the peak load for the day would have to be carried steadily to produce the same I^2R loss.

For a strictly accurate calculation enough data should be available to make it possible to determine the shape of the load curve on a typical circuit for one typical day for each month in the year. If this be not possible, however, a fairly accurate approximation may be arrived at if the load curves for only one or two months are available. If the equivalent number of hours at peak load for a typical day for these months is determined, the equivalent hours for the other months may be calculated more or less accurately by making them proportional to the number of hours between sunset and about 10 p. m., allowing a little additional time in the winter months for the morning lighting peak. The figures obtained in the present case for these monthly equivalent hours at peak load will be found in the second column of Table II.

Since the loss for any day in a month is proportional to the square of the maximum current for the day multiplied by the equivalent hours per day at peak load

as obtained above, the loss for this day = (maximum current for the month)² \times (0.95)² \times equivalent hours per day at peak load $\times R$, if it is assumed that the average daily peak will be 95 per cent of the peak for the month. The monthly peak, however, is equal to a certain fraction of the yearly peak, so the loss for this day = (maximum current for the year)² \times (fraction for the month)² \times (0.95)² \times (equivalent hours per day at peak load for that month) $\times R$. For example, the equivalent hours per day for February are four and one-half. The peak for February is 0.845 of the yearly peak. Hence for a typical day in February the I^2R loss = (yearly maximum current)² \times (0.845)² \times (0.95)² \times 4.5 $\times R$. But the (yearly maximum current)² $\times R$ will be the same for any particular circuit, so that in finding the equivalent hours for the year that part of the above equation may be neglected. The quantity (0.95)² is also a common factor. This leaves only two items which vary from month to month, the equivalent hours at peak load for each month and the ratio of the peak for the month to the peak of the year. The square of the latter multiplied by the former will give a weighted value of equivalent hours for each month the average of which multiplied by (0.95)² gives the number of hours per day throughout the year for which the yearly peak load would have to be carried to produce a loss equivalent to that caused by the actual variable load. This value has been worked out by means of the data tabulated in Table II.

The value just obtained for t has a real significance, as it means that for the purely lighting load assumed the peak load for the year will be carried for about two and one-quarter hours each day. As pointed out before, these data should check closely with a set of data taken on almost any city lighting circuit and should be applicable to any lighting circuit feeder. Knowing the price of copper, the cost of energy at the substation switchboard and the maximum current for the year to be expected on any such feeder, the most economical size of wire may be determined readily from the curves in Fig. 1.

It is naturally possible to work up similar curves for feeders carrying a load of different character; in other words, to determine I and t for those circuits and then use the equation given above to obtain the curves.

Electric Lighting Plants in Costa Rica

United States Vice-Consul Albert B. Pullen, writing from Port Limon, Costa Rica, says that in that district there are eighteen towns and villages with populations of 200 and upward. There are two electric lighting plants in the district—at Port Limon and at Siquirres. The plant at Port Limon is owned and operated by the United Fruit Company, with H. O. Easton as superintendent and E. E. Mullens as manager. Inside of buildings the wires are visible, being usually suspended from the ceilings by lamp cord. The plant at Siquirres is known as Compañía de Luz Eléctrica de Siquirres, with N. A. Finlay as manager. The wires, both inside and outside, are strung as at Port Limon. There is a small market in this district for electrical goods and supplies. Very few fixtures are used, and the imports are limited to equipment and supplies necessary for the maintenance and upkeep of the plants.

Types of Motors Designed for Different Loads

Importance of Good Commutation and How It Is Secured—Industrial Applications to Which Different-Type Motors Are Adapted—Changing Speed Ratios by Mechanical Means

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

SYNOPSIS.—This article is a continuation of the discussion in the last installment on the elements of speed, torque and power in machine-tool motor work. Typical operations are considered on the basis of which the principal types of motors available at present may be grouped according to their operating characteristics. Reference is made to the advisability of using mechanical methods for changing speed in connection with constant-speed motors where an adjustable-speed equipment might at first seem the only choice. The principal steps which have been taken to improve commutation for direct-current industrial motors are outlined and considerable emphasis is placed upon the relatively wide field for alternating-current motors of various types. Frequent references are made throughout the article to the developments in motors of the various classes, so that the present discussion is of fundamental interest to those who are actively engaged in the motor application field.¹

SINCE commutation has been perhaps the principal limitation to the satisfactory operation of the direct-current motor in the past, the steps which have been taken to improve commutation assume an unusual degree of importance from the practical standpoint of motor application work.²

Classified according to design features which improve commutation direct-current motors fall under the heads of (a) the non-commutating-pole, (b) the commutating-pole, and (c) the compensated motor. In the first class the problem of successful commutation has been approached more or less indirectly, with the result that satisfactory conditions may be produced for one given load with somewhat less favorable results at other loads.

A. C. Lanier points out that the chief steps which are responsible for successful commutation in motors of the first class are the tendency to use shallow and broad slots, decreased lengths of the armature core, reduced turns per armature coil, a higher ratio of air-gap field ampere-turns to the armature distorting ampere-turns, relatively flat neutral and high contact-resistance (carbon) brushes. This summary points to the various items which bear on the commutation problem, and it furnishes a comprehensive idea of the channels through which marked improvements have been made possible in modern motors of this type in comparison with earlier equipment.

The difficulty in the way of compensating for the shift of the commutating coils of such motors into the regions of reduced flux from the main poles is illustrated in Fig. 1, which has been based on a somewhat similar diagram by Lanier. From this diagram it is seen that the correct value (approximately) of the flux for successful commutation and for a given speed, and

hence a given field excitation, obtains at one value of armature amperes (load) only, *i.e.*, at *a*. For another value of field current made necessary, for example, by a required change in speed, the load current for the approximately correct flux value is at *b*. In this diagram, at loads greater than *c*, the resulting flux reverses and aggravates sparking, similarly at *d* for the lower field current. These features depend, of course, on fixed brush position and indicate the difficulty of adapting the ordinary non-commutating-pole motor to loads where wide speed adjustment is necessary. Of course, this condition is aggravated where, owing to reversing service, a neutral brush setting is required.

The points mentioned have only a limited bearing on the motor-application problem; however, their importance is greatly increased when it is considered that the commutating-pole motor has made possible (at least to

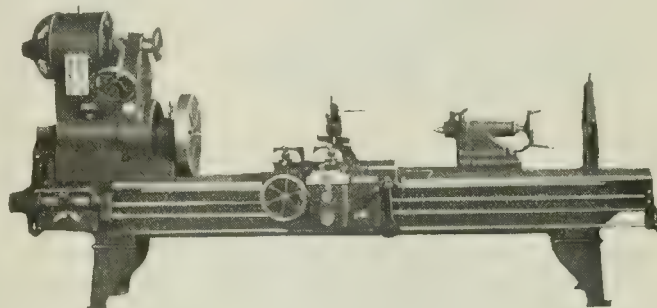


FIG. 1—HEAVY-DUTY LATHE EQUIPPED WITH MOTOR LIKE THAT IN L, FIG. 3

a considerable extent) the wide speed range found impracticable with the non-commutating-pole type. It should also be noted at this point that in the so-called compensated direct-current motor with its distributed auxiliary field winding in series with the armature current the practical elimination of field distortion has been accomplished for the higher-voltage motors which are applied to operations with a heavy reversing duty cycle.

The principal characteristics to be observed in the motors for (a) constant speed and continuously running drives with small variations in load, (b) non-reversing and continuously running drives with large variations in load, and (c) reversing operations, are summarized in Table I. These are discussed at length in the paper previously referred to (see footnote 1).

INDUSTRIAL APPLICATIONS FOR DIFFERENT ALTERNATING-CURRENT MOTORS

Of the three general types of alternating-current motor—the induction motor, the commutator motor and the synchronous motor—the first-named constitutes the widespread and important type. A lesser number of applications of the other two types, although important ones, exist in certain classes of service. The induction

¹This discussion is fundamentally a review of present aspects of the industrial motor situation. As such, frequent reference has been made to various sources, including data submitted by leading motor manufacturers. Hence individual references are not made in all cases in the text to the source of the information, except in a few special instances, which are covered by appropriate footnotes.

²See discussion by A. C. Lanier, *Transactions A. I. E. E.*, Vol. 34, pp. 176 to 196.

motor,³ in the ordinary sense of the term, is a constant-speed unit possessing characteristics similar to that of the direct-current shunt motor in load and speed. As such its field of usefulness lies largely in that class of applications coming within constant-speed operation. This statement is, of course, general, and allowance must be made for the fact that the induction motor may be made to come under the variable-speed class by introducing extra rotor resistance, or under the adjustable-speed class to a limited extent by changes in the polar connections or other arrangements.

In general the constant-speed-type induction motor is adaptable to practically all classes of service where the straight direct-current shunt motor is applicable. However, even under such circumstances there is sometimes a preference for the induction motor, although either might be used from the standpoint of the supply, for example in such cases as steel-mill drives. The constant-speed induction motor has the advantage of ruggedness, and, of course, does not present commutation troubles.

The very extensive possible applications of induction motors to industrial purposes is evidenced by the fact that in tables compiled to show the types of motors which may be used for a variety of machines the induction motor covers a large part of these uses. Thus, in twenty-nine different machine tools as listed in the "Handbook for Electrical Engineers" (page 893) the induction motor is listed as suitable for every case, with the obvious provision that in many of these cases where adjustable speed is required mechanical speed-changing facilities are provided.

PRINCIPAL USES OF SYNCHRONOUS MOTORS

The early difficulties of starting, hunting and direct-current excitation experienced with synchronous motors are no longer of such great importance with the modern motors of this class because of marked improvements in design for the first two items and the general availability of direct-current supply in most factories and other places where they might be employed.⁴ The principal uses of the synchronous motor are for loads requiring no adjustments in speed, from which it follows that one of its chief points of usefulness is for machinery where highly constant speed is required. It may also be used for driving slow constant-speed machinery and in those cases where power-factor correction is the special feature, mechanical power being sometimes drawn from the machine at the same time.

Carl J. Fechheimer summarizes the practical uses of the synchronous motor from the mechanical standpoint as including the driving of line shafting where the starting torque is not more than 50 per cent of the normal motor rating, centrifugal pumps and fans where the pull-in torque near synchronous speed is at or below 40 per cent of normal rating, alternating-current and direct-current motor-generator sets, frequency-changer sets, low-speed air compressors, and as a synchronous condenser. This list indicates little or nothing of interest to machine-tool applications, although several references may be made later on to one or another of the special uses of this motor in the more general field of industrial applications.

³An interesting discussion of induction-motor characteristics by A. E. Averett is found in *Transactions A. I. E. E.*, Vol. 34, p. 223.

⁴Several references are made to a discussion by C. J. Fechheimer, *Transactions A. I. E. E.*, Vol. 34, p. 213.

The synchronous motor may be started either as an induction motor⁵ or by means of a small auxiliary motor used to bring the speed of the main motor up to a value slightly above synchronous speed, after which it may be thrown on to the supply circuit by synchronizing. The last-named method is recommended where the motor must be started frequently through the average day. The first method requires a squirrel-cage induction-motor winding on the pole faces of the motor, which must be carefully designed as to cross-section if the proper starting torque is to result.

The alternating-current commutator motor possesses some interesting features in the industrial applications field. There are two important reasons for the use of

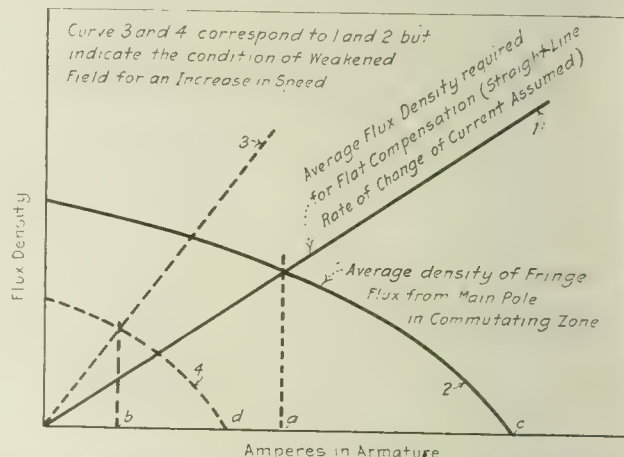


FIG. 2—CURVES ILLUSTRATING DIFFICULTY OF COMPENSATING FOR COIL SHIFT IN NON-COMMUTATING-POLE MOTOR

this type of motor which are more or less easily confused, although both may apply at the same time to some given motor applications.⁶ They are (a) that the commutator makes high starting duty possible on single-phase circuits, and (b) that the commutator makes variable-speed operation possible with the alternating-current motor. These advantages may, however, be completely offset by the higher first cost of this type of motor.

E. F. W. Alexanderson takes the stand that there is a tendency for the motor operator who has used variable-speed direct-current motors (adjustable-speed shunt characteristics implied) to consider that the adjustable-speed characteristics are essential to meet the needs of his machine, whereas many cases have demonstrated the fact that the characteristics of the variable-speed alternating-current motor have been very well able to cover the requirements, in spite of the preliminary conclusion that the characteristics of the adjustable-speed direct-current shunt motor were essential.

Hence some caution is desirable in the promiscuous recommendation of the more expensive equipments of the last-mentioned type, and it should be kept in mind that this choice is not warranted unless its added expense in comparison with the cost of a variable-speed

⁵Still another method of starting which may be mentioned is through the action of the hysteresis and eddy currents set up in the field poles by the rotating field of the rotor, i.e., when the field winding of the synchronous motor is open-circuited and the machine is of the polyphase type with the latter connected to the alternating-current supply mains. This method is not ordinarily practicable owing to the low starting torque produced. For additional information on synchronous motor starting, see the "Handbook for Electrical Engineers," pp. 1023 and 1025.

⁶A discussion at some length on the uses of this type of motor by E. F. W. Alexanderson is found in the *Transactions A. I. E. E.*, Vol. 34, p. 212.

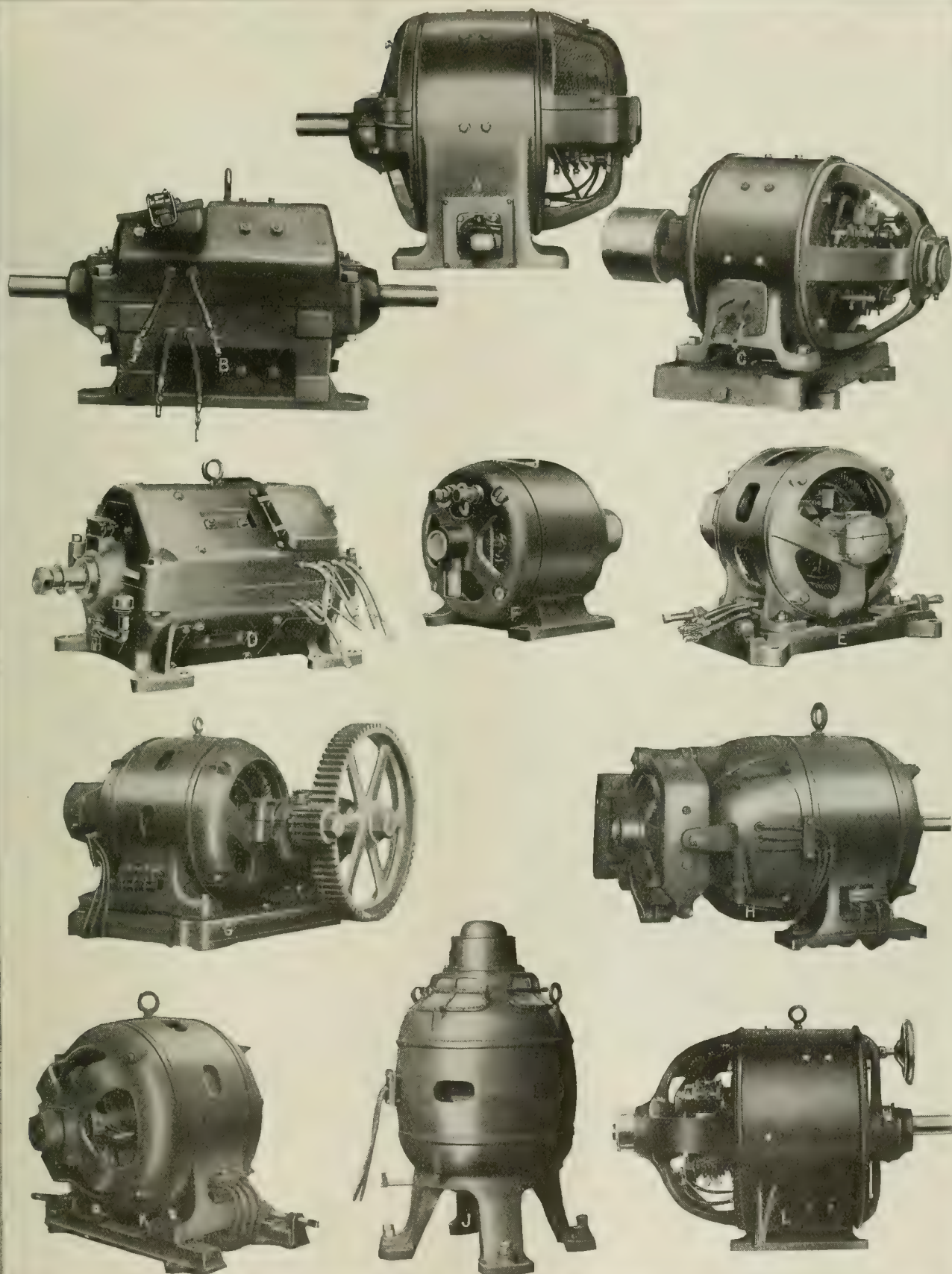


FIG. 3—SOME TYPES OF MOTORS SUITABLE FOR CONSTANT AND ADJUSTABLE SPEED WORK

A—Direct-current adjustable-speed motor for reversing-duty cycle. B—Commutating-pole-type crane and hoist motor. C—Commutating-pole motor available in sizes from $\frac{1}{2}$ hp. to 75 hp. D—Rolling-mill motor. E—Squirrel-cage three-phase induction motor. F—Single phase split-phase start induction motor. G—Motor equipped with back gear. H—Fully inclosed three-phase induction motor with brake. J—Vertical single-phase motor ($5\frac{1}{2}$ hp.). K—Single-phase motor with slide-rail attachment. L—Adjustable-speed motor employing change of reluctance in magnetic circuit

motor of the series type or equivalent is offset by clearly defined advantages.

SPECIAL TYPES OF MOTORS

A number of types of motors are on the market whereby wide speed adjustment is possible by variations in the reluctance of the magnetic circuit. These must be distinguished from those discussed in the foregoing notes as they make use of a method distinct from that in the ordinary direct-current shunt motor of the adjustable-speed type with field control.

In one commercial motor of this type unusually wide adjustment in speed is permitted by lateral movement of the armature with respect to the pole pieces. The

PRINCIPAL MOTOR-OPERATING CHARACTERISTICS OF INTEREST IN VARIOUS CLASSES OF INDUSTRIAL SERVICE

Factors Requiring Special Consideration	Constant speed; continuous running; infrequent shut-down; moderate variations in load	Non-reversing; continuous running; wide cyclic load variations; excess duty peaks	Reversing duty cycle
	1. Speed torque 2. Commutation 3. Stability 4. Heating 5. Ventilation 6. Efficiency	1. Speed torque 2. Commutation 3. Inertia 4. Heating 5. Ventilation 6. Efficiency	1. Speed torque 2. Commutation 3. Inertia 4. Stability 5. Heating 6. Ventilation 7. Mechanical construction

armature is cone-shaped and pole pieces are designed to correspond so that a small lateral motion of the armature will greatly increase the air gap and hence decrease the flux. While the adjustable-speed direct-current shunt-field-control motor is commonly designed for no greater speed adjustment than a ratio of four to one (maximum to minimum speed), the ratio is as high as ten to one in commercially practicable motors of the type described.

Subsequent discussions will show that many actual cases of machine-tool applications can be amply provided for by a speed ratio of four to one, and in such cases it follows that these higher speed ratios would hardly provide any additional advantage over the smaller ratio. However, the gradual changes in speed of the adjustable-field-reluctance motor form an interesting and important consideration for this type, and, of course, those cases where higher speed ratios than four to one are required would be especially well covered by this type.

CHANGING SPEED RATIOS BY MECHANICAL MEANS

From what has been said it follows that the usefulness of constant-speed motors for industrial applications requiring speed changes rests almost wholly on the availability of mechanical speed-changing devices such as the cone pulley or the gears now commonly employed. Furthermore, where the gradations in speed are not sufficiently close with such mechanical auxiliaries it follows that the adjustable-speed motor possesses its great advantage. There is no hard-and-fast rule for covering all cases. In fact, one of the most important phases of this work relates to the determination of this very point as a dividing line or limit to the use of the constant or nearly constant speed motor. It has also been mentioned in this same connection that sometimes

this dividing line is rendered less distinct by the possibility of using one or another of the variable (series characteristic) motors in place of those of the adjustable-speed (shunt characteristic) type.

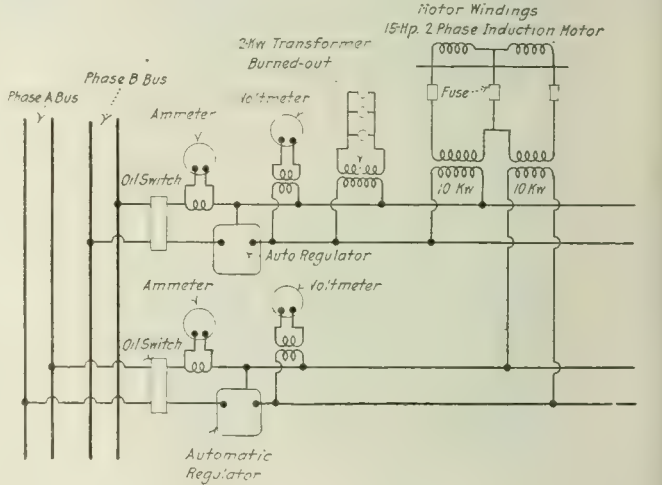
PECULIAR CASE OF VOLTAGE ON SUPPOSEDLY DEAD FEEDER

Two-Phase Induction Motor Operating Single-Phase Pumps Energy Into Other Phase of Circuit

BY E. CHARLES SEARES

Some time ago the writer's attention was called to a peculiar case of voltage on a supposedly dead feeder. The circuit involved was part of a 2200-volt, two-phase, four-wire distributing system supplying service to residences and an electroplating factory. During the night a short circuit occurred (later traced to the burning out of a 2-kw. single-phase lighting transformer), opening the station oil switch on phase B. This was not noticed, however, as the oil switch was of the type in which the handle does not show when the switch has been opened automatically and because there were no pilot lamps or signals to indicate the fact either.

During the course of the evening when the station attendant read his meters he noticed that the voltage



CONDITIONS EXISTING WHEN OIL SWITCH OPENED, CAUSING INDUCTION MOTOR TO OPERATE SINGLE-PHASE

across this phase was lower than normal. Later on the voltmeter showed no reading, and it was then that the operator first noticed that the oil switch was open.

On investigating the trouble and endeavoring to explain the low voltage prior to the complete interruption to service on phase B it was decided that a two-phase induction motor which runs all night at the electroplating factory had operated single-phase after the opening of the phase-B oil switch but had energized phase B by acting as a generator. In the early morning, when customers began turning on their electric lights, the load became too great for the motor, and the fuses opened, causing the first indication at the station of the open oil switch in phase B. The motor had been able to operate single-phase without blowing its fuses as long as it did because it was rated at 15 hp. and only carried a load of 10 hp., not including the small amount of power it had been supplying to phase B.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

FOUR-WIRE OPERATION HELPED BY GOOD GROUNDS

Grounding of Neutral at Numerous Points Essential to Prevent Single Transformers Being Supplied from Floating Section of Neutral

BY S. B. HOOD

The chief requirement for successful operation of four-wire, three-phase star systems is the maintenance of good grounds on the neutral. A number of companies are grounding the neutral wire only at substations and are having a considerable amount of trouble. This method of depending upon a single ground is not the proper one to use. The neutral wire must be grounded at numerous points throughout, being so placed that in no case can a broken neutral wire leave even a single transformer bank supplied from a floating section of ungrounded neutral. These grounds must be made by connecting two water pipes, as driven-pipe grounds are not generally of low enough resistance to give satisfactory results. Where water-piping systems are not available for grounding it is doubtful whether the four-wire star system gives as good operating results as the older delta system. Fortunately, however, few towns of any size are to-day without their water-supply system, and little opposition need be expected to the use of these pipes for grounding, as it has been conclusively proved that no injury to the pipes will result. This method is now recommended by both the National Electric Code and the National Electrical Safety Code.

A still further refinement of the four-wire, three-phase system is that of using a common grounded neutral. This system is being used quite extensively both in some of the larger Canadian cities and in cities of the United States. Broadly speaking, it consists of using a fair-sized interconnected grounded single-wire network covering the entire district to be served. This network is thoroughly grounded at many points and is used commonly as a grounded neutral in both primary and secondary systems. The grounds can best be made by grounding each individual service to the water piping on the customer's premises. This insures individual protection to each and every customer.

This system has been used for a period exceeding six years in a city of more than 500,000 population distributing about 20,000 kva. for lighting and power purposes. During this period it has been proved to be by far the most economical and reliable of all systems of distribution. On this network very few lightning arresters are installed, although it is in a district subjected to very severe lightning disturbances. One year's record showed only six transformer failures out of a total of approximately 1800 transformers, or about one-third of 1 per cent. In this same district there is a competing delta-connected network, giving an excel-

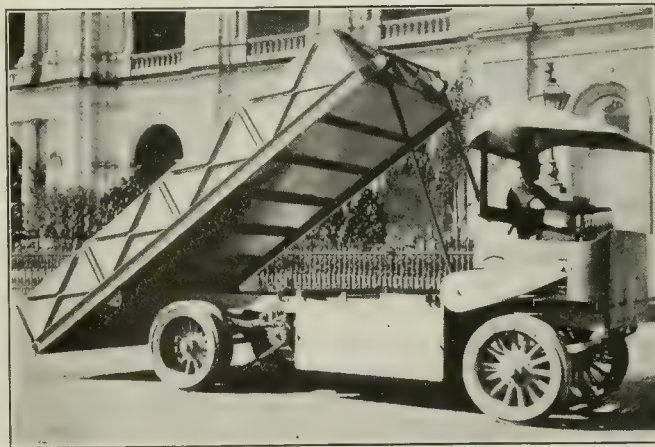
lent opportunity for comparison between the two systems under the same conditions of exposure.

In one severe lightning storm the delta system was completely put out of service, having nearly every transformer fuse blown in spite of the fact that each transformer had its own set of lightning arresters installed. About thirty transformers were burned out completely. The star-connected common-neutral system went through without any interruption, although fuses were afterward found to be blown in three transformers feeding into the interconnected secondary network.

SELF-DUMPING ELECTRIC COAL-DELIVERY TRUCK

Has a Range of 45 Miles at a Speed of 7 Miles per Hour and Handles 50 Tons Daily, Replacing Eight Tip Drays

The City Electric Light Company, Ltd., Brisbane, Australia, has put into service a 5-ton electric self-tipping lorry for carting coal from the coal chutes to its power station, a distance of approximately $1\frac{1}{4}$ mile (2 km.). The lorry, which weighs about 10 tons when



COAL TRUCK THAT REPLACES EIGHT TIP DRAYS

loaded, is propelled by an electric motor operated from a forty-four-cell "Exide" storage battery. Its range when loaded is 45 miles (72.42 km.) on one charge, with a speed of seven miles (11.26 km.) per hour.

The body of the lorry can be elevated to an angle of 45 deg. and is therefore self-emptying. The elevating of the body is done by a 3-hp. motor which is gear-connected to two vertical screws. Less than one minute is required to reach maximum elevation. The lorry and its driver are now handling 50 tons of coal daily and have replaced eight trip drays. The average consumption of electricity by this lorry, taken over one month, was 2.43 units per mile of route. The chassis was made by the General Vehicle Company, but the body and gear were designed and built in Brisbane.

OPINIONS ON PRESENT UNDERGROUND PRACTICE

Ohio Operating Men Call Attention to Types of Construction Which They Have Found Give Best Service

According to opinions expressed at a recent meeting of the transmission and distribution committee of the Ohio Electric Light Association in Cleveland, brick is considered as having an advantage over concrete for manholes when speed of construction is taken into account. However, it does have the disadvantage that the construction of a manhole of this type requires skilled labor. When using collapsible sectional forms, however, a manhole can be installed by ordinary labor. Concrete is best in gravel or sandy soil where sheeting would be necessary anyhow. A concrete bottom is not recommended unless sewer connection is provided. G. W. Wenzel of the Northern Ohio Traction & Light Company, Akron, stated that the cost of 8-ft. by 7-ft. 6-in. by 6-ft. 8-in. (2.43-m. by 2.28-m. by 2.02-m.) deep standard concrete manholes was \$125 complete.

W. E. Salber of the Northern Ohio Traction & Light Company pointed out that fiber is more flexible than clay, that it is easier to install, that the joints are more certain to hold, and that by laying the fiber in a band of concrete a solid mass can be obtained which will permit of a limited amount of moving of the complete mass without injury to the cable. Considerable difference of opinion existed regarding the relative ease of pulling cable into fiber and clay ducts. It was thought that the clay duct, if properly cleaned, would afford an easier surface to pull over than the fiber. However, the possibility of raised unglazed portions being present in clay ducts makes the pulling of cable in such duct a trifle more difficult than in fiber.

F. M. Hibben, Cleveland Electric Illuminating Company, stated that radiation depends a great deal upon the condition of the soil and the amount of moisture therein. Paved streets hinder the radiation of heat from cable beneath because water does not get into the soil so easily. R. J. Feather, Columbus (Ohio) Railway, Light & Power Company, explained one instance where he found it necessary to use forced draft by means of a 0.25-hp. motor-driven blower together with two pipe connections carried to the surface at the curb, one for intake and the other for exhaust. It was thought that the fiber was more or less detrimental to the radiation of heat.

A very economical method of fireproofing cables in manholes was described. It consists of using a 3-in. (7.62-cm.) strip of cheesecloth tape bound around the lead sheath. A stiff sand cement is forced between the cheesecloth and the cable to a thickness of about 1 in. (2.54 cm.). The cost of this fireproofing amounted to approximately 18 cents a foot (60 cents a meter). This covering is fairly flexible.

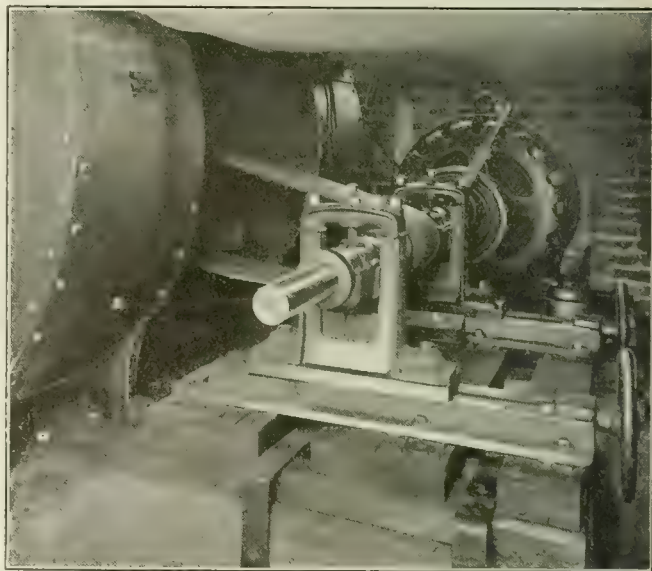
In the round-table discussion of high-tension cables, joints, etc., F. M. Hibben said that the adoption of a standard-size cable containing No. 4/0 B. & S. conductors for all work has proved an advantage in making the system very flexible. Considerable emphasis was laid upon the necessity of installing underground cables while warm in order that the cracking of insulation might be eliminated. C. D. Fitch, Toledo Railways & Light Company, said that it has been notice-

able that failures do not occur during peak loads. They usually occur at light loads. This was explained by the fact that the carbonization of the dielectric due to heat continues after the load is removed, when breakdown is very likely to be augmented by excess voltage due to light load.

SYNCHRONOUS MOTOR FOR DRIVING AIR BLOWER

Power-Factor-Corrective Ability of Motor Used to Compensate for Small Squirrel-Cage Motors Elsewhere in Plant

A somewhat unusual application of a synchronous motor, but one that is being used more and more extensively as the advantages of power-factor correction become more generally appreciated, is shown in the accompanying illustration. The motor, which is a 70-hp. Westinghouse machine, operates a blower consisting of two 60-in. (152.4-cm.) fans in the exhaust system of a large shoe factory. Originally the blower was driven by a 50-hp. squirrel-cage motor. While this was entirely satisfactory as far as operating the blower



BLOWER MOTOR THAT COMPENSATES FOR POOR POWER FACTOR
OF OTHER AUXILIARY MOTORS

was concerned, conditions elsewhere in the factory made the change to a synchronous motor highly desirable.

The factory has its own power plant and contains about 200 hp. of squirrel-cage motors, none of which (with the exception of the blower motor) is larger than 10 hp. All of these small motors run at light load most of the time, since a shoemaking machine, even when in constant use, is loaded intermittently only. In consequence, the power factor of the electrical system was low, rarely exceeding 70 per cent and often falling to nearly 60 per cent, and this caused the generator and exciter to overheat even under light loads and seriously affected the voltage regulation.

The use of a synchronous motor to raise the power factor was, of course, the proper remedy, and it was applied to the blower, since the blower offered the only large, uniform and continuous load in the factory. The

synchronous motor had to be larger than the original induction motor so as to provide additional capacity for power-factor correction. With its use the power factor is maintained at 98 per cent, which greatly improves the operation of every piece of electrical apparatus in the plant.

Since the synchronous motor does not have sufficient starting torque to bring the blower up to full speed, it is necessary to use a clutch, by means of which the load is thrown on the motor after it reaches full speed. The motor is controlled from the power house, the starting switch, field rheostat and power-factor meter being mounted on one of the panels belonging to the main switchboard of the plant.

TRANSFORMER RECORD CARD
USED BY WESTERN COMPANY

One Side of the Card Gives the History of the Transformer Service, the Other Records Test Data and Condition of Oil

Reproduced below is a transformer record card that has been used for several years with success by a Western company. The two sides of the card are shown, one side giving a complete record of the life of the transformer and the other side test information and condition of oil. It will be noted that the form

TRANSFORMER RECORD									
MAKE		TYPE		VARIETY NO.		COMPANY'S NO.			
G. E.		H ₂ Form G		137/4/6		2563			
VOLTS		PRIM 11000 10500-10000		CAPACITY K W 50		DATE REC'D 4-7-15			
		SEC 2300-460							
STATION NO.		INSTALLED		REMOVED		REMARKS			
		Mo. Day Yr.		Mo. Day Yr.					
7146		5 1 15		10 7 15					
9011		11 2 15		1 3 16		Primary Bushing Broken			
61700		2 2 16							

TEST RECORD					
DATE	WATTS CORE LOSS	AMPERES E.P.C. CUR.	INSULATION VOLTS	RATIO	REMARKS
4-9-15	248	.043	22000	OK	
10-10-15	245	.040	22000	OK	
1-8-16	245	.041	22000	OK	Repaired Primary Bushing

OIL RECORD	
DATE CHANGED	REMARKS
10-10-15	
1-8-16	Flushed Coils

FORM OF TRANSFORMER RECORD AND TEST SHEET USED BY WESTERN COMPANY

records exclusively information with reference to the transformer. Information concerning the load connected to a transformer after it is installed is put on a second card file, which contains transformer station numbers, arranged numerically, whereas in the transformer card file the transformers are arranged numerically by company number. A cross reference between these two files is in the one case the transformer number and in the second case the station number. Station numbers are arranged in such a way that the number tells at a glance the district and feeder to which the transformer is connected. The company

number appears on the cover and side of each transformer in white letters 2½ in. (6.4 cm.) high, easily legible and not likely to be obliterated.

REVERSED PHASE CAUSES
SUBNORMAL MOTOR SPEED

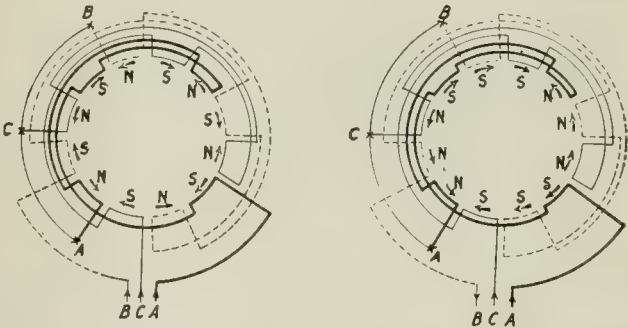
How the Abnormal Operation of a Reconnected Motor Was Traced to a Wrong Connection of One Winding

BY M. M. CLEMENT

While working in a power plant in a small Western town the writer had to reconnect a three-phase, four-pole, series star-connected motor so it would operate at a different voltage. Changes were made according to blueprints, but when the motor was tested it operated at only about one-third normal speed.

To locate the trouble the star connection was opened and opposite ends of each phase were joined to the terminals of a storage battery. By testing the poles of the armature with a small pocket compass while current was flowing in this manner it was found that the poles of each phase were symmetrically placed around the armature and that they were alternately marked "south," "north," etc., just as they should have been.

Next the star connection was joined again and current allowed to flow in two leads and out the third. Under this condition and with a properly connected three-phase, four-pole motor the polarity of three consecutive poles should be in one direction (Fig. 2), while that of the next three should be opposite, etc., thereby forming four flights of alternately different polarities.



CONNECTIONS AND POLARITIES AS THEY SHOULD HAVE BEEN IN MOTOR WHICH WAS REWOUND

In this motor, however, it was found that the adjacent pole faces had opposite polarities, indicating that one phase was reversed.

To determine which was reversed all of the leads were connected with the positive terminal of the storage battery, while the star connection was joined with the negative terminal. Under these conditions in a properly connected armature the polarities of adjacent poles should be opposite, but in this motor three consecutive poles had similar polarities, while the next three had the opposite polarity, etc. Since the only polarities that could be reversed to bring about the proper arrangement were those corresponding to phase B, it indicated that this phase had been reversed; that is, the terminal which should have been a lead was connected to the star point and vice versa.

CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

GAIN OF 60 PER CENT IN NEW-BUSINESS SALES

Scarcity of Domestic Labor Has Resulted in Greatly Increased Appliance Sales by the Doherty Organization

Sales by the new-business department at the Doherty properties are one-half again as much as in 1916, according to a statement made by George Williams, manager of the new-business department of the organization. Mr. Williams said that the growth this year was typified by the September figures, which showed appliance sales amounting to \$151,000 for the month as compared with \$90,000 for September, 1916.

In commenting upon the increased sales, Mr. Williams pointed out that the war was chiefly responsible for the greatly increased demand for electric and gas appliances. He said the war, in causing a scarcity of labor in all branches of work, had not overlooked domestic workers, with the result that servant girls were scarce. This scarcity of servants has made the housewives of the country do their own work, and they have tried to simplify that work as much as possible. For that reason the labor-saving gas and electric appliances have been in great demand, with the consequent benefit to new-business sales.

CITY MANAGEMENT DOES NOT MEAN MUNICIPAL OWNERSHIP

H. M. Waite, City Manager of Dayton, Ohio, Lays Down Reasons for Co-operation Between Utilities and Municipalities

Co-operation between communities and utilities will solve the difficulties the former have in getting service and the latter in making a living, according to H. M. Waite, City Manager of Dayton, Ohio, who discussed the subject at the recent city managers' convention at Detroit. Part of his remarks are abstracted below:

Undoubtedly many have the idea that city management means municipal ownership. There is just one thing in which communities are interested jointly with utilities, and that is service. By this I mean, broadly, everything that service implies, gives and requires—proper service to the community and a fair return to the utility on a fair valuation. Public ownership of utilities is a long way off, though it may ultimately be the answer. Our municipal governments are too uncertain yet to think seriously of municipal ownership, granting that you must have co-operation between the municipality and its utilities.

Cities all over the United States are spending a great deal of money in laying out a program for everything but utility service. Money is being spent on sewers, water and streets, but how many cities are spending money on future service from their utilities? If your utilities have not a sufficient return to give service, the community suffers. If your transportation utilities cannot automatically expand to meet the transportation of your community, your community suffers.

Financially to-day the utilities are struggling. It isn't a question of war times—their securities started to shrink long before war was mentioned. What is the trouble? What is the answer? Is there co-operation between the municipality and the utility? There seems to be a feeling of antagonism toward public utilities. Is it because the utility is not giving the service that the public demands or thinks it needs? Does the public know what service it does need? Those two questions absolutely demand investigation. As long as this public antagonism exists there is a corresponding shrinking of securities, and naturally there follows a shrinkage in the service rendered by the utility.

Everything points to the necessity of co-operation between the utility and the people.

Having followed this line of thought in Dayton, we went to the transportation utilities and asked: Where are you heading? They do not know. The operating man has not time to think as to the future of his property ten to twenty years hence, but he knows that he is being pinched now. The city employed a man to go over the properties and make a preliminary report as to where they were heading.

You never can get co-operative feeling between the public and the utilities with intermediate franchise. You cannot create an interest in the public mind in any utility if the public has not a direct interest in that utility. I believe that the answer is going to be, and very quickly, an abandonment of these franchises, giving direct to the public a direct benefit, and it will mean a laying out in our communities of a liberal, fair program of expanse to meet the requirements of service.

If your utilities cannot expand automatically, freely, fairly and economically to meet the demands of your community, your community suffers, so, therefore, I believe that it will result in thorough investigations and thorough agreements between municipalities and their utilities, with a determined franchise, with a fair valuation of the property and fair fluctuations in the cost of service to meet the requirements of the time, with a certain return to the city of all over a certain fair return on a fair valuation.

A PLAN FOR HOLDING THE SALES FORCE TOGETHER

How a Sales Manager in Competitive Territory Has Arranged the Work of His Department to Fit the Changed Conditions

A Middle Western lighting company faced with a severe competitive situation has come to the point where it virtually has no electricity in large blocks to sell. To let the sales force go the management feels would be folly, as it is impossible to tell when the competing company will let loose a "drive" for business. Moreover, it is manifestly undesirable to hold a large sales force together merely for the purpose of having the men ready in case such a condition arises.

Previously the new-business department of this company was divided into four groups, residential salesmen, commercial salesmen, power salesmen and special salesmen. It will be observed that these men were all creative salesmen in that it was their business to get as many new customers as possible, regardless of whether they got them from new fields or from the lines of the

competitive company. When the shortage of power arose the company, feeling that something must be done, rearranged its work so that one-third of the force is now engaged in selling appliances, one-third is engaged in holding the present business, and another third is charged with the duty of securing new business.

It is thought that this plan has many advantages. First, it is expected to build up an appliance business on which the company will make a direct profit, since it sells all goods at list price, besides increasing the revenue from existing lines. The third of the sales force employed in holding the company's present business is virtually engaged on defense, and while it really does little that is of creative value, it helps to hold the number of disconnections within a figure close to what the company usually expects from various causes, including customers switched to the other company's lines. Finally, that third of the sales force which is charged with getting new business consists of the best men in the company's department. They go out with instructions to pick the new customers, selecting only those which are the most profitable and whose business will fit best into the valleys of the company's load curve.

This plan, which was originated to build up an appliance business and to hold the company's sales organization intact, has been working for some time, and it appears to be accomplishing its purpose. Later, when it seems advisable to change back to aggressive tactics, the sales manager will have the further advantage of possessing men who are trained appliance salesmen, and even if they should be reassigned to territory with instructions to solicit for all sorts of business, they will have had the advantage of this appliance sales training, and it is less likely that they will forget to mention appliances when closing sales for house-wiring or soliciting other business.

RESIDENCE LIGHTING RATES AND ENERGY CONSUMPTION

Data on a Number of Communities of Varying Size Using Rate Based on Floor Area and Energy Used

BY F. F. ESPENSCHIED

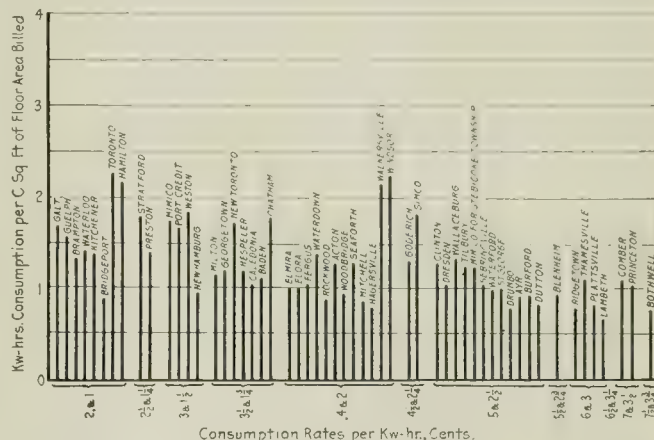
In studying domestic lighting rates and power costs for the purpose of possible readjustments the accompanying charts among others were prepared. Since they refer to a widely scattered group of cities, towns and villages served from the same transmission system, and further since the rates appear quite equitable and satisfactory, the results attained seem worthy of a short explanation.

All the municipalities considered utilize Niagara power, but being situated at various distances from the source of power, the cost delivered varies from town to town. Residence lighting rates are standardized on the following basis:

1. A uniform "service charge" of 3 cents per 100 sq. ft. (9.29 sq. m.) of floor area per month—minimum area 1000 sq. ft. (92.90 sq. m.), maximum area 3000 sq. ft. (278.70 sq. m.). This area is obtained by measuring the outside dimensions of the house, not including porches, and multiplying by the number of living floors; cellars, outbuildings and unfinished attics not being considered. 10 per cent is deducted for walls, etc.

2. A "first consumption rate" of 5 cents or 4 cents or 2 cents per kilowatt-hour, as the case may be, differing from town to town with the cost of power and local conditions. This rate is applied for all energy consumed monthly up to 3 kw.-hr. per 100 sq. ft. of floor area.

3. A "second consumption" rate of 2½ cents or 2 cents or 1 cent per kilowatt-hour, as the case may be, for energy in



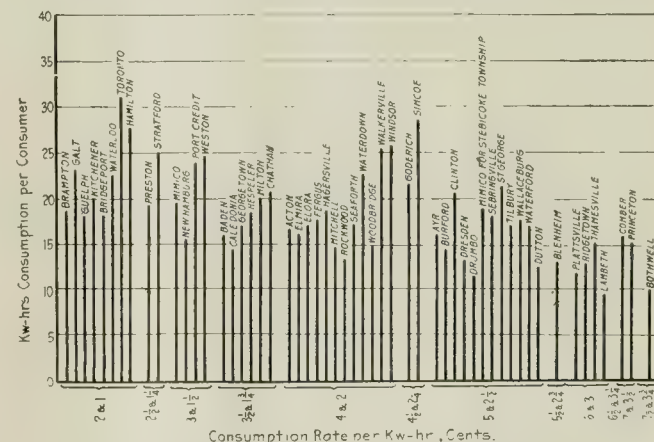
AVERAGE MONTHLY CONSUMPTION PER FLOOR AREA BILLED

excess of that used at the first rate. This second rate is taken as half the first rate.

4. From the entire monthly bill 10 per cent discount is allowed for prompt payment.

While these rates have worked out well in encouraging the use of electrical devices and stoves, it is found that a very small proportion of residence lighting users consume up to 3 kw.-hr. per month per 100 sq. ft. without a stove. When a stove is installed a part of the energy for cooking comes in at the higher rate, and it is now proposed to change the first consumption rate to apply only to the first 2 kw.-hr. per 100 sq. ft. of floor area. It is also possible that the second consumption rate will be limited to the next 3 kw.-hr. per 100 sq. ft., and that a third consumption rate of approximately half the second rate will apply to all consumption after the first 5 kw.-hr. per 100 sq. ft. per month. When this is done it is anticipated that electric cooking will greatly increase in popularity.

Cost and revenue studies would indicate that with



AVERAGE MONTHLY CONSUMPTION PER CONSUMER

these rates no additional service charge is necessary to take care of stove demands, the diversity being so great that the increased consumption of energy will compensate for the slight extra investment in secondary lines and transformers. The accompanying charts were compiled from customers' records for the months

of December, 1915, and June, 1916, averaged and considered as representing an average month in the year. With the exception of a few of the very small villages all municipalities have been operating several years.

In Hamilton, Windsor and Chatham electric light competition exists. Artificial gas is available in Guelph, Waterloo, Stratford and Kitchener, with natural gas in Hamilton, Galt, Chatham, Windsor, Wallaceburg, Simcoe and Walkerville. As a matter of fact, gas competition for residence lighting is not a noticeable factor, but artificial gas in some places, such as Toronto, Guelph and Kitchener, is a competitor for cooking.

INCANDESCENT-LAMP SALE TO FILL UP THE SOCKETS

West Penn Power Company by Offering Standard Package Lots at Reduced Prices Expected to Dispose of 80,000 Lamps in Five Days

The West Penn Power Company during the five days from Dec. 3 to Dec. 7 inclusive conducted its fourth annual incandescent-lamp sale. This sale, which is for the sole purpose of filling up the sockets, can be patronized only by customers. All lamps are sold for cash and none is delivered.

There are two residential sizes in the sale, 25-watt and 50-watt. These are sold only in standard-package sizes, namely five lamps. Both sizes were sold this year for 90 cents per package of five. In the commercial sizes only 75-watt lamps are offered. Gas-filled units are offered for 45 cents apiece, and vacuum units for \$1.30 per package of three, or \$2.15 per package of five.

Display advertisements announcing the sale appeared for the two preceding weeks in all of the newspapers in the territory in which the company operates. Besides, all customers, residential and commercial, receive a post card in advance of the sale giving a list of the sizes offered and the price.

The first year the company put on this sale approximately 20,000 lamps were sold. Last year resulted in the sale of about 70,000 lamps, while the estimate for this year was 80,000 prior to the sale. As no returns have as yet been received, it is not known how closely the company came to its original estimate.

MORE COMPANIES REFUSE TO FINANCE EXTENSIONS

Binghamton (N. Y.) Property Demands Assurance from Customer that Money Used Cannot Be Better Used to Meet War Requirements

The policy of refusing to finance service extensions and connections is rapidly being taken up by central stations under the stress of present financial conditions. The Binghamton (N. Y.) Light, Heat & Power Company recently made the following announcement of its policy in this connection. It is also stated that this policy is being adopted by all subsidiary companies of the Eastern Power & Light Company and the General Gas & Electric Company:

This company, recognizing that every effort must be made by man, woman and child to win the war, is endeavoring in its operations to conserve coal, labor and supplies, so as

to aid in every possible way the authorities at Washington. The recent order of the Fuel Administration in the discontinuing of sign lighting for certain periods in order to save coal at the power plants is a small part of this program and is a forerunner of further economies to be ordered by the authorities.

Beyond these savings, however, there is the urgent necessity of saving capital if we are to give the government the financial support it requires to provide the large sums of money necessary to carry on the war. Extensions to the system of a public utility company, whether in distributing or power plant, require capital which in times such as these should be used only for war purposes. This company has nearing completion a large modern power plant which is effecting a material saving in coal over the present inefficient generating station. This will be completed, as it aids materially the conservation plan and as all arrangements were made prior to the war and the construction is nearing an end.

No further electrical extensions or connections will be made unless the parties to be served advance to the company the cost of such extensions or connections, and then only provided assurance is given satisfactory to the company that the money loaned for the purpose cannot be better used in some other way to meet the nation's war requirements. Where the light or power is required by manufacturers for war contracts, in special cases exceptions to the above rule may be made upon proper evidence from Washington that such contracts are for war necessities.

COST OF ARC LIGHTING IN AN INDIANA CITY

In Town with One Arc Lamp for Each Forty-seven Inhabitants Total Cost Is \$46.03 and Operating Cost \$17.42 per Lamp per Year

The Crawfordsville (Ind.) Electric Light & Power Company, which is operating 238 arc lamps in its city of 11,300 population, lays claim to having more arc lamps per 100 inhabitants than any other American city. The ratio leads that at Detroit, where, according to the latest records, there is one arc lamp for each forty-nine people. During the year ended July 1, 1917, lamps burning in Crawfordsville on a 4000-hour schedule were operated at a cost of \$17.42 each, not including interest and depreciation. The total cost of the arc lighting, with interest figured at 4 per cent and depreciation at 10 per cent, was \$46.03 each. The itemized costs were as follows:

Energy	\$1,933.60
Trimming and inspecting	283.76
Lamp supplies	518.87
Miscellaneous supplies and expenses.....	76.64
Maintenance:	
Material	485.69
Labor	338.47
Rectifier bulbs	406.42
Total operation	\$4,043.75
Depreciation at 10 per cent.....	\$4,800.00
Interest on arc-lighting investment at 4 per cent. 1,928.00	6,728.00
Total.	\$10,771.45

The energy for operating the lamps, which are of the 4.4-amp., 75-volt Westinghouse magnetite type, amounted to 276,251 kw.-hr. This was charged to the street-lighting system at the cost of energy on the switchboard.

This quota of lamps provides an arc lamp on every corner in the city except in the business district, where incandescent "white way" and incandescent alley lighting is employed. F. H. Miller, manager of the Crawfordsville plant, stated that the outages in the arc-lighting system average only one a night.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

I. E. S. SUGGESTIONS FOR LIGHTING SCHOOL BUILDINGS

Tentative Code of Practice Framed for the Information of Legislative Bodies, School Boards and Others Concerned

GOOD factory and office lighting cannot assure the highest efficiency of future generations if their eyesight is impaired by improper lighting while at school. Recognizing this fact, the Illuminating Engineering Society has prepared a tentative code of lighting for schools for the information of legislative bodies, school boards and others interested in enactments, rules and regulations for better lighting. Extracts from this code follow:

Desirable and minimum illumination intensities, based upon present ideas of good practice, are given in Table I.

Glare, either from lamps or from unduly bright reflecting surfaces, produces eye strain; therefore lamps should be suitably shaded and arranged so as to secure

TABLE I—DESIRABLE AND MINIMUM ILLUMINATION

	ARTIFICIAL LIGHTING FOOT-CANDLES (LUMENS PER SQUARE FOOT)* AT THE WORK	
	Minimum	Ordinary Practice†
Storage spaces.....	0.25	0.5- 1.0
Stairways, corridors.....	0.50	1.0- 2.5
Gymnasiums.....	1.00	2.0- 5.0
Rough shop work.....	1.25	2.0- 4.0
Auditoriums, assembly rooms.....	1.50	2.5- 4.0
Classrooms, study rooms, libraries, labora- tories, blackboards.....	3.00	3.5- 6.0
Fine shop work.....	3.50	4.0- 8.0
Sewing, drafting rooms.....	5.00	6.0-12.0

*It should be borne in mind that intensity of illumination is only one of the factors on which good seeing depends.
†Under the column headed "Ordinary Practice," the upper portion of the range of intensities is preferable to the lower; where economy does not prohibit even higher intensities than those cited are often desirable.

good distribution of light on the work, to avoid objectionable shadows and prevent sharp contrasts of intensities. Walls should have a moderate reflection factor, the preferred colors being light gray, light buff, dark cream and light olive green. Ceilings and friezes should have a high reflection factor. The preferred colors are white and light cream. Walls, desk tops and other woodwork should have a dull finish.

The code also emphasizes that basements, stairways, storerooms and other parts of the building, where required, should have switches or light-controlling ap-

*The illumination intensity should be measured on the important plane, which may be the desk top, blackboard, etc.

paratus at the entrance. Emergency lighting should be provided at main stairways and exits to insure illumination when through accident or other cause the regular lighting is extinguished. All parts of the lighting

TABLE II—ORDER OF MAGNITUDE OF THE BRIGHTNESS OF SOME LIGHT SOURCES IN COMMON USE

	Brightness (Approximate Millilamberts)
Indirect lighting: Ceiling directly above the lighting unit.....	5 to 75
Semi-indirect lighting, heavy density glass-ware.....	35 to 100
Semi-indirect lighting, light density glass-ware.....	200 to 1,000.
Direct lighting, 10-in. (25-cm.) opal glass ball containing 100-watt vacuum tungsten lamp at center.....	500
Direct lighting, vacuum tungsten lamp (frosted) in open-bottom reflector.....	2,000 to 3,000
Vacuum tungsten lamp, filament exposed to view.....	500,000
Gas-filled tungsten lamp, filament exposed to view.....	2,000,000
Gas-mantle, bare.....	15,000
Gas-mantle, concealed in 6-in. (15-cm.) opal glass globe.....	1,000
Mercury arc tube (glass).....	8,000
Daylight, clear blue sky.....	1,000

system should be properly maintained to prevent deterioration due to dirt accumulation, burned-out lamps and other causes. To insure proper maintenance frequent inspections should be made at regular intervals.

Direct, semi-indirect and indirect systems of lighting are in successful use in schools, but there has been

TABLE III—APPROXIMATE COEFFICIENTS OF UTILIZATION—MODERN LIGHTING EQUIPMENT*

	Light Color Walls Light Color Ceiling	Medium Color Walls Light Color Ceiling
Small rooms (offices, corridors, etc.):		
Direct lighting, dense glass (open-bot- tom reflectors).....	0.40	0.35
Semi-indirect lighting; dense glass....	0.25	0.22
Indirect lighting.....	0.23	0.20
Medium-sized rooms (classrooms, labora- tories, etc.):		
Direct lighting, dense glass (open-bot- tom reflectors).....	0.50	0.45
Semi-indirect lighting, dense glass....	0.35	0.30
Indirect lighting.....	0.30	0.25
Large rooms (auditoriums, etc.):		
Direct lighting, dense glass (open-bot- tom reflectors).....	0.60	0.60
Semi-indirect lighting; dense glass....	0.45	0.40
Indirect lighting.....	0.40	0.38

*The working plane in this case is a horizontal plane 30 in. (76 cm.) above the floor. These values refer to the initial installation without any allowance for depreciation. At the present time, 1917, the lighting output of tungsten-filament electric incandescent lamps, based on average service conditions of regularly maintained installations, ranges from 8 lumens per watt for the smaller vacuum tungsten lamps to 14 lumens per watt for the larger gas-filled tungsten lamps employed in school lighting.

a growing preference for semi-indirect and indirect lighting, especially since the introduction of modern lamps of great brilliancy. Local lighting by lamps placed close to the work is unsatisfactory except for special cases such as the lighting of blackboards, maps, charts, etc. Examples of bad lighting are illustrated.

Except in very rare instances bare light sources should not be exposed to view. They should always be

adequately shaded or completely hidden. Even when shaded by translucent media, such as dense glassware, the lighting units should be placed well out of the ordinary range of vision. In other words, it is recommended that lighting units be of low brightness,² even if they are high in the field of view. The maximum brightness contrast of juxtaposed surfaces in normal visual field should be preferably not greater than twenty to one. Glossy surfaces of paper, woodwork, desk tops, walls and blackboards are likely to cause eye-strain because of peculiar or mirrorlike reflection of images of light sources, especially when artificial light is used. Matte or dull-finished surfaces are recommended. The illumination intensity on horizontal working planes should be as uniform as possible. The variation should not be greater than four to one.

The chief factors which must be considered in arriving at the size and number of lamps to be used in a given room are: (1) the floor area; (2) the total luminous flux emitted per lamp, and (3) coefficient of utilization of the particular system considered. The computation for the total lumens required to give a certain illumination intensity in foot-candles can be made with the following formula:

$$(N \times L \times E) \div A = I,$$

where N is the number of lamps, L the lumens output per lamp, E the coefficient of utilization, A the area of floor or horizontal working plane in square feet, and I the illumination intensity in foot-candles.

The placing of blackboards is also considered. Methods of eliminating glare and types of blackboards to be used are brought out. Methods of rehabilitating the lighting of old buildings are described. The code ends with a paragraph in which it is brought out that a systematic maintenance should be provided in order to insure against depreciation in the illuminating intensity due to burned-out lamps, broken gas mantles, discoloration, etc., and to accumulations of dirt upon the lamps and upon the surfaces of the reflecting and transmitting media. It is found in practice that carelessness in this respect may easily reduce the effective illumination by 50 per cent, especially in indirect and semi-indirect lighting.

Generators, Motors and Transformers

How to Overcome the Difficulties of Electrical Repairs.—C. W. STARKER.—The author points out that a large stock of repair parts is a costly investment, and on the other hand deliveries of spare parts are apt to be slow. Looking to the future in planning a motor installation, it is wise to buy only standard types of machines, select only a few ratings and adhere to one type of distribution.—*Industrial Management*, November, 1917.

Lamps and Lighting

Preferred Proportions in Combining General and Localized Lighting.—F. C. CALDWELL and W. M. HOLMES.—A test was made in a small room with a white ceiling and very simple dark-colored furnishing. The general lighting was obtained entirely by reflection. The localized lighting was from a table lamp with

²Preferably not to exceed 250 millilamberts. A millilambert is equal to the brightness of a perfectly reflecting and diffusing surface illuminated to an intensity of 0.929 foot-candle (0.929 lumen per square foot).

opaque reflector and diffusing glass. One hundred observers expressed their preference, and for the conditions described the following conclusions are drawn: (1) With light ceiling and dark walls and throughout a range of foot-candle intensities on the work from two to six, about 40 per cent of localized and 60 per cent of general lighting is preferred; (2) within the above range this ratio is not materially affected by the intensity of illumination upon the working plane; (3) this ratio is approximately the same for men and women; (4) changing the walls to a light color does not greatly affect this ratio; (5) for the above preferred proportions of direct and indirect light and with dark walls the ratio of the brightness of the ceiling to that on the working plane lies between $2\frac{1}{2}$ and 3.—Paper issued by the Illuminating Engineering Society.

Approved Electric Lamps for Miners.—H. H. CLARK and L. C. ILSLEY.—This bulletin describes a number of types of miners' lamps that meet the Bureau of Mines' requirements for safety and performance. The character of tests to which lamps will be subjected before the approval of the bureau is granted is given.—*Bulletin* 131, Bureau of Mines.

Generation, Transmission and Distribution

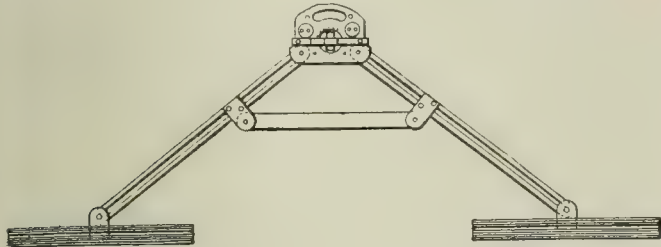
Comparison of the Working Costs of the Principal Prime Movers.—OSWALD WANS.—The author compares in detail the working costs of the steam engine, gas engine, oil engine and Diesel engine for powers up to 500 brake-hp. and shows for what prices of fuel they are equivalent. The items constituting the total working costs are (1) capital charges, including depreciation, insurance and interest upon capital expenditure, and (2) running charges, including cost of fuel, lubricating oil, water supply, sundry stores, labor and repairs. Rent and taxes are not included. The author includes curves on expenditure, fuel consumption, consumption and load curves and working cost curves.—*London Electrician*, Nov. 9, 1917.

Pressure Increase in the Corona.—EARLE H. WARNER.—Experimental results show that (1) the increase in pressure due to corona appears and disappears much more rapidly than when due simply to heat; (2) the heat in the corona discharge is not a prominent factor until many seconds after the corona appears; (3) in equal energy experiments the increase in pressure due to corona differs from the increase in pressure due to heat by about 50 per cent; (4) at the instant the corona appears the gas in the tube at a small distance from the wire is cooled; (5) the theory advanced by Kunz is verified in one more field, namely in the relation between current and pressure for constant voltage. These results, together with conclusions drawn from simple calculations, force one to believe that the pressure increase in the corona discharge is not due to Joule's heat. With the recent knowledge of the distortion of the field in the corona tube it seems very possible that the increase in pressure is due to ionization.—*Physical Review*, November, 1917.

Installations, Systems and Appliances

Apparatus for the Discovery of Metallic Objects Buried in the Soil.—When one thinks of the formidable mass of iron, steel and metallic alloys that during long months have been showered on the battlegrounds of Europe the question arises of how the earth is to be

rid of this encumbering metal, which because of the great quantity of unexploded shells and hand grenades that it contains would form an acute danger to agricultural laborers. A systematic "sweeping" of all the bombarded regions will be a necessary preliminary to the resumption of peaceful pursuits therein. So thinking, M. Guillebot de Nerville, engineer in chief of telegraphs and professor at the Ecole des Ponts et Chaussées, draws attention to an interesting apparatus which, though created for this special object, can be applied to other usages, since it will indicate the presence of all metallic bodies not too deeply buried in the soil. This "Alpha" apparatus, as it is called because of its form, will show the presence of a 75-mm. shell at a depth of 40 cm. (about 16 in.) and of a grenade at somewhat less depth. It is based upon the principle of the Hughes induction balance. A vibrated electric current furnished by a Ruhmkorff coil is transmitted to two identical but separated exploring coils, causing respectively an inductive emf. in two secondary coils which are in juxtaposition with them. These secondary coils are connected in opposition in the circuit of two telephone receivers. The two pairs of coils, comprising each a



ELECTRICAL APPARATUS FOR DETECTING BURIED METAL

primary coil and a secondary coil, are theoretically identical. The inductive emf. should therefore maintain a constant equilibrium and the receivers should transmit no sound. This is not usually the case, however, because dissymmetry always exists in the coils, which must be corrected by a regulator. When this has been accomplished, if one approaches a metallic mass with one pair of coils the inductive conditions of these coils will be changed and the telephone will sound. In the Alpha apparatus, of which M. Chanoit was the designer, the four exploring coils are arranged in pairs around two horizontal wooden disks, 60 cm. (about 2 ft.) in diameter, suspended at the ends of two wooden arms fixed at an angle of 45 deg. and joined by a cross-piece. The centers of the disks are about 1.5 m. (4.8 ft.) apart. The regulator is placed at the apex of the two arms. It comprises two small inclosed coils. Of these the exterior coil is fixed and in series with the primary circuit; the interior coil, inserted in the secondary circuit, can be turned 180 deg. in such a way that the angle of the two coils may vary 90 deg. in either direction. This instrument has already been put to use in connection with water service in locating the plates covering taps in places where these have been covered with earth and their exact position is uncertain. Whether the contrivance can be so improved as to be of use in mineral regions or to operate at greater depths remains for the future to show.—*Le Génie Civil*, Nov. 10, 1917.

Pressure Regulation of Rotary Converters.—R. G. DICKMAN.—Two methods of pressure regulation are discussed, (1) by means of reactance and (2) by means

of a synchronous booster. The principle of the first method is explained briefly and several curves are given showing values of power factor and reactance under varying conditions. The principle of the synchronous booster is discussed at length, and vector diagrams are given showing its action under different conditions.—*London Electrician*, Nov. 9, 1917.

Wires, Wiring and Conduits

Electrically Controlled Motorboats.—The British Admiralty states that the electrically controlled motorboats used by the Germans on the Belgian coast are twin petrol engine-driven vessels partly closed in, and travel at a high speed. They carry a drum with 30 miles to 50 miles (48.3 km. to 80.5 km.) of insulated single-core cable, through which the boat is controlled electrically. The forepart carries a considerable charge of high explosive, probably from 300 lb. to 500 lb. (136.1 kg. to 226.8 kg.) in weight. The method of operating is to start the engine, after which the crew leave the boat. A seaplane, protected by a strong fighting patrol, then accompanies the vessel at a distance of 3 miles to 5 miles (1.4 km. to 2.3 km.) and signals the shore operator regarding the direction of the vessel. On being steered into a ship the charge is exploded automatically. The device is a very old one. The only new features in the German boats are the petrol engines and W. T. signals.—*London Electrician*, Nov. 16, 1917.

Electrophysics and Magnetism

Anode Resistance Films.—JOHN T. TATE and PAUL D. FOOTE.—Experimental work has confirmed the existence of an anode polarization film, the resistance being less than that of the cathode film. The resistance of the anode film varies inversely with its area, but it should be emphasized that this relation was tested for wires of the same diameter and hence would probably not hold for wires of different diameters.—*Journal of Washington Academy of Sciences*, Dec. 4, 1917.

Efficiency of Production of X-Rays.—PAUL T. WEEKS.—The energy given out in the form of X-rays by a Coolidge tube has been determined by means of a bolometer, the values lying between 20 joules and 125 joules per ampere-second for potentials between 28 kv. and 54 kv. The energy supplied to the X-ray tube has been measured by its heating effect. The ratio between the X-ray energy and the energy supplied to the tube, or the efficiency of production of the X-rays which has been found for these potentials, varies between 0.58 and 1.87×10^{-3} . The X-ray energy is found to be nearly proportional to the cube of the potential across the tube. A comparison of these results with those obtained by others on the total ionization produced by X-rays indicates that only a fraction of the energy of the X-rays is transformed into the energy of the ions produced on total absorption in air.—*Physical Review*, November, 1917.

Telegraphy, Telephony and Signals

Telegraphy and Telephony at the French Front.—It is pointed out that portability is an essential element of signaling stations used at the French front, but the apparatus and methods employed approximate very closely those used in civil service. A central telegraph station, dynamo room and portable telephone switchboard in a station are illustrated and described.—*London Elec. Review*, Nov. 16, 1917.

Scientific and Industrial Research

A Department Devoted to Interchange of Ideas, Investigations Contemplated, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF

Cornell University, Ithaca, N. Y.

Summary of Investigations, Available Apparatus and Research Suggestions

INVESTIGATIONS UNDER WAY OR COMPLETED (RESEARCH WORK REPORTED SINCE NOV. 17)*

CABLES, HEATING OF.

Experiments are being conducted on heating of paper-insulated cables (some armored) in the ground, in bitumen and in conduits. Valuable results have been obtained showing the relation between the final temperature rise and current density. The values of the thermal resistances of the cable coverings and of the surrounding stoneware troughs filled with bitumen are also being determined.—*National Physical Laboratory and Prof. E. W. Marchant of the University of Liverpool, England.*

COAL.

Classification of coal resources of each district according to their qualities and the seams which are being worked, or which might in certain circumstances be worked, and the industrial uses to which the different kinds of coal are being put. It is intended to conduct investigations into the nature and origin of the various types of coal and into the chemical and physical behavior of their constituents under the action of heat and other agents.—*Fuel Research Board of the Privy Council, London, England.*

GLASS, FOR FIXTURES.

Progress has been made with several systematic investigations on glass problems, and the results of one of them have been published. These relate to the influence of small amounts of chlorides and sulphates in producing opalescence in glass.—*National Physical Laboratory, England.*

MEASURING INSTRUMENTS AND METHODS.

Development of electro dynamometer-type bridge comparator. Development of null method for measuring current, voltage and power; to replace use of electro dynamometer as deflection instrument.—*F. Wenner and E. Weibel, Bureau of Standards, Washington.*

OIL.

Research has been conducted for the last four years into the properties of insulating oils. A number of important engineering laboratories and firms have placed the services of their technical staffs and their works, together with a considerable quantity of oil, at the disposal of the research. A careful collation of existing information was undertaken before laying down the program for work.—*Institution of Electrical Engineers, London, England.*

PEAT.

An inquiry into the methods of preparation and use of peat for fuel and other purposes, and to suggest what means shall be taken to ascertain the conditions under which in the most favorably situated localities it can be profitably prepared and used.—*Committee of Inquiry, Department of Technical Instruction, Dublin, Ireland.*

PORCELAIN.

Extensive laboratory researches into porcelain and refractory materials.—*Dr. Mellor, Central School of Science and Technology, Stoke, England.*

RADIO TRANSMISSION.

Radiation resistance measurement by direct method taking into consideration all losses and field influences.

Form factor of radio antennas, measurement of.

Electromagnetic waves, investigation of the method for finding the direction and distance of origin.

Imperfect conductors and networks in the field of radio antennas, influence of.

Platinum-iridium and telluride vacuum thermo-element to be used for the measurement of very small currents in conjunction with a sensitive galvanometer, study of a new type of.

Thermo-elements for measuring small alternating and oscillatory currents in conjunction with low-resistance galvanometer; development of stable and sensitive types (completed 1917).

Antenna inductance, capacity and resistance, measurement of, with 1 per cent accuracy, taking into consideration the reflection and refraction throughout the system with capacity or inductive loading or parallel loading (completed 1916).

Weather conditions, influence of, on the logarithmic decrement of radio antenna systems and the influence of corona losses (completed 1916).

Antenna ground losses and the influence of geologic formation upon the natural free period of the system (completed 1915).—*Charles S. Ballantine, Director Radio Research Laboratories, Philadelphia, Pa.*

SEA WATER, SALINITY OF.

Development of compensated electrolytic cell for measurement of salinity of sea water.—*E. Weibel and A. L. Thuras, Bureau of Standards, Washington.*

STEAM.

A survey is being prepared of the field of research into the flow of steam in pipes.—*Bradford Association for Engineering Research, England.*

X-RAY BULBS.

Investigations have been conducted for the purpose of removing the difficulties experienced by manufacturers of X-ray bulbs.—*National Physical Laboratory, England.*

SUGGESTIONS FOR RESEARCH

CABLES.

Some tests indicate that a mineral-oil base is vastly superior to a rosin-oil base for impregnating paper insulation of high-tension cables. Considering the dielectric losses, it is claimed by some that mineral oil possesses certain disadvantages in other respects—for example, a greater tendency to drain—although from our experience and observation this is not the case. Some, therefore, recommend a mixture of the two. The dielectric strength of mineral oil varies but little with the temperature, while for rosin oil it decreases rapidly with increasing temperature. Further systematic tests would be of great importance in definitely clearing this point; also tests to determine the exact kind of mineral oil that gives the best results.—*A. S. Bang and H. C. Louis, Consolidated Gas, Electric Light & Power Company, Baltimore, Md.*

CABLES, COOLING.

Among various methods proposed for increasing the current-carrying capacity of underground cables, one is to lay them in special conduits through which water can be circulated or air may be blown. It is desired to work out the mechanical details of such an arrangement and to estimate the benefit derived with the different rates of water or air discharge.

FURNACES.

Electric furnaces for the fixation of atmospheric nitrogen.—*A. I. E. E. Committee on Electrochemistry.*

FUSES, ANNUNCIATOR FOR.

After a fuse has blown on a high-tension branch of a rural transmission line, it sometimes takes several hours before a lineman can be reached. It would be very desirable to provide a simple device which would be set in action by the blowing of the fuse and would report the fact to the nearest station over a special low-tension annunciator wire or over a service telephone line.

FUSES, SELF-RESETTING.

An inexpensive high-tension magazine fuse for branches of rural transmission lines. The fuse should have, say, six wires, of which only one is in service. Should it blow, the next wire should be placed automatically in the circuit. Should two or three fuses blow in rapid succession, indicating a real trouble, an automatic catch should prevent the next wire from sliding into place.

ILLUMINATION.

Automobile headlight glare, its scientific measurement and elimination. Definite standards for state laws and city ordinances.—*Editorial Suggestion.*

LIGHTNING ARRESTERS.

An inexpensive lightning arrester for rural transmission lines at voltages between 22,000 and 60,000. The device must be sensitive enough to relieve promptly over-voltages and at the same time to suppress effectively a power arc should one occur. The arrester may have moving parts, but must not require frequent attention, charging, refilling with a liquid, etc., and must not freeze in the winter.

OIL SWITCHES.

Should high-tension oil switches be rated in terms of the current which they can safely interrupt?—*A. I. E. E. Committee on Protective Devices.*

RELAYS.

Classification and distinct nomenclature of various types of protective relays to prevent their improper use to the impairment of service. Development of relays which permit greater economy in transmission-line metal by enabling lines to be operated in parallel in a number of combinations.—*A. I. E. E. Committee on Protective Devices.*

SWITCHES AND CIRCUIT BREAKERS.

The amount by which their rating should be cut down in cement and flour mills or other dusty atmospheres.—*J. M. Drabell, Cedar Rapids, Iowa.*

TRANSFORMERS, INSULATING.

On some long rural transmission lines on which troubles have been experienced from static disturbances and electric surges isolating transformers have been used in a few cases with apparently good results. Either a bank of one-to-one ratio transformers is used or else two banks of standard step-down and step-up transformers, so as to avoid ordering special transformers. It is of importance to investigate theoretically and experimentally the actual effect of such transformers and to determine for which particular kinds of disturbances they are effective in localizing the trouble.

TRANSMISSION AND DISTRIBUTION.

A letter of inquiry was addressed to twenty-three members asking for definite suggestions as to the most urgent problems concerning transmission and distribution. Replies containing twenty-four suggestions were received from thirteen individuals. Twelve of these suggestions related to high-tension insulators, seven to underground cables, one to lightning protection, one to relays, one to towers, one to reactors, and one to suppression of transient voltages. It appeared from the result of this inquiry that troubles with high-tension insulators and underground cables were uppermost in the minds of those who replied, most of whom were either operating men or men in close touch with the operation of transmission and distribution systems.—*A. I. E. E. Committee on Transmission and Distribution.*

TRANSMISSION LINE, CAPACITY OF.

On a long rural transmission line carrying a small load considerable trouble has been experienced on account of a disturbing effect of the electrostatic capacity of the line. This capacity sometimes causes poor voltage regulation and also creates favorable conditions for natural oscillations, resonances and surges. It would be well to investigate the possibility of inserting compensating reactive coils at intervals either in series or shunted across the line. These coils must be inexpensive and reliable in service.

VALUATION OF PUBLIC UTILITIES.

Terminology, definition of terms used in appraisals, and a possible unification of views held by various interests and professional groups.—*A. I. E. E. Committee on Economics of the Electric Service.*

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

CALIFORNIA COMMISSION ON WAR-TIME PROBLEMS

John A. Britton, H. F. Jackson and R. H. Ballard
Present Their Views at Initial Session
in San Francisco This Week

At a hearing on Dec. 10 before the California Railroad Commission, in San Francisco, in its investigation of war-time conditions of electric utilities, John A. Britton, vice-president and general manager Pacific Gas & Electric Company, testified that the available supply of electrical energy in California, without development of water-power sites on government lands, would be exhausted in less than two years despite what can be done through co-operation by interconnection and using power to the greatest advantage. Mr. Britton stated that consumers should share in cost of extensions owing to high price of materials and scarcity of labor, to enable power companies to conserve their own resources for development of efficiency and new power. High price of fuel oil makes necessary the development of more hydroelectric power, but the use of power sites is deterred by federal regulations.

The government can give relief, Mr. Britton stated, by opening power sites on government land. If restrictions were removed, 500,000 hp. would be available in California, 150,000 hp. of which could be developed in two years.

H. F. Jackson, Sierra & San Francisco Power Company, stated that duplication of distributing facilities should be eliminated, thereby saving labor and material. One steam relay plant should be made to serve several companies in the same region, saving fuel oil, wages, upkeep, etc. He believes that the present government policy which is holding back water-power development should be changed quickly. Power companies building large and expensive reservoirs in the mountains benefit irrigation districts below, therefore investment in reservoirs should properly be shared by the power company and the irrigation district.

R. H. Ballard, Southern California Edison Company, spoke of the undesirability of duplication, particularly the paralleling of utility lines by municipalities. The principal handicap of companies is inability to secure capital for development of natural resources. His opinion was that the present financial crisis affecting electric utilities is temporary, due only to the war, and that relief might be obtained by having federal reserve banks discount notes of public utilities.

Mr. Ballard also called attention to the fact that practically every utility in southern California is interconnected and steps are under way to extend that interconnection which benefits consumers and gives added efficiency in operation.

The investigation will continue. The commission will set forth the situation as it finds it and propose the proper remedies. The problems are being worked

out with full co-operation and assistance of representatives of all public utilities interested. Jan. 14 has been set for the next hearing, though this date is not definite.

"LIGHTLESS NIGHTS" PLANNED BY FUEL ADMINISTRATION

Proposed to Extinguish All Outdoor Lighting, Except Street Lights and Special Policing Lights on Certain Days

A statement forecasting "lightless nights" was issued by the United States Fuel Administration, Washington, on Dec. 10. It follows:

The United States Fuel Administration has under consideration a definite plan for "lightless nights" throughout the country, somewhat similar to "wheatless" and "meatless" days.

It is now proposed to darken all outdoor lighting, other than street lights and special municipal lights needed for police purposes, on certain nights of each week. On other nights, according to the plan, signs would be permitted to burn.

The plan under discussion provides for radical changes in the order put out on Nov. 9 last, which restricted illuminated signs to certain hours, making such exceptions of merchants' and theater signs as seemed reasonable. In actual application, it appears, this order is impracticable.

The evidence of all eyes is that the streets of cities are virtually as light as before these special signs were darkened. State federal fuel administrations in New York, Illinois and other states have reported in detail on the impossibility of getting results from the old order. They say it is the tens of thousands of small signs that count.

"Lightless nights" would save coal in large quantities, according to the figures before the Fuel Administration. It would be a part of the plan to show every citizen the war necessity and have him join in the saving. In every residence, apartment house and office building people would be asked to use not more than one-half the usual lighting.

Under the conditions noted in the November order the "white ways" have kept their brilliancy and the coal saving has not been large; under the new plan the "white ways" would disappear entirely on certain nights.

ASSOCIATED MANUFACTURERS MEET WAR SERVICE COMMITTEE

Enthusiastic Organization of Industry to Co-operate
with the Government Is Furthered by
Meeting in New York

Enthusiastic organization of industry to help the government win the war was accelerated by a meeting of members of the Associated Manufacturers of Electrical Supplies held at Delmonico's, New York, on Thursday of this week. It was a conference between members and chairmen of sections of the association and the representatives of the association on the general war service committee of the electrical manufacturing industry. Among those who spoke were H. B. Crouse, Robert K. Sheppard, J. R. McKee and A. W. Berresford.

INDUSTRIAL MOBILIZATION FOR THE PURPOSE OF WAR

Chamber of Commerce of United States, at Meeting
in Washington This Week, Brings About
Mobilization of Industries

The Chamber of Commerce of the United States at a meeting of committees of business men at Washington on Wednesday of this week brought about the mobilization of industries of the United States for war purposes.

The viewpoint of the government was presented to the meeting by W. S. Gifford, director of the Council of National Defense; Daniel Willard, chairman of the War Industries Board; Harry A. Garfield, Fuel Administrator; Edwin B. Parker of the Priority Board; Clarence M. Woolley, representing the War Trade Board; George N. Peek, industrial representative of the War Industries Board, and others.

Mr. Gifford said that the co-operative committees of the Council of National Defense, which have just been dissolved, had played a most important part in assisting the government to organize the war. It was now advisable to have the industries themselves name committees which should do some of the work which had been done by the council committees, and he intimated that it would not be an easy task to organize industry in this country completely.

Mr. Willard, in discussing the industrial end of the war, said that one mistake made was in concentrating orders too much in certain localities. This brought with it housing problems, transportation problems and in certain instances too great a demand for electric power. He said that at Niagara Falls there has been an overdrain on the supply of electricity available at that point.

Dr. Garfield startled his hearers by proposing the idea that there might be combined action by agreement in each industry with the purpose of reducing the consumption of coal, and said he would be glad to make such an arrangement if the business men present wished to do so. He gave figures to show that coal is being produced and supplied to all industries in larger quantities than in normal times, but that the United States is still 50,000,000 tons short of the unusual demand. These figures led him to suggest willing, co-operative conservation as the only method by which American business can get out of the hole it is in for want of coal.

Edwin B. Parker of the Priority Board, who spoke in place of Judge Lovett, director of priority in transportation, analyzed the objects of the War Industries Board, as he conceives them, one to increase production if necessary, and another to curtail demand if necessary to meet supply. He explained some of the problems of the priority agency in supplying the government as well as private industry, and its successful work through a system of classification, under which certificates allowing shipments are issued in twelve classes. The first, under "A," of which there are six, comprehend the demands of the United States and the allied governments in the way of munitions; those under "B," of which there are also six, comprehend materials for manufacturers, power for manufacturers and transportation requirements for manufacturers.

Clarence M. Woolley, representative of the Depart-

ment of Commerce on the War Trade Board, urged that business men generally bear in mind the elimination of "profiteering" although not of profit, and paid tribute to the average American business man, who, he said, is doing as much to help to win the war as the boys in the trenches.

George N. Peek, industrial representative of the War Industries Board, spoke of the necessity of co-operation between the industries board and the manufacturers. No industry, he said, will be classified as non-essential, but he said there are, however, many non-essential portions in some industries—odd sizes and styles—and that cutting down these non-essential portions will strengthen industry and prove beneficial to the government and the public at large.

At the Wednesday night session a central war industries committee of the National Chamber was created, of which Waddill Catchings is chairman. The new central committee was empowered by the convention in its resolutions to either increase its number or to organize an advisory council from the chairmen of the various war service committees, or both.

The convention voted that where there are at present war service committees they be requested to ask recognition of the war committee of the National Chamber, and it was provided that if they are organized in conformity with this report they be so recognized. All existing national trade organizations or associations which have not already appointed war service committees are requested to do so immediately. Where there is no national trade association or organization it was recommended that such organization be formed immediately. It was the sense of the convention that war service committees as far as possible shall be representative of the entire industry they represent. All war service committees now existing or selected as provided in the resolutions are to be vested with authority to represent the industries in their relations with the government during the war.

WAR SERVICE COMMITTEE DATA ON CAPACITY AND DEMAND

Electrical Division of War Industries Board Expresses Appreciation of Patriotism in Offers to Invest in Additional Equipment

A bulletin of the electrical division of the War Industries Board dated on Dec. 8 says:

The requirements for motors above 100 h.p., and for power transformers above 500 kva. have increased this past week. Some of the manufacturers have expressed a willingness to expand their capacity in the larger sizes provided we could assure them this additional capacity would be utilized. It would be inadvisable to offer such assurance at this writing. The data brought to Washington by the war service committee for the second conference are being digested and the available capacity tabulated against the existing demands. As soon as this study has been completed, we will know the exact status of production capacity as compared with the demands.

It is our purpose first to satisfy the existing demands and then attempt to estimate future needs. The results of this estimate will be given you for your guidance as to the desirability of increasing your capacity in any type of equipment.

It is a pleasure to express our appreciation of the patriotism displayed in these offers to invest in additional equipment.

CONTRACTORS PROGRESS IN NEW PLAN OF ORGANIZATION

Now Believed to Be Every Probability that New
National Executive Committee Will Be Called
Together in January

Rapid progress in the acceptance of the new constitutional plan of the National Association of Electrical Contractors and Dealers is reported by James R. Strong. This plan, as outlined in previous issues of the *ELECTRICAL WORLD*, was prepared by a committee consisting of Mr. Strong as chairman, William L. Goodwin and Earnest McCleary. It was adopted at the annual meeting in New Orleans in October and is now being considered and acted upon separately by the individual state organizations. Mr. Strong said to a representative of the *ELECTRICAL WORLD* that the plan is receiving enthusiastic acceptance and support. He says that progress is so encouraging that it is likely the new national committee will be called together before the middle of January in Chicago.

The organization meeting of the national executive committee is dependent, however, said Mr. Strong, upon action by the sixth State in the Atlantic division and the second State in the Pacific division.

"Eight or nine States in the Central division have accepted the plan," Mr. Strong said, "and it was expected that a meeting of that division would be held in Chicago this week. In the Atlantic division five States have adopted the plan in the order named: New Jersey, Connecticut, Pennsylvania, Massachusetts and New York. At least four other States are less well organized: Georgia, Virginia, Maryland and also the District of Columbia, which is recognized under the plan as a State. Rhode Island is expected to have a meeting early in the year. It is expected that a meeting of the Atlantic division will be called in New York before Christmas. I am gratified," he went on, "that the lighting companies are taking hold so strongly. The Public Service Electric Company of Newark, N. J., through its merchandising department, has joined the national association as an associate member."

FIGURE COAL SHORTAGE NOW EQUAL TO 130,000,000 TONS

Mr. Manning Shows How Poor Quality Really
Increases Deficiency—Good Engineering and
Boiler-Room Conservation Needed

In discussing the general need of fuel conservation in boiler rooms, Van H. Manning, director of the Bureau of Mines, issued the following:

There is one phase of the present coal situation which may put an entirely different light on the supposed increased production of coal of the present year. In round numbers, there was produced 600,000,000 tons of fuel last year. Statement has been made that 50,000,000 more tons will be mined this year. The preparation of this increased quantity of coal has not been so good as in times past. Analyses of samples show in many cases a greatly increased quantity of ash. Repeated cases are brought to the attention of the Bureau of Mines where coal which would run from 6 to 8 per cent ash in normal times is running from 12 to 18 per cent of ash in these abnormal times. Complaint about the preparation of coal is very general, and it is not at all improbable that 5 per cent more ash is included in this year's coal than in previous years. If such a figure

is true, it means that 32,500,000 tons of the estimated output of 650,000,000 tons is nothing but increased ash. If we can imagine over 600,000 car loads of ash being added to the present burden of transportation, the evident effect on car supply and transportation troubles will be seen.

If this were the end of the matter it would not be so bad, but there is another factor well known to engineers which is apt to be overlooked by the non-technical user. The extensive experiments carried on by the government at the St. Louis exposition showed that with the coals used there was a decrease of about $1\frac{1}{2}$ per cent in efficiency for each 1 per cent addition to the ash content of the coal—that is to say, the inclusion of more ash with the coal not only decreases the value of the fuel the amount equal to the useless ash but it also makes the remaining good coal less effective to the extent of $1\frac{1}{2}$ per cent for each 1 per cent of ash. The inclusion of 5 per cent more ash in the fuel, therefore, means a reduction in efficiency of the remaining good coal of about $7\frac{1}{2}$ per cent, which, added to the 5 per cent useless ash, makes a total reduction in effectiveness of $12\frac{1}{2}$ per cent.

According to this point of view, although 650,000,000 tons may be produced in 1917, its effectiveness as compared with previous years is probably about seven-eighths of this and equivalent to a production of normally prepared coal of about 570,000,000 tons. We have, then, instead of an increased production as compared with last year, an actual decrease of effective coal of about 30,000,000 tons. If this be added to the estimated increased needs, due to our accelerated activities, of 100,000,000 tons, we have a deficiency of the equivalent of 130,000,000 tons, instead of 50,000,000 tons, to make up by good engineering and true fuel conservation in the boiler room.

ENGINEERING STUDENTS IN MILITARY SERVICE

New Ruling by Provost Marshal General Places Se-
lected Students in Enlisted Reserve Corps
of Engineer Department

A new ruling of the Provost Marshal General, modifying in material degree the position held heretofore in regard to the exemption of engineering students in the draft, was issued at Washington on Dec. 8.

The following has, therefore, been added by the Provost Marshal General to Section 151 of the selective service regulations:

"Under such regulations as the chief of engineers may prescribe a proportion of the students pursuing an engineering course in one of the approved technical engineering schools listed in the War Department as named by the school faculty may enlist in the Enlisted Reserve Corps of the Engineer Department upon presentation by the registrant to his local board of a certificate of enlistment. Such certificate shall be filed with the questionnaire, and the registrant shall be placed in Class V on the ground that he is in the military service of the United States."

The regulations of the chief of engineers limit this privilege to those students to whom the school issues the following certificate properly attested by the president of the school:

"I hereby certify that ——— is a regular student of the ——— class in good standing as candidate for an engineering degree at ———, and that in the judgment of the faculty of this school, based upon his academic record supplemented by his relations with fellow-students and by observation of his instructors, he may fairly be regarded as deserving a place in the first third qualitatively of the young men graduating from this institution during the past ten years."

Service Quickly Restored at Halifax

After-Results of Terrible Explosion's Disaster and Loss of Life Are Lessened by
Rapid Restoration of Public Utility Service—Great Devotion Shown
by Officers and Employees—Many Offers of Help

FOUR thousand tons of trinitrotoluol (T. N. T.) exploded on board the French munitions ship Mont Blanc at Halifax, Nova Scotia, on Thursday morning of last week, killing about 1200 persons, injuring many thousands and destroying about five square miles (1295 hectares) of the city and suburbs on the north side of the provincial capital. The explosion followed a collision in the "narrows" of Halifax harbor between the Mont Blanc and the Belgian relief ship Imo, and led immediately to conflagration which transformed the afflicted area into ruins within a few hours. About 25,000 people were rendered homeless, scarcely a building in Halifax or Dartmouth escaped injury, and the property loss is estimated at \$20,000,000. Despite the terrible and widespread devastation, public utilities in the main escaped crippling losses. A representative of the ELECTRICAL WORLD who went to Halifax reports that in the period of rescue and revival these utilities are rendering service of untold value.

Electric lighting and power service in the Halifax district is supplied by the Nova Scotia Tramways & Power Company, Ltd., which also operates the electric railway and manufactures and sells gas in Halifax. It serves a population of about 65,000. The Canadian government has undertaken extensive dock improvements at Halifax to cost about \$30,000,000, of which about \$10,000,000 has already been expended or contracted for. Annual gross earnings of the Tramways & Power Company are about \$800,000. The company owns important water-power rights on the Gaspereau River, 55 miles (88.5 km.) from Halifax, capable of a hydroelectric development of about 12,000 hp.

A general description of the central station system was published in the ELECTRICAL WORLD Nov. 23, 1912, page 1089. The generating plant is on the west side of Halifax harbor, about one-half mile (0.8 km.) from the business center and approximately 2.5 miles (4 km.) south of the explosion center. Its generating ca-



NOVA SCOTIA TECHNICAL INSTITUTE

Although this building is situated two miles south of the explosion center, nearly every window on the north side of the structure was blown in by the force of the concussion.



DEVASTATION OF WATERFRONT, HALIFAX HARBOR, NORTH OF THE NORTH STREET RAILROAD STATION



ONE OF HUNDREDS OF SHATTERED ARC-LAMP GLOBES; WRECK OF 13,200-VOLT TROLLEY LINE



TELEPHONE AND SUPPLY LINE WRECKAGE; TROLLEY CAR WARPED OUT OF SHAPE; EMERGENCY LINES AT RIGHT

capacity is 5700 kw. There are now two horizontal turbo-alternators supplied by the Canadian General Electric Company and two 600-kw. units directly connected to Rice & Sargent engines. The turbines are rated at 1500 kw. and 3000 kw., the latter machine having been added recently. The boiler plant consists of seven 350-hp. and seven 300-hp. Babcock & Wilcox units, the former being equipped with Jones underfeed stokers and the latter with B. & W. chain-grate stokers. There are two Alphons-Custodis stacks, one 90 ft. (27 m.) high and 7 ft. (2.1 m.) inside diameter, the other 175 ft. (53.3 m.) high, with an inside diameter of 8 ft. (2.4 m.).

Quite recently the company has added materially to its power load, and its residential and commercial lighting business is an important factor in its service. Window lighting, however, is restricted in Halifax by war regulations requiring the shielding of interior illumination from egress through windows and doors. It is estimated that if this restriction were not enforced about 500 kw. in additional lighting load would be thrown upon the station. H. R. Mallison is managing director of the Tramway & Power Company, Philip A. Freeman being superintendent and chief engineer.

Telephone service in the Halifax district is furnished by the Maritime Telephone & Telegraph Company, J. H. Winfield being general manager. Telegraph facilities are handled by the Canadian Pacific Railway, Fred L. Colborne being in charge of the local office, and by the Western Union Telegraph Company, G. L. Laidlaw local manager. Halifax is also an important cable center.

EFFECTS OF THE EXPLOSION AND FIRE

The explosion occurred at 9.05 a. m. and destroyed the greater part of the overhead lines in the so-called Richmond district of Halifax, as well as in Dartmouth. Breaks and short circuits in the distribution system of the Tramways & Power Company necessitated shutting down the generating plant for a short period, but within an hour the station was again supplying energy through parts of its territory outside the explosion zone. The fall of the overhead circuits, trolley wire and feeders opened a large number of automatic breakers and switches at the power plant. Practically all windows and doors on the north side of the station were blown in, debris scattering about the operating room for 40 ft. to 50 ft. (12 m. to 15 m.) from the wall. The tremendous air currents set in motion knocked down some employees. None in the station, however, was injured seriously. Windows on the north side of the station were of wired glass set in steel sashes, but these were blown to bits. A large amount of glass was blown into the motor-generators near the north wall, and the railway switchboard was also subjected to a shower of this material. Little damage was done, however, either in the station or in the adjacent car repair shop. The boiler room suffered little if at all. Considerable damage was done to the gas holder, which was stripped of some crown plates. About 200,000 cu ft. (17,000 cu. m.) of gas escaped. The holder was repaired and gas put in on Sunday morning at 11 o'clock. The company is not yet aware of the damage which mains may have sustained in the zone of the explosion and fire. Minor cracks developed in the gas retorts.

Many of the short circuits on the distribution system were burned out quickly. As soon as possible the line superintendent and two men proceeded to the vicinity of the North Street station (the Halifax railroad passenger terminal) and cut clear across the city, beginning at North Street, all the overhead lines of the company entering the devastated district. This work was completed during the afternoon.

Restoration of general service to residences and commercial establishments within a few hours of the explosion was greatly appreciated by citizens and customers. Many power customers had business places damaged by explosion or destroyed in the fire. Prior to the disaster the peak load upon the station was 3100 kw., but curtailment of demand resulting from destruction of so large an area has reduced this to about 1500 kw.

Street-lighting service was not generally interrupted outside the explosion zone. Some rearrangement of circuits was required at the station tub transformers, but this was done in time to light streets over a large part of the city when night fell. A considerable number of arc lamps were injured by the air blast, many globes being broken. A shortage of lamp trimmers resulted from the natural disorganization because employees went into the danger zone to ascertain the condition of families and homes. No public utility linemen were killed in the explosion or fire so far as has been learned, and great devotion has been shown by officers and subordinate employees of all the companies in striving to get things back toward normal in all branches of service.

The tramway company supplies energy to Dartmouth over a 13,200-volt transmission line, which passed through the explosion zone. This line was wrecked at one point not far from the North Street terminal. It crossed the harbor as a submarine cable and as yet it is not known whether the cable was injured.

For an hour after the explosion operators continued giving service, but were obliged to leave their posts upon demand of the military authorities. Meanwhile fire was raging in the stricken district and caused further serious damage to both telephone and telegraph lines. Telephone service in the downtown and southwestern parts of Halifax was resumed rapidly, and by mid-afternoon conditions approached normal outside the explosion area. Many operators remained loyally at work in spite of having relatives killed or injured. During the afternoon a government telegraph line was placed in service. Two telephone company operators are among the missing.

A great degree of credit is due to public utility employees and officers whose unselfish efforts accomplished so much in the face of great obstacles. Telegraph operators and company staffs outside Halifax, no less than within the city, worked without stint day and night to restore lines and to handle the traffic.

Public utility companies, manufacturers and engineers in many parts of Canada and the United States have vied with each other in relief work, sending personal representatives and offers of aid to a degree greatly appreciated in Halifax.

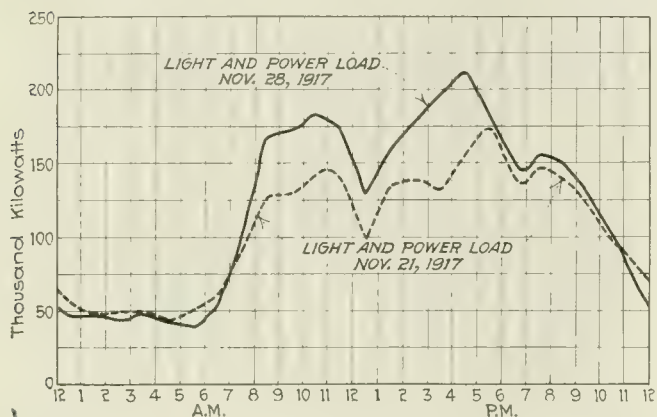
It seems probable now that financial losses to public utilities will not exceed \$150,000 to \$200,000, although details are scarce. The tramway company loss appears to be under \$100,000 at this writing.

HOW DAYLIGHT DARKNESS AFFECTS THE LOAD CURVE

Condition of Atmosphere Makes Difference of 35,000 Kw. in Light and Power Load of Commonwealth Edison Company of Chicago

The entire city of Chicago was blanketed by a dense black cloud of fog and smoke on Nov. 28. In the downtown or loop district especially darkness equal to night was closely approximated.

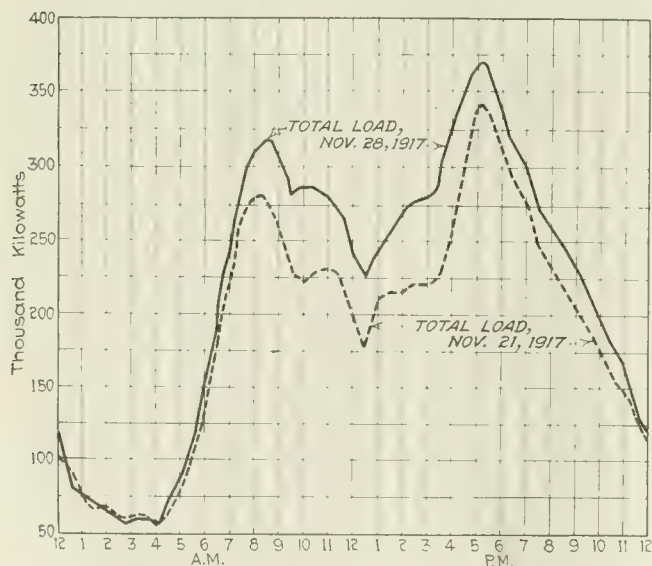
The effect of "daylight darkness" on the load thrown



LIGHT AND POWER LOAD ON A DARK AND ON A LIGHT DAY

on the Commonwealth Edison Company lines is best shown in accompanying curves.

Fig. 1 shows the light and power load on Nov. 28—the dark day—and on Nov. 21, a fairly clear day one week previous. In both forenoon and afternoon peaks the load was about 35,000 kw. greater on the dark day. If imagination is given free rein, the curves may be interpreted to show also that some people did not arise so early on the dark day as was their custom. The small dip in the curve between 6 p. m. and 7 p. m.



TOTAL LOAD ON A DARK AND ON A LIGHT DAY

might be attributed by some to effectual working of the Fuel Administrator's sign order. The truth is, however, that it is caused by the going-home habit, and represents the period between which light is used at the office and at the home. The sign business is too small to show any effect.

Fig. 2 shows the total load on Nov. 21 and Nov. 28.

These curves include light and power load in addition to railway load. It is interesting to compare the curves with a similar set on another dark day in 1913. Those curves were published in the ELECTRICAL WORLD on Dec. 13, 1913, page 1199.

SMALL-TURBINE SITUATION AND WATER-COOLING DATA

Abstracts of a Few Important Papers and Discussions Presented Before the Recent Annual A. S. M. E. Meeting in New York

Several valuable papers and discussions were presented at the recent annual meeting of the A. S. M. E. which could not be abstracted in last week's issue of the ELECTRICAL WORLD for lack of space. They were on the subjects of "A Commercial Analysis of the Small-Turbine Situation," "The Cooling of Water for Power-Plant Purposes" and "The Transfer of Heat Between a Flowing Gas and a Containing Flue," being prepared by W. J. A. London, C. C. Thomas and Lawford H. Fry respectively.

COMMERCIAL ANALYSIS OF SMALL-TURBINE SITUATION

Mr. London's paper was devoted to a commercial analysis of the four types of small steam turbines now on the market and used for the driving of auxiliary machinery. The paper deals principally with non-condensing units. In these high thermal efficiency is in many cases unnecessary on account of economic utilization of the exhaust steam, and as economy bears a definite relation to first cost, a highly efficient machine is often a mistaken investment. Moreover, operating conditions are generally such that the designer must sacrifice considerations of efficiency if they interfere in any measure with simplicity and durability.

The theoretical design, according to the author, presents no difficulties, but the mechanical design is what determines success or absolute failure. Some of the problems involved and the methods that have been employed in solving them successfully are indicated.

The average specification calls for very rigid guarantees as to steam consumption, speed regulation and load requirements. These, in the opinion of the author, are in most cases unnecessarily severe and merely tend to increase the cost of installation. After an extended survey of the situation, he has formulated a "code of practice," given in an appendix to the paper. The adoption of this code would, he believes, bring about a reduction in selling prices, eliminate many of the unpleasant experiences which now often arise between manufacturers and customers, and thereby increase the popularity of the turbine-driven unit.

Among those presenting discussions on this paper were O. D. H. Bentley, C. P. Crissey, M. Nusim, Prof. A. G. Christie, A. L. McMurtry and Herbert D. Reynolds.

Mr. Bentley pointed out that the water rate rather than the horsepower determines the diameter of a turbine rotor and questioned the advantage of the extra capacity of Curtis turbines for a given diameter. Although overhung turbines are cheaper, most engineers favor rotors hung between bearings. Self-contained apparatus has the advantage that the responsibility for improper operation cannot be shifted

Owing to the difficulties in providing proper clearances with overhung units, Mr. Crissey stated that overhung units should be developed only by manufacturers of combined units and not by manufacturers of separate units which are later combined.

Mr. Nusim pointed out that the steam economies possible with some of the small units now on the market are as high as those formerly obtained with much larger units. On account of war conditions, water treatment and use of economizers are more necessary than ever, Professor Christie contended. Since less exhaust steam is required for feed-water heating when economizers are used, the efficiency of auxiliary turbines should be higher than would otherwise be necessary. Attention was called to the necessity of knowing the effect of various back pressures on the performance of turbines and of determining whether maximum efficiency should be obtained at normal rating or less.

Mr. McMurtry urged simplicity, reliability and efficiency in auxiliary turbines. To this end the company with which he is connected is arranging for forced oil circulation in all turbines except small ones using ball bearings. Oil coolers are advisable, and governors should receive ample lubrication. Machines should be designed so that flexible shafts are not required. Emphasis was laid on the importance of purchasers specifying the conditions under which turbines should carry rated load.

Mr. Reynolds points out that turbine efficiency is important where exhaust is used for feed-water heating, since, while all heat is recovered, utilization of the exhaust steam does not make up for the boiler losses in producing the steam. Where the exhaust is used for industrial heating, etc., the efficiency is not so important.

In closing, Mr. London pointed out that considerable trouble is due to turbines getting out of alignment. Under present conditions more serious thought should be given to the question of whether to pay more for a turbine to obtain higher efficiency, as operating costs are becoming considerably larger relative to fixed charges. In replying to Mr. McMurtry's contentions, he expressed the opinion that forced feed is not necessary for small turbines as oil rings are sufficient. Overhung turbines should not be objected to on the basis that the critical speed is reduced, as the latter is a direct function of deflection. Since this is reduced when an overhung rotor is used, the critical speed is raised.

COOLING OF WATER FOR POWER PLANT PURPOSES

The paper by C. C. Thomas gave the results of an extended experimental investigation into the conditions governing the cooling of condensing water of power plants by means of spray ponds. This investigation involved determining the efficiency of the cooling process under varying conditions of pressure at the spray nozzles, the temperature of the water to be cooled, the power required to circulate the water, the height of sprays above the pond surface, the effect of wind velocity on the cooling range, etc. The work has resulted in a large collection of data, much of which was included in the paper.

As a result of his experiments the author has developed a new form of spray head or nozzle which is so adjustable that the film of water discharged may be broken into a uniformly fine spray, a mist or a large number of small drops, as desired. This method of

spraying is particularly applicable to low-pressure work, a pressure of 10 in. (25.4 cm.) of mercury giving an exceedingly fine spray, and 8 in. (20.8 cm.) usually sufficing. The newly developed spray head provides for the control of the system in a manner which, while somewhat less complete than in the case of the cooling tower, yields results comparing very favorably with those for the tower and can be installed and operated at a much lower cost.

Among those who discussed the paper were B. R. T. Collins and Prof. A. G. Christie. Mr. Collins pointed out that it is advisable to have a certain depth of water in a cooling pond, as the bottom of the pond will otherwise absorb heat and transmit it to the water, thus cutting down the cooling effect. He also said that the lowest efficiency is obtained in cool, dry weather, whereas the highest efficiency is obtained in hot, humid weather. This is just the opposite of experience with cooling towers.

Professor Christie said that it had been found that 18 in. to 20 in. (45.7 cm. to 50.8 cm.) of water is better than 3 ft. (91.4 cm.) of water in a spray-cooling pond.

TRANSFER OF HEAT BETWEEN A FLOWING GAS AND A CONTAINING FLUE

In his paper on this subject, Lawford H. Fry of Burnham, Pa., showed that, in the range of experimental data available, a logarithmic formula adapted from that proposed by Hedrick and Fessenden gives satisfactory results. In passing x ft. along a flue of mean temperature t the change in gas temperature from T_1 to T_2 is given by the equation

$$\text{lolog } T_1/t - \text{lolog } T_2/t = Mx,$$

where "lolog" means the "the logarithm of the logarithm" and the coefficient M is determined by the perimeter and hydraulic depth of the flue and by the rate at which the gas flows. Simple formulas connecting the coefficient M with these quantities are given.

The wide range of the experimental data on which the formula is based may be summarized briefly as follows:

Gases.—The gases experimented with were products of combustion, lighting gas, CO, and air, all at atmospheric pressure; also air at pressures ranging from 0.15 lb. to 140 lb. per square inch (1.05 kg. to 7.8 kg. per sq. cm.) absolute.

Rate of Flow of Gas.—The rates of flow ranged from 0.5 lb. to 650 lb. (0.23 kg. to 294.8 kg.) per hour.

Flues.—Flues of annular and circular cross-section were used, with effective diameters ranging from 0.5 in. to 2.0 in. (1.27 cm. to 5.08 cm.), and of lengths from 0.64 ft. to 20 ft. (0.18 m. to 6.1 m.).

Temperatures.—The inlet temperatures ranged from 2340 deg. Fahr. (1280 deg. C.) with the products of combustion being cooled to 55 deg. Fahr. (12.8 deg. C.) with air being warmed.

The paper was discussed by Prof. E. A. Fessenden, G. L. Ostrand and D. S. Jacobus.

W. J. Baldwin of New York City presented a paper on "Apparatus for Cooling, Drying and Purifying Air."

"Plotting Boiler-Test Curves" was the subject of a paper by A. H. Anderson of Chicago, Ill. A method is presented by the author, the utility of which is demonstrated by the solution of problems from graphically recorded test data.

UTILITIES TO HELP SELL THE WAR SAVINGS STAMPS

Frank A. Vanderlip Says Companies Can Establish in
Their Offices Authorized Selling Agencies—
John W. Lieb Urges Co-operation

Frank A. Vanderlip, as chairman of the National War Savings Committee, asks utility companies to help the sale of the \$2,000,000,000 of war savings stamps.

John W. Lieb, chairman of the National Committee on Gas and Electric Service and president of the National Electric Light Association, to whom Mr. Vanderlip has written about the matter, has formally called the attention of the N. E. L. A. to the plan and urges active co-operation to assist the government.

The letter from Mr. Vanderlip to Mr. Lieb says in part:

These stamps will be obtainable at post offices, banks and trust companies, but to make the campaign an unqualified success it is the government's desire to have them for sale at as many other authorized agencies as possible.

The public utility companies offer admirable facilities for assisting in this campaign through their offices, which

SELL WAR SAVINGS STAMPS

Mr. Vanderlip says in his letter to Mr. Lieb:

"In brief, the war-savings plan offers a means whereby any individual may assist in winning the war by investing his savings in amounts of 25 cents in government thrift stamps. When sixteen thrift stamps have been acquired they may be exchanged for a five-dollar war savings stamp, by adding 12 cents in cash prior to Feb. 1, 1918, and 1 cent additional each month thereafter. Those who prefer may buy five-dollar war savings stamps outright. Both kinds of stamps will be purchasable from December, 1917, to Dec. 31, 1918, and the war savings stamps will be redeemable on Jan. 1, 1923, at purchase price plus accrued interest at 4 per cent per annum, compounded quarterly. Thrift stamps will bear no interest."

are equipped to handle cash and are constantly coming in contact with the general public.

While the committee will send communications to all utility companies asking their assistance by establishing in their main and branch offices authorized selling agencies of the United States Treasury, it has felt that your association can be of great help by indorsing this movement and urgently soliciting the hearty co-operation of its members.

Inclosed is a pamphlet giving full details concerning the war savings stamps together with a circular suggesting steps to be taken by utility companies in establishing in their offices authorized selling agencies of the United States Treasury. Companies can buy original supply of thrift stamps and war savings stamps at nearest post office as per second method in attached circular and replenish their offices according to day-to-day sales capacity.

The government invites your co-operation and assistance in this very important undertaking. The urgency of your giving all co-operation possible cannot be too strongly emphasized. If we are to win the war, we must win it as a united people. The thrift and savings of every man, woman and child are necessary to insure American honor and the cause of democracy throughout the world.

The formal letter sent to the N. E. L. A. by Mr. Lieb as chairman of the National Committee says:

The National Committee on Gas and Electric Service, representing various public utility industries in war service matters, has rendered effective service to the Treasury Department through the member companies of the national associations of the respective industries in connection with the promotion of the Liberty Loans. The committee has now been called upon for further service and has promised the hearty support and co-operation of all of the public utility companies represented in its activities in connection with the placing with the public of thrift and war savings stamps, soon to be issued by the United States Treasury Department under the auspices of the National War Savings Committee, Frank A. Vanderlip chairman.

You will receive at an early date a letter from Mr. Vanderlip containing a direct appeal to your association, inviting its co-operation through the utility companies which it represents throughout the country in assisting the placing of the war savings certificates with the people by placing them on public sale in all of the cash-handling offices and branch offices of the utility companies, which for this purpose will be made authorized selling agents of the United States Treasury.

On receipt of the communication from the National War Savings Committee, will you kindly communicate at once with each member company represented by your association, urging its active co-operation in assisting the government in giving the widest possible publicity to the plan of war savings, and making available, as far as practicable, as sub-agencies of the government for the sale of these stamps, every public utility office in the land?

It is expected that the National War Savings Committee will communicate directly from its Washington headquarters with every utility company in the United States, whether connected with a national association or not, but it is urged that you may be of assistance by indorsing the movement and inviting in a separate communication to each one of your member companies its hearty co-operation and support of the movement.

"SURELY CONGRESS WILL RELEASE THESE RESOURCES"

Secretary of the Interior Lane Draws Attention to
the Need of Congressional Action on
Water Powers

Secretary of the Interior Franklin K. Lane, in a brief practical discussion of the war, says in his annual report to Congress, made public this week:

Modern industrialism may be epitomized as power plus iron. We lack neither. It is the unprecedented and the not-to-be-anticipated burden of providing not alone for ourselves, but for nearly all of western Europe and part of Asia and Russia which makes the great demand. For our own needs we have coal and iron and nearly all the rich line of less common minerals in abundance. It sounds most boastful to say that the most paternal of governments, intent upon a dynastic purpose, would hardly have found ways to supply itself more liberally with the fundamentals of the great war industries than has been effected by the quiet searching and working of this free people. And what is true as to minerals is equally true as to the products of the soil. The large liberty of life and the casting of responsibility upon the individual, allowing personal ambition to be a substitute for direct command, and curiosity to be the spur to knowledge—these have put under crop the greater part of the continent and made this the relief depot of starving nations.

Of one thing, however, we may be sure, that a nation intent upon its own self-sufficiency would not be holding under what is tantamount to government withdrawal the two newest sources of power—substitutes for that coal which costs the labor of a million men and is the greatest of all the burdens of our railroads—water power and petroleum. It may be expected surely that Congress in its coming session will release these resources by passing those leasing bills which have so long been pending in both houses.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Minimum Charge Advanced.—The Cloverport (Ky.) Light & Ice Company has advanced the minimum charge for lighting service from 50 cents to \$1 monthly.

Detroit Edison Stockholders Authorize Debentures.—Stockholders of the Detroit Edison Company have authorized the issue of \$9,000,000 convertible debenture bonds. The interest rate will be determined by the directors.

Water Shortage Affects Tacoma Plant.—The long-threatened water famine in the Nisqually River has materialized, and the Tacoma municipal light plant at La Grande has been incapacitated so badly that Commissioner of Light H. F. Gronen has been compelled to cut off the Nitrogen Products Company load of 3000 kw., the Bilrow Alloy Company load of 3000 kw. and the Tacoma Railway & Power Company emergency load of 3000 kw.

Malicious Breakeage Costs City \$30,000 a Year.—The Department of Gas and Electricity, city of Chicago, announces that each year it is forced to spend approximately \$30,000 to repair malicious damages to street-lighting equipment. Work now in progress will within a year double the number of street lamps in operation, and this will probably increase the damage to \$60,000. It is estimated that \$60,000 would pay for operation of approximately 8000 new-style tungsten lamps, now being installed, or 2000 600-cp. lamps. The department of gas and electricity is endeavoring to institute a vigorous campaign against this wanton waste and hopes soon to be able to make an example of some of those who commit the depredations in question.

Municipal Plants at Hamilton, Ohio, Losing.—In the report of Engineers Maed and Seastone the valuation placed on the municipal gas, water and electric plants at Hamilton, Ohio, is \$1,672,250. Each is said to be in an unsatisfactory physical condition. In 1916 the electric plant is said to have showed a profit of \$22,359, but the water plant lost \$11,687 and the gas plant \$32,344. The loss for the last seven years is placed at \$300,000. Causes for this condition are the lack of co-operative action between the executive and legislative departments of the city government, resulting in insufficient appropriations for extensions; non-observance of state laws and city ordinances, bad administrative policies, and appointments apparently made on a political basis rather than for ability and efficiency. The report advises increase of rates in all departments and improvement of plants according to modern methods. It criticises municipal

ownership and says that its history is not one of which the country can be proud. A municipality cannot, as a general proposition, it holds, generate power or furnish service at a cost to itself as low as a private company can. Messrs. Maed and Seastone were employed by the city to make an investigation of the plants at a cost of about \$3,000.

Giving Telephone Service in Washington.—D. S. Porter, manager Chesapeake & Potomac Telephone Company at Washington, has made public interesting figures in regard to growth of war-time telephone service. There are now more than 7000 government telephone stations in Washington and its environs. On Jan. 1, 1917, Washington had a telephone plant for 350,000 people, the population. Needs of the company had been prearranged for a year, including a 30 per cent increase on account of the inauguration period in March, but there was a 55 per cent increase about April 6, when war was declared. The total increase has now become 70 per cent for Washington calls and 219 per cent for long-distance calls. More than 400 expert workmen from other communities have been employed in Washington in installation work since the middle of March. Five training schools for operators were established. One difficulty is that the company has surrendered to the government many trained operators needed for most important government stations. Government telephone stations in Washington alone increased 75 per cent during the period. Switchboard manufacturers all over the country turned their complete output over to Washington.

Increases in Rates.—Joseph H. Brewer, president American Public Utilities Company, says in a report to stockholders: "In addition to the increases in rates reported to you on Oct. 1, the company has been successful by negotiation with the citizens in obtaining increases in its rates at Jackson, Miss., where we are operating under franchises. At Holland, Mich., where the rate for gas is 90 cents per 1000 cu. ft. and where the company has for a number of years been operating at a loss, notice has been given to the city authorities that the company is unable to meet its present operating expenses from the revenues derived from the sale of gas and therefore, regardless of the provisions of the franchise, it will be necessary to collect \$1.15 per 1000 cu. ft. or cease operating the plant. The city authorities have indicated a disposition to contest the proposed action of the company in raising its rates and this will undoubtedly lead to litigation and possibly a receivership for the Holland City Gas Company. All of the stock and substantially all of the bonds of the company are owned by the American Public Utilities Company. It has been the judgment of the officers of the company that this result is preferable to suffering further loss over the period of the franchise. Every kilowatt-hour which it is possible to generate at the new Wisconsin dam is being sold."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Rules Regarding Meter Deposits.—The general rule is that a public service company furnishing gas may require the charges to be paid for a reasonable term in advance or be secured by a reasonable deposit by the consumer, and may enforce such a requirement by the refusal of service to persons who do not comply, the Court of Appeals of Kentucky held (197 S. W. 1081). The rule permitting the utility to require a deposit does not permit the company to hold the consumer's money without paying interest.

Water Appropriations Aid Abandonment.—Under the code, where the first appropriator within reasonable time commenced to apply all the water claim to the use stated, he could ignore intervening and subsequent appropriations, the Supreme Court of Washington held in Pleasant Valley Irrigation & Power Company versus Okanogan Power & Irrigation Company (167 P. 1122). The mere fact that a flume carrying waters from several streams was the same size above and below the point of diversion from one stream did not show an abandonment of the right to take waters from such stream at some future time.

Damages Where Insurance Is Available.—In an action against an electric company for damages for the death of plaintiff's husband, a lineman in the employ of a telephone company, killed by coming in contact with the electric company's defectively insulated wire strung on the same pole and close to the telephone company's line, the plaintiff's release of her rights against the telephone company on the receipt of certain insurance money from an insurance fund payable independently of negligence, did not preclude her action of tort against the electric company, although the release in terms covered any claim which plaintiff might have against the telephone company, the Supreme Court of Pennsylvania held in Ridgeway versus Sayre Electric Company (102 A. 123). In an action for personal injury the defendant cannot show, either as a bar to the action or in reduction of the damages, that the injured person received, or was entitled to receive, compensation for his injury in form of insurance or otherwise. An electric company whose wires by agreement were strung on the same pole as those of a telephone company and carried a heavy current was bound to see that its wires were in such reasonably safe condition as to afford protection from injury to employees of the telephone company coming in contact with them in the course of performing the duties of their employment.

Louisiana Engineering Society.—A meeting of this society was held Dec. 10, First Lieut. Joseph F. Ward, O. R. C., telling of his experience in training camp.

Jovian Electrical League, Los Angeles.—Judge Benjamin F. Bledsoe of the United States District Court addressed the league at its meeting on Dec. 5 on "Americanism."

Buffalo Engineering Society.—The Electrical Section of the Buffalo Engineering Society was recently addressed by L. H. Hart on the subject of "Electricity on the Barge Canal."

The Institute of Radio Engineers.—The Institute of Radio Engineers held a meeting on Dec. 5. At this meeting Dr. Frederick H. Millener of the Union Pacific Railroad presented a paper on "Radio-telephony."

Pittsburgh Section, A. I. E. E.—General Willis J. Hulings, retired, addressed the Pittsburgh Section of the American Institute of Electrical Engineers, Dec. 11, on "Why Do We Fight?" G. M. Baker is secretary of this section.

Worcester Polytechnic Institute Branch, A. I. E. E.—G. M. Eaton, head of the railway division, engineering department of the Westinghouse Electric & Manufacturing Company, presented a paper on "The Other Half of Engineering" before the Worcester Polytechnic Institute Branch of the A. I. E. E. on Dec. 7.

New York Companies' Section, N. E. L. A., Attendance Record Broken.—Between 400 and 500 men and women of the New York Companies' Section, N. E. L. A., crowded the Fifteenth Street auditorium on the evening of Nov. 20. W. H. Whitton of the New York Edison Company read a paper, with a discussion by J. A. F. Randolph and A. F. Berry, the subject being "Real Estate and the Central Station."

Buffalo Section, N. E. L. A.—Joseph T. Whitwell, chief of the Bertillon System of the Buffalo (N. Y.) police department, and Caleb J. Coatsworth of the Lafayette escadrille in the French flying corps, were speakers at the last monthly meeting of the Buffalo Section of the National Electric Light Association in the General Electric building. Mr. Whitwell described the method of taking finger prints and filing the prints so that they are immediately available in the identification of an individual, and Mr. Coatsworth told of scenes along the battlefield at Verdun.

Idaho Society of Engineers.—At a recent meeting of the Idaho Society of Engineers at Lewiston, Idaho, two papers were delivered on the water-power possibilities in that section, as follows: "The Distribution of Water in the Upper Snake River Basin," by S. E. Vance, Jr., of the State Engineer's office at Boise; "Power Developments Possible and Proposed in the Lower Snake River Valley," by Robert A. Foster of Clarkston. Mr. Foster made extensive investigations and study of this subject while manager of the Lewiston-Clarkston Light & Power Company.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

New York Electrical Society.—At the next meeting of the New York Electrical Society on Dec. 20 Frank M. Leavitt, inventor of the Bliss-Leavitt torpedo, will give "a brief historical sketch on the development of the torpedo," and W. A. LaDue of the Public Service Electric Company of Newark, N. J., will give an address on "Aerial Cable Construction," illustrated with motion pictures.

Ice Manufacturers Operating Central Station Plants Meet.—The Western Ice Manufacturers' Association, in twentieth annual convention at Kansas City, Mo., Nov. 21 to 23, devoted much time to discussion of cost-accounting methods and to the necessity of such systems under present conditions. There was almost unanimity among the manufacturers who have "side lines" that cost systems are imperative to ascertain where net profits are going and what branch of the business needs readjusting. Many of the ice manufacturers who operate electrical central stations frankly said that the ice plants had been carrying the electrical service, although they had never taken the trouble to get their cost sheets down to the point of actually showing it. There seems to be a tendency among ice manufacturers to confine their efforts to manufacturing ice and to leave central station work to other interests. With the greater facilities for securing service from central stations there is also said to be a more important trend toward raw-water ice manufacturing, with the purchase of power and light from a central station.

San Francisco Jovian League.—An old-timers' meeting of the San Francisco Jovian League was held on Nov. 28 at which tribute was paid by a record attendance to six "old-timers" of the industry on the Pacific Coast. Those to whom signal honor was accorded were: H. V. Carter, formerly of the Pacific States Electric Company; Frank Smith, Western Electric Company; E. B. Strong, *Journal of Electricity*; S. V. Mooney, John A. Roebbling's Sons Company; T. A. Addison, General Electric Company, and John A. Britton, Pacific Gas & Electric Company. Mr. Britton spoke of men not present to whom he said yet greater honor was due for their pioneer part in the electrical field. He named particularly John Martin, Eugene De Sabla and R. R. Colgate. The first-named had the courage to plan a hydro-electric project which set an example for the whole world; the second had the ability to convince others of the feasibility of the plan, and the third

had enough confidence in its future to advance the \$600,000 which made the start possible.

Brooklyn Company Section, N. E. L. A.—The November meeting of the Brooklyn Company Section, N. E. L. A., held on Nov. 20, was attended by a large audience, there being about 600 members of the section present. A paper entitled "Our Part in Winning the War" was read by I. T. Smith of the sales department and was discussed by various members of the section. This is the first paper to be presented in the 1917-18 competition, which is being carried on along the same lines as heretofore, the winner to receive \$50 in gold. W. F. Wells, vice-president and general manager of the Brooklyn Edison company, made a very interesting address, as did F. Smith of the New York Telephone Company.

New York Chapter of the A. A. E.—The American Association of Engineers has organized a local chapter in New York City. Headquarters have been established at 220 West Forty-second Street. Temporarily meetings are being held at the Hotel McAlpin, Broadway and Thirty-third Street. Up to the present time these meetings have been mainly devoted to the work of the organization. This is now nearing completion, and the society will soon be in a position to engage in constructive work along the lines which have been followed by the national association. The next meeting will be held on Dec. 17. One of the members of the chapter will deliver a short talk on "Subaqueous Pile Driving."

Electrical League of Cleveland.—The Electrical League of Cleveland, Ohio, did some excellent work in the campaign for Y. M. C. A. funds for army work recently. A complete military staff organized for war work managed the affair, with officers as follows: Major General, J. Robert Crouse; brigadier general, Norman Anderson; adjutants, F. C. Maxheimer and H. J. Wright; aide de camp, D. B. Hopkins; quartermaster, R. S. Dunning; advisory board aviation corps, Col. H. S. Greene, Col. G. S. Milner, Col. F. C. Foster, Major Roy Davis (110 girls), Major Charles B. Gray (95 girls), Major G. W. Thompson (110 men); colonel of cavalry, C. R. Matheny; lieutenant-colonel of cavalry, R. S. Ingle; cavalry captains (fourteen men to company), M. H. Blakeley, F. M. Grant, E. J. Bonsor, C. A. Kuehn, O. M. Friestand, E. H. Spalding, O. N. Jones; cavalry regulars, 100 men; colonel of artillery, J. M. Smith; lieutenant-colonel of artillery, F. R. DuGuay; artillery captains (fourteen men to company), R. A. Parkin, F. P. Harris, B. H. Decker, G. A. Morrell, J. T. West, B. J. Spitzig, A. F. Schefft, W. L. Bell; artillery, 100 men. Stands, with large milk cans topping them, were placed at street corners, in retail and department stores and at every other point of vantage in the city. They were attended by young men and young women who volunteered to assist the Electrical League in its campaign.

T. J. Spragle has been appointed local manager of the Kentucky Utilities Company at Elizabethtown, Ky.

L. M. Russell, for the last four years city engineer of Elkhart, Ind., has joined the engineering staff of Arthur J. Sweet, consulting engineer, Milwaukee.

Ernest L. Shotwell has been transferred from the post of superintendent of the Kentucky Utilities Company at Versailles, Ky., to be superintendent at Somerset, Ky.

Laurence H. Parkhurst, formerly manager of the bond department of the Old Colony Trust Company, has been elected a vice-president of the Electric Bond & Share Company.

Donald Stewart, formerly manager of the Baton Rouge (La.) Electric Company, has been transferred to New London, Conn., where he is general superintendent of the Connecticut Power Company.

William J. Hardaker, Reading, Pa., for the past twenty-five years connected with the Reading Transit & Light Company, has been appointed general superintendent for that company and the Metropolitan Edison Electric Company interests in Lebanon County.

Alex D. Bailey, for the last eight years assistant engineer of the Fisk and Quarry Street stations for the Commonwealth Edison Company, Chicago, has been appointed chief engineer to succeed Olaf E. Oleson, who is now president and general manager of the Edwards Valve & Manufacturing Company, Chicago.

R. N. Ehrhart, chief engineer of the condenser department of the Westinghouse Electric & Manufacturing Company, has resigned to take up his duties as president and consulting engineer of the Sedar Coal Company. He has been retained also as consulting engineer by several engineering firms and by the Westinghouse company.

Davis H. Tuck, until recently assistant physicist for the United States Public Health Service, has resigned to accept the position of commercial engineer for industrial and street lighting with the Holophane Glass Company, New York City. Mr. Tuck was graduated from the Massachusetts Institute of Technology in 1911 with a degree of B.S. of electrical engineering. For three years he was with the photometric department of the United States Bureau of Standards at Washington, and since then has been illuminating engineer for the United States Public Health Service division of field investigation of industrial hygiene. While in this work he made a study of the status of illumination in the garment industry in New York City, the steel industry in Pittsburgh and public buildings in Washington, and he has co-operated with the Industrial Commission of Wisconsin in inaugurating its campaign for better lighting in the State, being a member of the Wisconsin committee for drafting a new code of lighting legislation for that State. Mr. Tuck will be in charge of the industrial lighting department of the Holophane Glass Company.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

J. B. Stewart, Jr., has been made assistant general manager of the Mahoning & Shenango Railway & Light Company, with offices at Youngstown, Ohio. Mr. Stewart has been with this company since 1913, when he became safety and efficiency engineer and superintendent of freight. Subsequently he was appointed superintendent of equipment and traffic and was then made assistant to the general manager, Richard T. Sullivan. Mr. Stewart is a graduate of the Massachusetts Institute of Technology. He has been employed on the Middlesex & Boston Street Railway, Newtonville, Mass.; the Buffalo & Lake Erie Traction Company, Erie, Pa.; the Elmira, Corning & Waverly Railroad, Waverly, N. Y., and the Lehigh Valley Transit Company, Allentown, Pa.

Leonard S. Cairns, assistant general manager of the Manila Electric Railroad & Light Company, Manila, P. I., has been appointed general manager of the Eastern Pennsylvania Railways Company, Pottsville, Pa., by the J. G. White Management Corporation, New York City, the operating manager of both companies. Mr. Cairns has arrived in the United States and has assumed the duties of his new position. He succeeds L. H. Palmer, who lately became assistant to the president of the United Railways & Electric Company, Baltimore, Md. Mr. Cairns upon leaving high school entered the employ of the Twin City Rapid Transit Company at Minneapolis, Minn., and, after several promotions, was made general superintendent of that company. In 1912 he was employed by the J. G. White Management Corporation to fill the position of assistant general manager of the Manila Electric Railroad & Light Company.

Theodore Malm, who for the last six years has been electrical and mechanical engineer for various Mackenzie-Mann interests, including the Toronto Railway Company, Toronto Power Company, Toronto Electric Light Company, Toronto & York Radial Railway Company, Toronto Suburban Railway Company, London Electric Company, Suburban Construction Company, Canadian Northern Railway Company, etc., has established two companies. These are the Railway & Power Engineering Corporation, Ltd., and Theo. Malm & Company, with offices in the Canadian Pacific Railway Building, Toronto, Can. The Railway & Power Engineering Corporation will deal in railway, light and power equipment, and Theo. Malm & Company will undertake surveys, plans and estimates for the development of electric power, prepare plans,

estimates and specifications and supervise the work of electric street and interurban railways and mining electrifications, as well as complete systems for the generation, transmission and distribution of electrical energy for commercial purposes and industrial plans.

A. G. Cobb, commercial manager of the Commonwealth Electric Company, Summit, N. J., has resigned, effective Jan. 1 next. Mr. Cobb is trying for a commission in the Ordnance Officers' Reserve Corps. He has been connected with the Summit company since Jan. 1, 1917, going there from Uxbridge, Mass., where for three years he was new-business manager of the Worcester Suburban Electric Company.

Stanley V. Walton, commercial manager of the Pacific Gas & Electric Company, has handed in his resignation, which is to take effect Jan. 1. In the years during which Mr. Walton has held this position he has taken an active part in co-operative movements and has served on many inter-company committees. His retirement is caused by the fact that private interests will hereafter require practically all his time. Mr. Walton was born in California and received his electrical engineering education at the University of California, from which he was graduated in 1904. In January of the following year he entered the employ of the California Gas & Electric Corporation, the predecessor of the Pacific Gas & Electric. Two years later he was appointed commercial manager, which position he has held up to the present time. He has been prominent in N. E. L. A. affairs and has served as a member of the executive committee of the Commercial Section.

Obituary

C. O. Smith, manager of the Lewis County Light & Telephone Company at Morton, Wash., was recently found dead at the power plant of the company on the Tilton River. The cause of his death is unknown.

Julius Andrae, the founder of Julius Andrae & Sons Company, electrical jobbers, Milwaukee, Wis., died suddenly at the age of eighty-eight, on Dec. 2. Julius Andrae was born in Meissen, Saxony, in 1829, came to America in 1854, and established himself in business in Milwaukee in 1855. Later he engaged in the business of supplying tool boxes for the government and laid the foundation for the electrical company of which he became the head.

William D. Kearfott, president of the Kearfott Engineering Company, died on Nov. 12 at the age of fifty-three years. In the engineering profession Mr. Kearfott began work with the Morton Pool Company of Wilmington, Del. Later he was associated with such well-known manufacturers as the International Navigation Company, the Worthington Steam Pump Company and the Warren Steam Pump Company. At the time of his death he was head of the Kearfott Engineering Company, New York City, which he organized two years ago.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

STOCK REDUCTION GOING FORWARD AS YEAR CLOSES

Buying Largely to Fill Commitments with Difficulty in Obtaining Goods Actually Needed, Though No Reservations Are Now Being Made

With the approaching end of the year, as jobbers and dealers reduce their stocks to the minimum level, manufacturers and producers are keeping in close touch with conditions with a view of making their selling plans for next season. Changes are constantly occurring in the stock of staples and specialties, caused not only by the natural outgo but by peculiarities in the market. Priority order shipments are so numerous that commercial business has been hampered and in some instances seriously disturbed. Therefore, with deliveries "up in the air," no one is in a position to say what may be the trade situation even a week or ten days ahead.

December is a slowing-down month, with jobbers and dealers reducing stock at every opportunity, going under the market occasionally to dispose of merchandise of which they are either on the long side or which they wish to close out altogether. The buying is to fill requirements only, with no special articles predominating, although where a shortage is evident orders—staples almost invariably—for early delivery in the new year, when not obtainable sooner, are reported. There is no disposition to load up. The trouble is to obtain goods that are actually needed and to know if orders can and will be filled beyond a doubt. Unless this is provided for by unquestioned credit standing or anticipation, they are likely not to be forthcoming. No goods are being held in reserve.

A distributor of prominence when questioned about this said that no reservations are being made for any one. Should a buyer inquire for anything and it be in stock or obtainable the quotation must be accepted and the requisition filed at once. No one is being waited for as a matter of convenience these days. The same conditions apply to shipments from distant points. If the consignee is in a hurry for the merchandise he is informed the goods have passed from the factory, but when they will be delivered no one can tell. If the freight embargo intervenes, the information is passed along. That ends the matter—further complaints are not entertained.

EDISON ELECTRIC APPLIANCE COMPANY IS INCORPORATED

Capitalization, Officers and Certain Commercial Plans of Hotpoint, Hughes and General Electric Heating Devices Merger Announced

Incorporation is announced of the Edison Electric Appliance Company, Inc., under the laws of the State of New York. This company will take over as of Jan. 1, 1918, the Hotpoint Electric Heating Company and the Hughes Electric Heating Company (with the exception of certain foreign rights, particularly the Canadian business of these companies), and the domestic or household heating device business of the General Electric Company, as explained in the ELECTRICAL WORLD for Nov. 17.

The industrial heating device and furnace business will not be transferred by the General Electric Company to the new company.

The new company, it is announced, will devote itself actively to the question of standardization of the various devices, which, it is believed by the incorporators, will lead

to greatly improved commercial conditions in the distribution of these products by central stations, jobbers, dealers and other distributing agents.

The new company will operate three manufacturing plants—the Hughes factory at Chicago and the two Hotpoint factories, one at Chicago and one at Ontario, Cal. The General Electric Company's heating-device manufacture now carried on at Pittsfield will be removed to the Hotpoint and Hughes factories at Chicago. Commercial headquarters of the company will be at Chicago. The board will consist of Willis H. Booth, chairman; George A. Hughes, president; A. K. Baylor, vice-president; E. H. Richardson, A. F. Vaughan, G. F. Morrison, C. E. Patterson and H. C. Houck. W. H. Booth and E. H. Richardson are at present officers of the Hotpoint company and Messrs. Hughes and Vaughan of the Hughes company. P. H. Booth, now sales manager of the Hotpoint company, will act as sales manager of the new company. The complete factory, engineering and commercial forces of the Hotpoint and Hughes companies will go over to the new company. Certain of the commercial and engineering representatives of the General Electric Company's heating-device department will go with the new company. This list will include J. D. A. Cross, who has charge of the General Electric Company's heating-device sales, and C. P. Randolph, engineer in charge of heating-device production at Pittsfield, who will both be stationed at Chicago.

It is probable that the new company will continue to sell the three distinct lines of product, namely, the Hotpoint, Hughes and General Electric devices and ranges.

The capitalization of the new company will be divided into 25,000 shares of 7 per cent preferred stock, \$100 par, and 30,000 shares of common stock without par value.

One of the purposes of the organization is to effectively organize the merchandising talent throughout the country to promote heating-device sales, and beneficial results from this activity are expected to occur in common with the products sold into the household.

The new company is contemplating immediate extensions at the Hughes factory at Chicago.

THE OUTLOOK FOR 1918 ELECTRIC FAN SEASON

Competitive Conditions Temporarily Hold Up Announcements of Campaign Plans for New Year—Price Higher

About this time the manufacturers of electric fans usually announce their selling plans and price schedules for the coming year. Some of them have followed the customary rule, but not all. Heretofore a differential of from 75 cents to \$1 was made between direct-current and alternating-current fans, on account of an increased cost of manufacture. One of the leading manufacturers this year, it is understood, in placing his schedules before the trade puts both types on the same price level.

The expectation that an advance in fans would be made for 1918, on account of the increased cost of production and material, as well as a shrinkage in the supply of the latter, have both come true. Fans are marked up on an average of \$3 apiece, and in some models even more.

It is learned that the manufacturers generally had their schedules about ready for distribution when this leveling-up price announcement became known. Thereupon the proposed selling plans were held up for further consideration. The contention that one type costs more to manufacture than the other is generally expressed, but whether the

concern referred to above will coincide with this view and change its list accordingly remains to be seen.

Manufacturers knowing the stock of material was none too stable or plentiful closed their contracts in the spring, some making arrangements as early as March last. While these commitments stand, it is a question whether the merchandise can or will be delivered. As it stands, possibly a priority certificate from the War Industries Board may be necessary to have the material shipped, excepting in the case of very large producers who may have anticipated this crisis by ordering raw stock far ahead.

A meeting of the various sections of the Associated Manufacturers of Electrical Supplies in New York City is called for Dec. 13 to confer with the trade members of the Committee of National Defense on this among other matters of importance. In fact, it is stated that the future manufacture and supply of material on the entire line of electrical goods will come up for discussion. There is a probability that certain specialties and even staples may be designated as non-essentials by the government board, and suggestions and plans to avoid such a catastrophe will be offered for submission to the authorities.

There is a difference of opinion concerning the supply of fans for 1918. Manufacturers who should be in a position to know declare a shortage is bound to occur. Others equally well fortified are of a contrary mind and say they stand ready to fill all orders, unless the unforeseen should happen, as may be likely should a curtailed supply of material, not now figured upon, ensue. One of these companies is now in the field making contracts with distributors and jobbers. It avers that the buying has fallen off, the distributing trade taking on even less than last year, when a marked shortage followed during the summer of 1917. Naturally this jobbing attitude comes in for sharp criticism on several counts, especially that of shortsightedness. Another company will make an effort to introduce its quantity basis plan of selling, a marked success and satisfactory to both the seller and buyer in its other lines.

METAL MARKET SITUATION

Large Contracts for Wire Supplied by Electrical Manufacturers—Tin Goes Higher

On a governmental requirement electrical supplies manufacturers not long ago furnished 1,000,000 ft. of copper wire, apportioned among different plants to expedite its production and stabilize conditions, in thirty days. Subsequently 20,000,000 ft., similarly distributed, of No. 12 copper was furnished and delivered in ten days to the authorities for the cantonments and other military and naval purposes. Other orders from the same source may follow. Small consuming interests are having no trouble in obtaining all the copper required in less than car lots at 23.50 cents plus the 5 per cent rate officially established. Larger concerns are not suffering for metal and some are reported as having a surplus upon which to draw. One of the largest consumers of copper wire is desirous that the trade should be more familiar with the price and condition of base, in contrast with rather questionable reports in circulation. Again tin has increased in price, and the supply is still short.

NEW YORK METAL MARKET PRICES

	Dec. 3	Dec. 10
	£ s d	£ s d
Copper:		
London, standard spot.....	110 0 0	110 0 0
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	27.00 to 29.00*	27.00 to 29.00*
Lead, trust price.....	6.25	6.25
Nickel, ingot	50.00	50.00
Sheet zinc, f.o.b. smelter.....	19.00	19.00
Spelter, spot	7.70 to 7.80	7.67½ to 7.77½
Tin, Straits	81.00	86.00
Aluminum, 98 to 99 per cent..	34.00 to 36.00	34.00 to 36.00

OLD METALS

Heavy copper and wire.....	22.50 to 23.00	22.50 to 23.00
Brass, heavy	14.50 to 16.50	14.50 to 16.00
Brass, light	10.50 to 11.50	10.50 to 11.00
Lead, heavy	5.75 to 5.87½	5.75 to 5.87½
Zinc, old scrap	5.00 to 5.50	5.00 to 5.50

*Nominal.

THE WEEK IN TRADE

WITH the extraordinary sale of electrical equipment for new industrial enterprises of magnitude, and with strong buying of jobbers and dealers, the volume of trade is fast approaching a new high record. Priority shipments on War Industries Board certification are characterized as excessively exasperating, not only to the transportation companies, but also in commercial circles. Deliveries remain undependable in nearly all sections, to the annoyance of everybody affected. Motors and transformers are short, pole material increasing in price; electric ranges, appliances, sewing machines, etc., command a large and wide sale—in certain parts enormous. Orders on 1918 business are being booked. The December sales totals exceed those of November.

Collections are reported fair in some fields, elsewhere quite satisfactory. Credits are critically investigated and accommodations cautiously accorded on new accounts.

NEW YORK

Considerable activity is noticeable in the local market on various lines of goods. To be sure, holiday specialties are in the strongest demand, which is greatly stimulated by the generous and effective publicity campaigns carried on by the manufacturers. Nevertheless, staples are purchased for immediate calls, in not a few instances as subsidiary war material orders. Deliveries have improved on certain merchandise, but still are a disturbing element, embargoes and numerous priority shipments upsetting all calculations. Prices on some materials have advanced.

Collections are holding up in a surprising manner for December. Credits continue to receive the closest attention.

CHRISTMAS LIGHTING OUTFITS.—Reports that there would probably be a sharp cut in the supply of Christmas trees in the metropolitan district suggested a corresponding curtailment in the buying of festoons or lighting outfits. It developed on inquiry from reliable sources that the stock of trees will be as usual in quantity. The supply of outfits is abundant, and no falling off in buying is noted. In many instances contracts were signed months ago and deliveries to retailer are now being cleaned up.

INSULATORS.—An advance of 15 per cent on glass insulators became effective Dec. 1, but it was not retroactive, as was expected by some buyers. Stock is none too plentiful, but is easier than a month ago.

LAMP CORD.—There may possibly be a short supply on some grades of lamp cord, but a manufacturer whose plant makes it an exclusive product says any quantity—even to 100 per cent orders—may be obtained. Prices are high.

FLEXIBLE-STEEL CONDUCTORS.—A carload reached New York early in the week, quite to the surprise of the distributing trade. It was rapidly absorbed and more could have been easily sold in a rather short market.

SMALL MOTORS.—Deliveries, which were four weeks back on small motors a month or more ago, are now improved—very much so, according to some manufacturers. It is held this has been brought about by a lessened demand. Prices remain steady, but an advance is looked for after Jan. 1. A recent large order for war purposes materializing suddenly—"over night," as it was described—rather upset the market.

CROSS-ARMS, ETC.—Further difficulty is being experienced with Pacific Coast fir cross-arms. Recent governmental requirements for lumber about swept the Western market bare.

CORD.—All cords with a fine strand are difficult to buy, deliveries being six months behind.

LIGHTING FIXTURES.—Some jobbers hold that lighting fixtures will rapidly increase in price and will become scarce, owing to the fact that the War Industries Board will curtail the manufacture of bowls, globes and shades—in fact, has declined to furnish sufficient fuel to glass works turning out these goods. Other concerns are equally positive in de-

claring that the stocks of fixtures are unusually strong, on account of the sharp falling off in the demand for building operations. One glass manufacturer is advising jobbers to buy while they can, while on the other hand one of the local jobbers is offering a lot of 1000 lighting fixtures at a sacrifice price in order to realize and reduce his stock.

TRANSFORMERS.—Where a short time back the deliveries of transformers and medium-size motors were rather uncertain, now the situation shows a marked improvement. A leading manufacturer states that not only has the demand dropped but orders are being canceled where possible or held up by central stations and public utilities, which are unable to finance themselves sufficiently. Prices, however, are steady.

CARBONS.—Carbons for electrical uses may no longer be exported from France to the United States and allied countries without special license. Consul General Thackara reports from Paris that the permits for such exportation which formerly modified the embargo of Dec., 1914, affecting these articles have been withdrawn by a ministerial order of Nov. 19. Special applications must now be made for permission to export these goods to any country.

CONDUIT PIPE.—One of the largest producers of rigid conduit states that it is difficult to get any stock worth speaking of, let alone an accumulation. To add to his embarrassment in this respect customers are clamoring for deliveries under accepted contracts. Prices are unchanged.

SOCKETS.—Inquiry at the office of one of the leading manufacturers brought out that on standard lines and sizes the supply is growing short. Prices, it was stated, are not likely to advance.

REFLECTORS.—There is a good supply of reflectors in a majority of types held in stock by manufacturers. Shipments go forward as rapidly as the freight embargoes permit.

COLLECTIONS AND CREDITS.—December collections so far seem to be making as fine a record as those for November. Credits are carefully looked after, particularly on the opening of new accounts. Losses for the entire year have been small, and the run of buying on the part of dealers is along lines of actual needs and confined to useful articles rather than novelties. Stocks are being reduced as rapidly as possible with the close of the year.

JOBBER'S STOCKS.—A careful inquiry among leading jobbers reveals the fact that the buying this month is only to fill requirements. This, it developed, will continue until after Jan. 1, when the buying of staples is expected to take an upward turn.

BOSTON

General business continues to be good, but it is overshadowed and dominated by the "priority" given to all government requirements. Some factories would be able to make improved deliveries except for the generally unsatisfactory condition of railway traffic and the resulting embargoes. Price changes are largely negligible, and collections are only fair. There seems to be some differences of opinion regarding "trade acceptances." Their early and general adoption, however, would seem to combine patriotic necessity and a good business method of relieving the situation.

Holiday trade is coming forward but is not expected to equal that of a year ago. Labor conditions are not greatly changed, except that the Western Electric Company's strike is now settled, thus removing another disquieting situation.

LAMPS, RADIATORS AND RANGES.—Good and improving business is reported from week to week, this being especially true of government requirements, which appear to cover 50 per cent of the total.

STORAGE BATTERIES.—Conditions have not materially changed, being dominated by government requirements, these easily holding first place here as elsewhere.

HOUSEHOLD APPLIANCES.—Business continues to expand, but is still below that of last year.

MOTORS.—Demand outstrips supply, and deliveries are very far behind. Government orders are piling up, and their "priority" still further delays delivery to regular patrons.

CHICAGO

Manufacturers are trying to induce jobbers in the Middle West to stock up on staples. The theory is advanced that materials are going to be hard to get and that the fellow who has a stock will be lucky. Some of the jobbers are stocking up, but others are watching the action of the price boards now meeting at Washington to see what will happen to government prices on steel and copper when the time for a change comes. No one is ready to hazard an opinion on whether the price revision in copper and steel, if the price is revised, will be upward or downward. Business in the territory remains satisfactory as to volume, with some unsettlement in prices, owing to the fact that it was necessary for certain firms to meet competitive conditions.

COPPER WIRE.—Prices in general remain on a 34-cent and 35-cent base. Occasionally some manufacturer comes into the market with a lower price temporarily. January quotations on copper are lower, indicating probable price reduction after the first of the new year.

GLASSWARE.—As was predicted, glassware and glass insulators are advancing in price, the increase amounting to about 20 per cent so far.

IRON CONDUIT.—Some manufacturers are quoting card 38 on all sizes up to 2 in. and are asking 5 per cent premium on sizes 2 in. and larger. While some jobbers have good stocks they are worried about replenishing them.

SOCKETS.—On ½-in. key, keyless and pull sockets one jobber has reduced prices on small quantities 10 per cent.

LAMP CORD.—No. 18 lamp cord is cheaper in some quarters.

NON-METALLIC FLEXIBLE CONDUIT.—The standard sizes—¼-in. and 7/32-in.—are being quoted 10 per cent lower by one of the local jobbers.

PORCELAIN.—Knobs, cleats and other porcelain ware appear to be getting ready to follow the upward trend of glass. One manufacturer's representative stated he had sold more porcelain in November than in all of the preceding months of 1917. It is probable that the porcelain manufacturers are letting their regular trade buy heavily before an advance will be made. Jobbers' prices on porcelain have not changed.

ELECTRIC RANGES.—Orders have continued to come in. During the months of September, October and November electric range business with some of the companies has been equal to what it was in the spring months. While some of the larger buyers are out of the market, a greater number of smaller buyers have come into the market.

ELECTRIC APPLIANCES.—The best sellers in the Christmas season seem to be air heaters, round grills, toasters and percolators of both the pot type and the loving-cup type. It is reported that the big department stores are buying very cautiously.

SIGN FLASHERS.—On account of the additional argument which the Fuel Administrator's order on electric signs has given to sign-flasher manufacturers there has been a considerable stimulus to this branch of the trade.

CONTRACTING IN EASTERN OHIO.—The section of Ohio which lies east of the line through Cleveland and Massillon is experiencing such favorable industrial conditions that practically every electrical contractor in the territory has more work booked than he can handle between the present time and February. This situation has been brought about not only by increases in factory facilities, but also on account of the shortage of houses, which has made it necessary to build more residences and to put into shape property which was hitherto unrentable.

ELECTRIC SOLDERING IRONS.—The activity in the many shipyards on the coast is making an extraordinarily broad market for electric soldering irons. Two concerns in the Middle West have recently received orders aggregating \$26,000 for these devices.

ASH-HANDLING EQUIPMENT.—The demand for this sort of machinery created on account of the fact that it reduces the number of men necessary to handle any power plant, is extraordinarily active. One customer recently shipped an outfit weighing 4 tons from Chicago to New Hampshire by express.

ATLANTA

Business reflects sustained activity in many directions and underlying strength in nearly all lines of the electrical field. What is especially important is the fact that at the bottom general conditions are wholesome, and more so than six months ago, as there is less competitive and excited buying at this time. There are still many drawbacks in the general situation, and the new and extraordinary problems which are being encountered hinder progress in electrical lines as well as the industrial field.

The seriousness of railroad congestion is evidenced by the unprecedented measures now being taken to relieve the pressure. Outside of shipment difficulties the most serious subject the South has had to face lately is the fuel shortage. A number of central stations depending on coal deliveries are in dire straits, and in some instances output had to be curtailed. In addition to this problem quite a number of the large hydroelectric companies have experienced a drought during the last few months which lowered reserve water capacity and has created an acute situation in that a quantity of energy is now being supplied by supplementary steam plants. This, too, has tended to make the solving of the fuel problem more difficult.

The Langley Mills, Langley, S. C., have just closed contracts for electrical apparatus totaling about \$80,000, which will include 125 motors aggregating 2400 hp., four-frame and group drive, also two 315-kva., 150-r.p.m. vertical water-wheel generators. The Warren Mills, Warrenton, S. C., have closed an apparatus contract approximately for \$41,000 for twenty-three motors, aggregating 1550 hp. group drive. Both of these mills will be supplied with energy from the Augusta-Aiken Railway & Electric Corporation. Delivery about July, 1918.

INDUSTRIAL LIGHTING.—Business in this line has taken quite a boost this year, due to activity in textiles and other industrials requiring more and better illumination. The sale of steel reflectors has increased over 200 per cent for the year to date, deliveries on these being excellent. The lamp demand is evenly distributed between the 200-watt, 300-watt and 500-watt nitrogen-filled. Reliable sources report that there is some very big business in sight.

TELEPHONE EQUIPMENT.—The demand for increased efficiency has opened up a very lucrative field for intercommunicating systems in the large industrial plants, which heretofore has been practically dormant. Jobbers' sales show a big increase in this year's business, and no curtailment in the call is noted, although prices are slightly higher. Shipments are reported as being exceptionally good under the circumstances.

SPOTLIGHTS.—An excellent business is being carried on and the jobbers are unable to handle the automobile demand. Manufacturers are away behind on deliveries and shipments are growing longer. Prices remain unchanged.

SPECIALTIES.—Vacuum cleaners and sewing-machine motors are moving fast. Although headlight heaters have advanced about 20 per cent, the sales for this year will be record-breaking, in face also of poor deliveries.

WIRING SUPPLIES.—The demand for knobs, cleats and miscellaneous porcelains is very strong and shipments are fair. Sockets and receptacles are being turned over rapidly and local lots are grabbed up quickly. Local jobbers' stocks are in pretty fair shape, but anticipated future big business is reflected by the fact that substantial orders are being placed for delivery early in 1918.

SEATTLE

Activity continues in the electrical trade, government and shipyard orders sharing about equal prominence and dominating business during the last week. Heavy orders were placed by both the Bremerton Navy Yard and the Seattle shipyards for power apparatus. Orders from American Lake cantonment during the week dropped to practically nothing. The buying of electrical fixtures and appliances for up-Sound fort cantonments is very light, but is expected to increase shortly. Christmas sales of electrical household equipment are increasing daily.

Preceding the culmination of holiday buying, about Dec. 23, local shipyards will pay approximately \$1,000,000 in wages to employees, who are expected to invest heavily in staple electrical gifts. The dealers' plans for securing this business are carefully laid and are being successfully executed. Several of Seattle's largest dealers report the sale of electric sewing machines enormous, closely seconded by washing machines, irons and other electrical devices. The volume of sales of farm-lighting outfits increased considerably during the past week. Prices show no outward signs of fluctuating. Orders are being placed as needed, especially by retail dealers.

The President's order forbidding alien enemies approaching within 100 yards of the waterfront will affect more than 7000 persons in Seattle. The order will accentuate labor scarcity and work tremendous hardship on firms conducting waterfront business, particularly firms exporting and importing. Waterfront industrial plants will also suffer.

Both jobbers and retailers confidently expect business along all lines during December to exceed by far November's volume. Sales during the last ten days justify their prediction. The building department claims an increased activity. Fixture dealers report increasing sales. A concerted effort contemplated by architects and contractors is for encouraging building on the theory that labor and materials will never be lower.

With the settlement of the telephone strike service is again normal. The Western Pine Manufacturers' Association at Spokane voted to establish an eight-hour day in logging camps and mills. The government has asked the logging companies to continue operation beyond the holiday period, stating that the government is not getting 50 per cent of the airplane stock required.

The railroads centering in Seattle have applied for authority to discontinue intraterminal service. Unless opposed they will put an embargo on the use of cars for drayage purposes within the city limits.

Shipyards in Tacoma are preparing for a period of unprecedented activity. Applications were presented to the municipal lighting department for increased lighting facilities in several of the largest plants to accommodate night shifts. The demand for floodlighting systems is heavy.

A shortage of labor is the most vital problem that the Northwest industries are contending with. The problem facing mills and logging camps is serious. Smaller industries are also feeling the press. The department of labor and the United States Shipping Board, through representatives, are trying to analyze and devise means of relieving the shortage in the Northwest, as it affects the government war program. The chief aim of the departments will be to outline a plan for bringing 20,000 additional shipbuilders to the Pacific Coast, the Puget Sound country particularly, to increase the output of Seattle's shipyards. The commercial economy committee of the State Council of Defense has asked dealers in all lines to extend credit for not to exceed thirty days. Collections remain in a satisfactory condition. Credits are well in hand.

SAN FRANCISCO

Industrial-plant work is keeping contractors busy in San Francisco and adjacent cities. Building activities in the smaller towns, particularly in the San Joaquin Valley, continue and have developed quite a good business for contractors both large and small.

Small motors are in demand but deliveries are very slow. Motors above 15 hp. are not available from Pacific Coast stock. Transformers are almost impossible to obtain. No improvement is shown in factory shipments, which have been slow for some time. The supply of switches is fair. The demand for storage batteries, used principally for farm purposes, factories and automobiles, is brisk. Flashlights also show a steady demand. Deliveries are such that practically all orders can be filled. Retailers report a fair demand for vacuum cleaners, flatirons, percolators, etc. In fact, the demand for electrical goods in general is holding up practically as well as is usual during the pre-holiday season. Collections from dealers and contractors are about the same as last month, which was a little slower than usual.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B.&S. Size	List per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor

No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 Solid	List to \$61.00
Less than coil.....	10% to \$59.17
Coil to 1000 ft.....	10% to \$71.00
No. 12 Solid	List to \$71.00
Less than coil.....	10% to \$68.87
Coil to 1000 ft.....	10% to \$68.87

Twin-Conductor

No. 14 Solid	List net to \$105.00
Less than coil.....	\$70.00 to 10%
Coil to 1000 ft.....	10% to \$130.90
No. 12 Solid	List net to \$135.00
Less than coil.....	10% to \$130.90
Coil to 1000 ft.....	10% to \$130.90

DISCOUNT—CHICAGO

Single-Conductor

No. 14 Solid	+10%
Less than coil.....	+10%
Coil to 1000 ft.....	-10%
No. 12 Solid	+10%
Less than coil.....	+10%
Coil to 1000 ft.....	-10%

Twin-Conductor

No. 14 Solid	List to +10%
Less than coil.....	List to -10%
Coil to 1000 ft.....	List to -10%
No. 12 Solid	List to +10%
Less than coil.....	List to -10%
Coil to 1000 ft.....	List to -10%
No. 12 Solid	List to +10%
Less than coil.....	List to +10%
Coil to 1000 ft.....	List to -10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+20% to 12%
1/5 to std. pkg.....	List to 20%
Std. pkg.....	28% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.49	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.3175	.3275
Barrel lots.....	.2875	.2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, Per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less Than Coil	Coil to 1000 Ft
3/8-in. s. stp.....	\$75.00 \$69.75
3/8-in. d. stp.....	75.00 72.00
1/2-in. s. stp.....	100.00 93.00
1/2-in. d. stp.....	100.00 96.00

NET PER 1000 FT.—CHICAGO

Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip....	\$75.00 \$63.75
3/8-in. double strip....	78.25-78.75 71.25-71.75
1/2-in. single strip....	100.00 95.00
1/2-in. double strip....	105.00 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	2.....	.47
3/4.....	.15	2 1/2.....	.55
1.....	.18	3.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$25.00-\$55.00	\$20.50-\$24.50
1/4-in.—	\$28.00-\$60.00	\$22.50-\$27.00
		\$22.00-\$23.50

NET PRICE 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$36.66-\$55.00	\$35.00-\$37.50
1/4-in.—	\$40.00-\$60.00	\$27.00-\$30.00
		\$25.00-\$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List Elbows, List

1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.50
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.....	4% to 6%
2500 to 5000 lb.....	6% to 8%
5000 to 10000 lb.....	8% to 11%
(For galvanized deduct six points from above discounts.)	

DISCOUNT—CHICAGO

1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.....	1.3% to 3.7%
2500-5000 lb.....	3.3% to 5.7%
5000-10000 lb.....	4.3% to 6.7%
10000-25000 lb.....	6.3% to 8.7%
(For galvanized deduct six points from above discounts.)	

FLAT IRONS

NEW YORK

List price.....	\$5.00 to \$6.00
Discount.....	30%

CHICAGO

List.....	\$5.00 to \$6.00
Discount.....	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

Per 100 Net

Less than 1/5 std. pkg. \$5.00 to \$5.75
 1/5 to std. pkg. 4.50
 Standard package, 500. List, each, \$0.07.

CHICAGO

Per 100 Net

Less than 1/5 std. pkg. \$6.25
 1/5 to std. pkg. 5.25
 Standard package, 500. List, each, \$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List.
Regular, clear:		Each
10 to 40-watt-B.....	100	\$0.27
60-watt-B.....	100	.36
100-watt-B.....	24	.65
75-watt-C.....	50	.65
100-watt-C.....	24	1.00
200-watt-C.....	24	2.00
300-watt-C.....	24	3.00
Round bulbs, 3 1/8 in., frosted:		
15-watt-G.....	50	.50
25-watt-G.....	50	.50
40-watt-G.....	50	.50
Round bulbs, 3 1/4 in., frosted:		
60-watt-G.....	24	.72
Round bulbs, 4 3/8 in., frosted:		
100-watt-G.....	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg. Net
 Std. pkg. 10%

DISCOUNT—CHICAGO

Less than std. pkg. Net
 Std. pkg. 10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

Per 1000 Ft. Net

Less than coil (250 ft.) \$31.00 to \$33.98
 Coil to 1000 ft. 25.82 to 27.90

CHICAGO

Per 1000 Ft. Net

Less than coil (250 ft.) \$30.00 to \$36.56
 Coil to 1000 ft. 22.50 to 27.42

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100 \$20.00 to \$29.00

CHICAGO

Net per 100 \$19.25 to \$24.00

OUTLET BOXES

Nos.	List,
	per 100
101—A, A1 1/2, 4 S.C., 6200, 320.....	\$30.00
102—B.A., 6200 S.E., 300, AX, 1 1/2, 4 S.....	30.00
103—C.A., 9, 4R, B 1 1/2.....	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.....	20.00

DISCOUNT—NEW YORK

Less than \$10.00 list.... 25%
 \$10.00 to \$50.00 list.... 42%

DISCOUNT—CHICAGO

Less than \$10.00 list.... 40%
 \$10.00 to \$50.00 list.... 50%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg. 10%
 1/5 to std. pkg. 20%
 Std. pkg. 30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg. 10%
 1/5 to std. pkg. 20%
 Std. pkg. 30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

Per 1000 Net

Less than 1/5 std. pkg. \$20.00 to \$38.00
 1/5 to std. pkg. 19.00 to 26.70
 Standard package, 2200. List per 1000, \$20.

CHICAGO

Per 1000 Net

Less than 1/5 std. pkg. \$15.80
 1/5 to std. pkg. 14.80
 Standard package, 2200. List per 1000, \$20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net Std. Pkg. 3500 Std. Pkg. 4000 5 1/2 N.C.—Solid Nail-it—N.C.

Less than 1/5 std. pkg. \$27.50 to \$29.00 \$30.75
 1/5 to std. pkg. 15.60 to 20.75 21.20 to 24.20

CHICAGO

Per 1000 Net Std. Pkg. 3500 Std. Pkg. 4000 5 1/2 N.C.—Solid Nail-it—N.C.

Less than 1/5 std. pkg. \$11.85 \$30.75
 1/5 to std. pkg. 11.10 to 11.40 24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/2-in. cap key and push sockets.....	500	\$0.33
1/2-in. cap keyless socket.....	500	.30
1/2-in. cap pull socket.....	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg. Net
 1/5 to std. pkg. 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg. Net to 14%
 1/5 to std. pkg. 15% to 30%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:

30-amp. S. P. S. T.....	\$0.80
60-amp. S. P. S. T.....	1.20
100-amp. S. P. S. T.....	2.25
200-amp. S. P. S. T.....	3.48
300-amp. S. P. S. T.....	5.34
30-amp. D. P. S. T.....	1.20
60-amp. D. P. S. T.....	1.78
100-amp. D. P. S. T.....	3.38
200-amp. D. P. S. T.....	5.20
300-amp. D. P. S. T.....	8.00
30-amp. 3 P. S. T.....	1.80
60-amp. 3 P. S. T.....	2.68
100-amp. 3 P. S. T.....	5.08
200-amp. 3 P. S. T.....	7.80
300-amp. 3 P. S. T.....	12.00

Low Grade:

30-amp. S. P. S. T.....	0.42
60-amp. S. P. S. T.....	0.74
100-amp. S. P. S. T.....	1.50
200-amp. S. P. S. T.....	2.70
30-amp. D. P. S. T.....	0.68
60-amp. D. P. S. T.....	1.22
100-amp. D. P. S. T.....	2.50
200-amp. D. P. S. T.....	4.50
30-amp. 3 P. S. T.....	1.02
60-amp. 3 P. S. T.....	1.84
100-amp. 3 P. S. T.....	3.76
200-amp. 3 P. S. T.....	6.76

DISCOUNT—NEW YORK

Less than \$10 list..... List net to + 5%
 \$10 to \$25 list..... 11%
 \$25 to \$50 net..... 14% to 15%
 Less than \$10 list..... 5% to 10%
 \$10 to \$25 list..... 16%
 \$25 to \$50 list..... 24% to 25%

DISCOUNT—CHICAGO

Less than \$10 list..... +5%
 \$10 to \$25 list..... 11%
 \$25 to \$50 list..... 14%
 Less than \$10 list..... 5%
 \$10 to \$25 list..... 16%
 \$25 to \$50 list..... 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole.....	250	\$0.28
5-amp. single-pole, ind.....	250	.32
10-amp. single-pole.....	100	.48
10-amp. single-pole, ind.....	100	.54
5-amp. three-point.....	100	.54
10-amp. three-point.....	50	.76
10-amp., 250-volt, D. P.....	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole.....	100	\$0.45
10-amp. three-way.....	50	.70
10-amp. double-pole.....	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg. List
 1/5 to std. pkg. 15%
 Std. pkg. 28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg. +20% to list
 1/5 to std. pkg. List to —15%
 Std. pkg. List to —30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List
No. 155.....	Each
No. 155.....	\$0.34
No. 160.....	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list.....	List	List
\$2.00 to \$10.00 list.....	10% to 20%	5%
\$10.00 to \$50.00 list.....	20% to 30%	15%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list.....	25%	15% to 20%
\$2.00 to \$10.00 list.....	25%	20%
\$10.00 to \$50.00 list.....	25% to 35%	20% to 25%

TOASTERS, UPRIGHT

NEW YORK

List price \$6.00
 Discount 30%

CHICAGO

List price \$5.00 to \$6.00
 Discount 25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

No. 18, less than full spools.. \$0.44 1/4 to \$0.49
 No. 18, full spools 0.43 1/4 to 0.45

CHICAGO

No. 18, less than full spools.. \$0.57 1/2 to \$0.65
 No. 18, full spools..... 0.50 1/2 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
11.....	\$15.00-\$18.00	\$13.00-\$14.00	\$11.25-\$11.50
12.....	23.25-27.09	21.30-23.22	19.35-
10.....	32.40-37.80	29.70-32.40	27.00-
8.....	45.70-53.34	41.90-45.72	38.00-38.10
6.....	72.40-84.42	66.35-72.35	60.30-

CHICAGO

No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14.....	\$18.00	\$13.50	\$12.00
12.....	26.95-27.79	23.41-26.95	19.85-23.10
10.....	33.24-38.25	30.47-32.72	27.70-30.60
8.....	47.04-54.27	43.12-45.47	39.20-43.42
6.....	68.25-84.01	62.05-79.23	55.85-74.90

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

Per 100 Lb. Net
 Less than 25 lb..... \$35.25 to \$39.25
 25 to 50 lb..... 36.25
 50 to 100 lb..... 34.25 to 35.25

CHICAGO

Per 100 Lb. Net
 Less than 25 lb..... \$40.25
 25 to 50 lb..... 39.00 to \$39.35
 50 to 100 lb..... 38.00 to 38.35

NEW APPARATUS AND APPLIANCES

*A Record of Latest Developments and Improvements in Manufacturers' Products
Used in the Electrical Field*

Insulating Material

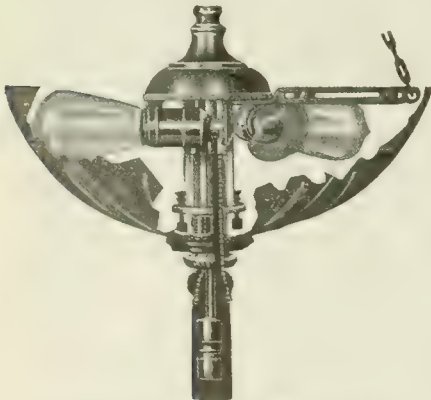
An insulating material which is said to be fireproof, waterproof, acid-proof and electric-current-proof, composed of chemically treated pulverized waste material which may be molded, stamped or pressed into all special or commercial sizes and shapes, has been developed by Harry A. Dorr. Attention is called to the fact that this material, to be known as "Dorrite," being composed chiefly of waste matter, can be sold at a very reasonable price.

A piece of this insulating material, 3 in. (7.6 cm.) in diameter, $\frac{1}{8}$ in. (3.2 mm.) thick, was immersed in water for seventy hours, then subjected to 40,000 volts, and no marks, change in weight or leakage appeared. The same piece was boiled for one hour in cutting oil at 650 deg. Fahr. (343 deg. C.) and stood the same test. A piece 6 in. (15.2 cm.) square and $\frac{1}{8}$ in. (3.2 mm.) thick stood a test of 88,000 volts in oil without leakage or breakdown. A piece of the same size was immersed in a 10 per cent solution of sulphuric acid for nineteen days without change.

This material and the finished product will be made by the Dorrite Insulation Company, Inc., 188-192 Culver Avenue, Jersey City, N. J., after Feb. 1, 1918.

Control for Fixtures

H. A. Bauer of Lansdowne, Pa., has developed a device which provides for lighting either one, two, three or four lamps on a fixture merely by pulling the cord for the corresponding lamp. The construction of the interior of the fixture is shown in the



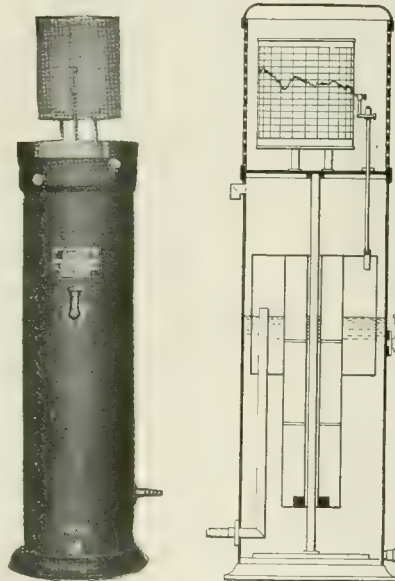
DEVICE USED IN A SEMI-INDIRECT
FIXTURE

accompanying illustration. It will be observed that it consists of a central support on which are lugs for horizontally mounting as many as four pull sockets of any standard make.

The upper part of the support is arranged either with some ornamental cover used purely for decoration or for the attachment of a single supporting chain or stem. When it is desired to use three or four chains these are attached to adjustable arms that can be mounted on the central support. These arms can be changed as to length to fit any desired size of bowl.

Pressure Recorder

The Bacharach Industrial Instrument Company of Pittsburgh, Pa., has brought out a pressure recorder, the action of which depends upon but one moving element, that of a float in



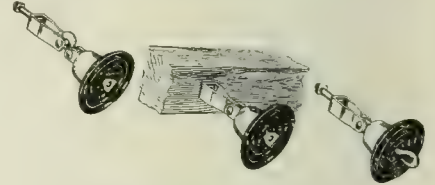
TWO TYPES OF RECORDERS

water. The standard apparatus consists of a cylindrical vessel or tank partly filled with water. The pressures to be measured are transmitted to the instrument and act upon the float. The interior of the bell-shaped float communicates with the gas main, the flue or the stack in which the pressure or draft is to be measured. The latter is transmitted to the space below the bell, whereas the space above the bell communicates with the atmosphere. The position of the bell is determined by the difference of pressure within and without the bell, the magnitude of its movement depending upon the design of the float proper and the bell.

A vertical pen rod is attached to the float and carries at its top a pivotally connected pen which charts the position of the float on carefully calibrated recording sheets.

Dead-Ending Clevis

Dead-ending clevises that will anchor a metal-cap strain insulator with any one of the three types of connections, namely, eye, clevis and hook, on the end of a bolt through



FOR THREE TYPES OF CONNECTIONS

the side of a cross-arm or building are being manufactured by Hubbard & Company, of Pittsburgh, Pa. These clevises are forged from flat steel, $\frac{1}{4}$ in. by $1\frac{1}{4}$ in. (0.6 cm. by 3.2 cm.), and fit both $\frac{1}{2}$ -in. (1.27-cm.) and $\frac{5}{8}$ -in. (1.6-cm.) bolts.

Magnetic Separator

The Magnetic Manufacturing Company, 610 Enterprise Building, Milwaukee, Wis., has just put on the market a magnetic separator especially designed for use in iron and steel foundries. The foundry refuse or mixed material is shoveled in at one end of the machine, and the sand is sifted out while passing through a revolving screen. The iron and steel are attracted by magnetism to the inside face of the revolving cylinder and are carried up and automatically discharged into a spout which deflects them to the discharge end of the machine, while the



FOR IRON AND STEEL FOUNDRIES

coke, slag and other non-magnetic materials discharge from the lower end of the cylinder. The three products of this machine may be received in wheelbarrows. The machine is motor-driven.

Foot-Candle Meter

An instrument for measuring illumination intensities, based on an arrangement of transparent paper and a standard lamp developed by Dr. Clayton H. Sharp, has recently been designed by the General Electric Company. Strictly speaking, the foot-candle meter, as the device is named, is not a substitute for the photometer but has a field of service distinctly its own. It is small, light and compact enough to be carried anywhere and used for approximate illumination measurements in places where a precision photometer would be unwieldy. It is sturdy and simple, so that it can be handled without fear of breakage, and it is pointed out that its cost is so low as to put it within the reach of even the smallest contractor and make the expense of upkeep a negligible quantity.

The instrument is contained in a neat black metal case 8 in. by 1½ in. (20.3 cm. by 3.8 cm.) in size, and consists primarily of a white opaque paper screen perforated by a line of round holes which are covered with transparent paper. This screen, which measures 5¼ in. by ¾ in. (13.3 cm. by 2.2 cm.), is fastened to a plate of glass fitted into an opening in the black metal case housing the entire instrument and is illuminated from below by a standard battery lamp of known candle-power. The opaque paper screen is illuminated by the light to be measured, and by comparison of the graded brightness of the holes with the uniform brightness of the surrounding portion of the screen some point of equality is found and a reading is thereby obtained directly in foot-candles from a calibrated scale which is printed on the screen beside the holes.

In order to keep the lamp candle-power constant, a rheostat and voltmeter are provided, which, together with the lamp, battery and screen, complete the instrument. The voltmeter scale has but one graduation in addition to its indices, that at which the lamp voltage is correct for the required candlepower. A hinged cover is provided for the paper screen, which keeps it clean when not in use and protects it from mutilation.

BASED ON AN ARRANGEMENT OF TRANSPARENT PAPER AND STANDARD LAMP

Once set for the proper voltage, the meter is equally accurate in any position and will maintain its accuracy for a considerable length of time without adjustment except of the rheostat. Provision is made for adjusting the voltmeter needle to its zero point, and battery renewals are easily made from any flashlight dealer's stock.

Globe-Holding Clamp

A globe-holding clamp has recently been developed by R. C. Hager of Jersey City, N. J., which it is claimed will materially reduce the breakage of large outer globes for street lighting. The device consists of two sheet-metal semi-circular forms connected together at one side by a hinge and at the other by a catch. The inner edge of this form is shaped to fit the flange of the globe, while the outside edge is made to fit over the collar of the post. The outside edge of the form has three L-shaped slots, 120 deg. apart, which allows the form to go over the holding screens that project outward through the collar of the post.

After the form is clamped on the globe it is placed on the post, turned



WILL REDUCE BREAKAGE

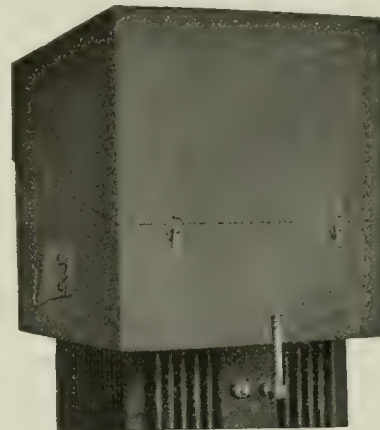
into position and held securely by lugs. It is made waterproof by the introduction of suitable material between globe and holder.

Outdoor-Type Induction Regulators

Outdoor induction feeder voltage regulators provide a means of obtaining voltage regulation in outlying districts or any other part of an alternating-current distribution system without the expense of housing or attendance, it is said. Being entirely waterproof and self-contained, one of these regulators may be mounted on a platform constructed on poles or on the ground protected by a suitable fence or screen. The only attention required will be a general inspection for oiling the motor bearings and worm-screw mechanism, filling the grease cups and examining the relay contacts at long intervals.

The Westinghouse Electric & Manufacturing Company's outdoor induction feeder regulators consist of a standard type C regulator of the familiar form used for indoor service. The following modifications have been made to adapt it for outdoor service. A steel housing

is securely mounted on the top of the regulator tank. This completely incloses the regulator top cover, on which in addition to the operating motor mechanism and secondary relay are also



UPPER SECTION OF REGULATOR WITH HOUSING ON TOP

mounted the primary relay, resistor and any other accessories required.

The steel housing has a hinged cover to facilitate the inspection of the apparatus which it incloses. The edge of the top cover of the housing when closed extends down over the edge of the bottom part of the housing, and a shoulder with gasket forms a moisture-proof joint. The housing is mounted on the regulator tank in such a way that it does not interfere in any way with the easy removal of the regulator from the tank. In most cases the proper location of such a regulator is at the center of distribution of the feeder circuit; that is, as close to the load as possible. When thus installed the regulator with proper setting of the primary relay will hold the voltage at the point where it is located at a predetermined value. An outdoor type voltage transformer must be provided and also a low-voltage alternating-current circuit for the operating motor.

This regulator has the advantage, it is pointed out, that all the accessories are mounted in one compartment with all the interior wiring complete when the regulator is shipped.

This regulator is designed for 10 per cent regulation on 2300-volt feeder circuits, and is furnished in four standard sizes, 5¼, 11½, 17¼ and 23 kva. These ratings correspond to 25, 50, 75 and 100-amp. feeders.

Electrical Alloy

A copper-nickel alloy, which, it is claimed, replaces German silver and is permanent and non-corrosive, withstanding higher temperatures than German silver, has been developed by the Electrical Alloy Company of New York City. This alloy is to be known as "Lucero." It is pointed out that it does not contain any zinc and is very useful for rheostats, car heaters, etc. The specific resistance is 290 ohms per mil-foot (48 microhms per inch), and the temperature coefficient is 0.001 deg. Fahr.

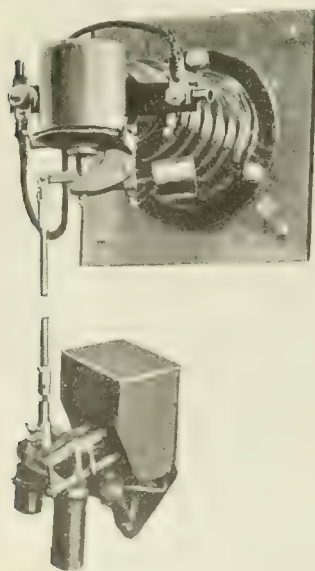
High-Voltage Series Relay

The General Electric Company has recently made several improvements in its high-voltage series relay used for the automatic tripping of oil circuit breakers. As illustrated, the mechanism of the relay consists of two main elements joined by a wooden rod.

The upper element—solenoid, counterbalancing weight and a mechanism for transmitting the motion of the solenoid plunger to the operating rod—is mounted on a high-tension insulator and isolated from ground. The lower element—relay contacts, cover for contacts, calibrating parts, and time-limit arrangement when used—is mounted below the upper element.

The solenoid is connected in series with the circuit, and one end of the coil is electrically connected to the solenoid frame to avoid static stresses. The solenoid coil and mechanism do not require adjustment after installation and thus are not a source of danger to the attendants. When the solenoid or relay operates the motion of the plunger is transmitted through the wooden operating rod to a set of double-break lever-switch contacts which close when the solenoid plunger rises because of overload or short circuit and open again by the weight of the plunger when these abnormal conditions are removed.

The oil-circuit-breaker tripping circuits are the same as when the more common secondary relays are used with circuit-closing contacts. The current adjustments and the time-delay setting are made at the lower end of the operating rod, and of course in safety to the operators. The relay is calibrated from normal to three times normal current. Current calibration is made by the sliding weight. Time-delay adjustments



35,000-VOLT, 100-AMP. INVERSE-TIME SERIES OVERLOAD RELAY

are made by an oil dash-pot. When instantaneous operation of the relay is desired the time-delay features are omitted.

Contacts, mechanism and solenoids are the same for all voltages—that is, from 15,000 upward—but the coils vary

in capacity according to the normal ampere capacity of the line. The insulators for mounting the solenoid will vary according to the line voltage and the factor of safety required. This relay is used mostly when the cost of high-potential current transformers for tripping purposes is prohibitive.

Lighting Fixture

The Doerr-Mitchell Electric Company of Spokane, Wash., has developed a lighting fixture which has been named the "Nitrolite." The fixture consists of a porcelain reflector or shade suspended upon a chain pendant or rod pendant, by means of an especially designed shade holder, and having suspended underneath, by means of three small chains attached to shade holder, a Monax glass diffusing bowl. The object of the combination is first to soften the glaring light from the



FIXTURE FOR NITROGEN LAMPS

nitrogen lamp by means of the diffusing bowl, and second, to increase downward lighting by redirecting the upward rays of light through the means of the porcelain reflector.

The reflector is sand-blasted on the under side, but is smooth on the upper side. The bowl is smooth on both sides. The latter can be raised or lowered or trued to a perfect alignment by means of three screws which pass through the shade holder and attach to the supporting chains of bowl.

Electric Steering Wheel Warmer

The Interstate Electric Company of New Orleans, La., is placing on the market an electric warming device for use on the steering wheels of motor cars. It consists of a neat leather grip which laces on the rim of the wheel. Special resistance wires are arranged between two copper plates in such a way that a small current suffices to keep the grip comfortably warm. Thermostatic control is provided to maintain the grip at an even temperature. The heating pad is operated from the automobile storage battery or magneto.

Electric Iron

The Savo Electric Company of Toledo, Ohio, has developed an electric iron equipped with a switch which opens automatically when the iron is not in use. The switch button is lo-

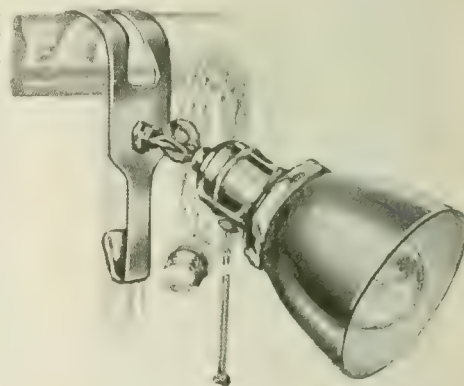


CURRENT IS FROM SWITCH HANDLE

cated in the forward part of the handle, convenient to the thumb. When ironing light pieces, it is pointed out, the current may be released for several minutes by simply removing the thumb. When more current is required simply replace the thumb over the button. It is pointed out that the danger of scorching valuable linen and the danger from fire are eliminated, as the switch opens when the iron is not in use. It is pointed out, also, that the button works exceedingly easily, making no strain on the thumb muscle. The stand is equipped with a catch which will close the button so that the iron may be warmed before using.

Portable Regulating Fixture

A portable lamp with a "Dim-A-Lite" regulating socket is being manufactured by the Wirt Company, Germantown, Philadelphia. In addition to a holder which makes attachment to a bed or back of a chair easy, the fixture is provided with an adjustable hinge bracket, giving flexibility of light direc-



FIVE CHANGES OF LIGHT ARE POSSIBLE

tion. Five changes of light are made possible by the socket regulation device.

The lamp is manufactured in brushed brass and is supplied with 8 ft. (2.4 m.) of flexible cord, with attachment plug.

Trade Notes

PAUL McJUNKIN, formerly of Fahn-McJunkin, Inc., of New York City, is again in business under his own name.

THE LOCKE INSULATOR MANUFACTURING COMPANY has changed its address from Victor to Rochester, N. Y.

THE ELECTRIC STORAGE BATTERY COMPANY of Philadelphia has opened new offices and service station at 1158 Cass Avenue, Detroit.

C. G. YOUNG is now connected with Ford, Bacon & Davis at 115 Broadway, New York City, having given up his offices at 14 Wall Street on Dec. 1.

S. T. HONEY, formerly with the Central Electric Supply Company of New York City, is now manager of the Lindstrom-Smith Company, 396 Broadway.

M. S. ORRICK, formerly sales manager of the Western Electric Company in San Francisco, Cal., has been made assistant manager of the company's branch there.

J. C. MANCHESTER, with the Economy Fuse & Manufacturing Company, Chicago, as district manager in the San Francisco territory, is now established in the Rialto Building.

OLAF E. OLESON, formerly chief engineer of the Commonwealth Edison Company, is now president and general manager of the Edwards Valve & Manufacturing Company, Chicago, Ill.

GEORGE A. SCHNEIDER, formerly in charge of the power equipment department of the Western Electric Company at San Francisco, Cal., has been appointed manager of the Buffalo (N. Y.) office of that company.

THE WAGNER ELECTRIC MANUFACTURING COMPANY of St. Louis, Mo., announces the opening of a sales office at 129 Church Street, New Haven, Conn. This office is in charge of C. M. French, formerly representative at Springfield, Mass.

PASS & SEYMOUR, INC., Solvay, N. Y., manufacturers of electrical specialties, are planning for the immediate installation of new machinery in the factory building just completed. It is expected to have the new structure in operation by the first of the year.

THE EDISON STORAGE BATTERY COMPANY, Orange, N. J., has removed its New York City sales office from 206 West Seventy-sixth Street to larger quarters, 209 West Seventy-sixth Street, directly opposite. Many additional facilities have been installed in the new place.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY of Pittsburgh, Pa., has filed plans for the construction of a new two-story addition to its transformer building at Trafford City. The structure will be about 55 ft. by 110 ft. The contract has been awarded.

THE ELECTRIC SUPPLIES DISTRIBUTING COMPANY having taken over the business and stock of the wholesale department of the Southern Electrical Company, announces the opening on Dec. 1, 1917, of its business in the Spreckels Building, 924 Second Street, San Diego, Cal. Sam L. Hall is manager.

R. N. EHRHART, formerly chief engineer of the condenser department of the Westinghouse Electric & Manufacturing Company, will engage in consulting engineering work for power-plant equipment, with special reference to turbine and condenser installation. His address is 217 Vine Street, Edgewood, Pittsburgh, Pa.

THE ARTHUR JONES COMPANY of Chicago has removed its general offices and salesroom to 2837-2843 South State Street. The service station is at 8 East Twentieth Street. The change, which became effective Dec. 1, was made necessary by the large increase in business and the need of adequate space and improved facilities.

THE GENERAL VEHICLE COMPANY of Long Island City, N. Y., has closed the negotiations for its sale, on the part of the Peerless Truck & Motor Company of New York City, which owns the entire capitalization. The plant covers eight acres and has 265,000 sq. ft. of floor space, and the consideration is reported at approximately \$2,500,000. A statement to the ELECTRICAL WORLD from the Peerless company is to the effect that this sale in no wise disturbs the manufacture of electric trucks, which will be continued as heretofore.

H. T. DYETT, president of the Rome Wire Company of Rome, N. Y., has accepted appointment as a member of the Underwriters' Laboratories Industry Conference for rubber-covered wires and cords.

Mr. Dyett was nominated as one of the three manufacturers' representatives on the conference at a recent meeting of the Wire and Cable Section of the Associated Manufacturers of Electrical Supplies. He succeeds the late John C. Bridgman of the Hazard Manufacturing Company. The other manufacturers' representatives are Leroy Clark, president of the Safety Insulated Wire Company, and Everitt Morss, president of the Simplex Wire & Cable Company.

New Incorporations

THE M. & S. ELECTRIC COMPANY of Flint, Mich., has been incorporated with a capital stock of \$50,000 by Paul Schagane, L. Carey and DeHull N. Travis.

THE DOMESTIC LIGHTING COMPANY of Tulsa, Okla., has been chartered with a capital stock of \$5,000 by R. E. Evans, A. B. Evans and G. B. Bristol of Tulsa.

THE TEXAS BATTERY CORPORATION of Dallas, Tex., has been incorporated with a capital stock of \$5,000 by Thomas R. Tennant, Albert Kramer and Max Rothman.

THE DESHLER (NEB.) LIGHT & POWER COMPANY has been chartered with a capital stock of \$20,000 by W. F. Kellman, John Bokenkamp, Frank Bokenkamp and H. C. Struve.

THE KER-CARE, LTD., of Toronto, Ont., has been chartered with a capital stock of \$20,000 by James H. Spence, 46 King Street West, and others. The company is capitalized at \$20,000.

THE JANDOUS ELECTRIC EQUIPMENT COMPANY of Bayonne, N. J., has been chartered with a capital stock of \$10,000 by E. Freed, L. Freed and G. Silverman, all of New York, N. Y.

THE EDISON ELECTRIC APPLIANCE COMPANY of New York, N. Y., has been incorporated with a capital stock of \$2,650,000 by C. E. Patterson, H. C. Houch and A. H. Jackson of Schenectady, N. Y.

M. J. WOHL & COMPANY of Brooklyn, N. Y., has been incorporated by Maurice J. Wohl, Max Mayer and Bernard Mayer. The company is capitalized at \$30,000 and proposes to manufacture electrical specialties.

THE AMERICAN AUTO LAMP COMPANY of New York, N. Y., has been chartered with a capital stock of \$10,000 by B. Puterman, M. D. Dreiling and W. Berke, 1030 Bryant Avenue, New York, N. Y.

THE EDISON ELECTRIC COMPANY of Canton, Ohio, has been chartered by Guy L. Tudor, H. L. Slagle, V. P. Meese and G. M. Montgomery. The company is capitalized at \$10,000 and proposes to deal in electrical supplies.

THE SMITH NOVELTY ELECTRIC COMPANY of Charlotte, N. C., has been incorporated with a capital stock of \$10,000 by S. J. Smith, E. H. Isenhour and A. B. Justice. The company proposes to manufacture mechanical toys, etc.

THE NELSON ELECTROLYTIC CELL COMPANY of Carteret, N. J., has been incorporated by Hamilton M. Dawes, Selina Apler and Otto J. Wagner of New York, N. Y. The company is capitalized at \$250,000 and proposes to manufacture electric cells and batteries.

THE LESLIE STEVENS COMPANY of New York, N. Y., has been incorporated by H. A. Leslie, C. H. Stevens and W. P. Faendler, 618 Eleventh Street, Brooklyn, N. Y. The company is capitalized at \$10,000 and proposes to deal in electrical and general engineering supplies.

THE MILES SMITH CORPORATION has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$1,000,000 to furnish electricity for lamps, heaters and motors. The incorporators are: C. L. Rimlinger, M. M. Clancy and Clement M. Egner, of Wilmington, Del.

THE ST. ALBANS (W. VA.) ELECTRIC MANUFACTURING & SUPPLY COMPANY has been incorporated by J. M. Britton of Charleston, H. W. Gonla, C. A. Zerkle, L. J. White and J. G. Sheway, all of St. Albans. The company is capitalized at \$50,000 and proposes to manufacture electrical supplies.

THE COCHRAN BROTHERS CORPORATION of Maysville, Ky., has been chartered with a capital stock of \$100,000 for the purpose of furnishing electricity for lamps and motors in Maysville. The incorporators are: H. J. Cochran, R. A. Cochran, W. D. Cochran, J. H. Cochran and A. M. Cochran.

THE HERCULES ELECTRIC STEEL COMPANY of New York, N. Y., has been incorporated with a capital stock of \$50,000 by A. Heller, 90 West Street; W. L. Scott, 18 Broad Street, and W. H. Rich, 110 Liberty Street, New York City. The company proposes to manufacture iron, steel, etc., and to act as metal brokers, deal in securities, promotion and to do a general commercial business.

THE DORRITTE INSULATION COMPANY, INC., 188-192 Culver Avenue, Jersey City, N. J., has been incorporated with a capital stock of \$200,000. Harry A. Dorr is president and general manager; C. O. Hall, vice-president; Robert D. Radcliffe, Jr., treasurer, and R. D. Adams, secretary. A large two-story brick building is now being equipped. The factory will be in operation about Feb. 1, 1918. The company intends to manufacture "Dorrutte," an insulating material which may be molded, stamped or pressed into all special or commercial sizes and shapes, for signal, third-rail and all insulating electrical uses.

Trade Publications

DIM-A-LITE.—The Wirt Company of Philadelphia, Pa., has prepared a bulletin descriptive of its "Dim-A-Lite."

TOOL GRINDING.—The Norton Company of Worcester, Mass., has issued a booklet known as "Tool-Room Grinding."

TELEPHONE ATTACHMENT.—The Chicago Writing Machine Company of Galesburg, Ill., has prepared a folder descriptive of its "adjustaphone."

CHAIN DRIVES.—"The Ideal Drive for Clay-Working Machinery" is the title of bulletin No. 310, which has been prepared by the Link-Belt Company of Chicago.

PRESSURE RECORDER.—"Hydro" pressure recorders are illustrated and described in a bulletin prepared by the Bacharach Industrial Instrument Company of Pittsburgh, Pa.

TURBO-GEAR.—The Poole Engineering & Machine Company of Baltimore, Md., has prepared bulletin No. 100, descriptive of its turbo-gear. Typical applications are illustrated and described.

REFRIGERATION.—"Raw-Water Ice" is the title of a bulletin that has been prepared by the De La Vergne Machine Company of New York City. This company has also prepared an attractive bulletin entitled "The Home of De La Vergne." Illustrations of various parts of the factory are given with the intention of presenting to those interested a comprehensive view of the scope of the factory.

ELECTRICAL SUPPLIES.—The Central Telephone & Electric Company of St. Louis, Mo., is now distributing copies of its 1918 catalog. Its preparation is unique, as it describes and illustrates only the appliances and products for which this company is distributor and which are carried in stock. It is a strong cloth-bound book of the loose-leaf type and has been made the exact size of the jobbers' association catalog. Copies may be had on application.

EXPLOSIVES AND BLASTING SUPPLIES.—The E. L. du Pont de Nemours Company, Wilmington, Del., has prepared a book descriptive of several of its products. The table of contents includes the following: High explosives, black blasting powder, blasting supplies, sporting powders, rifle and pistol powders, explosives for military uses, Du Pont Fabrikoid, Fairfield rubber cloth, Py-ra-lin, chemicals, paints and varnishes, miscellaneous commodities, special products, by-products and customers.

INDUSTRIAL MOTORS.—The second of a series of catalogs of industrial motors has just been distributed by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. This is known as catalog 30 and covers the company's complete line of direct-current motors and generators for industrial service. After several pages giving general information regarding the ordering, classification and selection of direct-current motors there follows matter covering a complete description, rating and dimensions for type SK commutating-pole motors, various modifications of type SK elevator motors, reversing planer motor equipment, Type CD motors, headstock equipment for woodworking plants, type SK and CD motor generators and arc-welding equipment. Much new information is given, especially on such subjects as arc welding, headstock equipment, motion-picture service and battery-charging service. The new catalog is identical in size and will fit the binder for the company's line of catalogs covering supply apparatus and small motors.

New England States

CAVENDISH, VT.—The Colonial Power & Light Company is increasing the voltage of the transmission line from Cavendish to Claremont from 11,000 to 44,000 volts.

VERNON, VT.—The local transformer station of the Connecticut River Power Company of Brattleboro was recently destroyed.

HUDSON, MASS.—Plans are being considered by the City Council for increasing the output of the municipal electric-light plant to meet the increasing demands for electrical service.

PLYMOUTH, MASS.—The Plymouth & Sandwich Street Railway Company, it is reported, is planning to build an extension from Sagamore Village along the northern shore of Cape Cod Canal to Buzzards Bay Village, a distance of about 5 miles, during the coming spring or summer.

WRENTHAM, MASS.—The Union Light & Power Company is planning to make improvements to both the street and domestic lighting systems in Wrentham.

HARTFORD, CONN.—Plans have been filed by the Colt's Patent Fire Arms Company, Huyshope Avenue, for the construction of a two-story power house, 50 ft. by 95 ft., to cost about \$15,000. Contract for building has been awarded.

Middle Atlantic States

ANDOVER, N. Y.—A petition has been filed with the Public Service Commission by the village of Andover asking a certificate of authority to construct and operate an electric-light plant for other than municipal purposes.

COHOES, N. Y.—The Business Men's Association and the Board of Trade has petitioned the City Council for an extension of the ornamental lighting system on White Street, west of Remsen Street, and the extension on Dudley Avenue to Bowery Street.

DUNKIRK, N. Y.—Improvements are being made to the municipal electric-light plant, including the installation of a frequency changer, to provide facilities for using Niagara power in connection with the power generated at the municipal electric plant.

PORT IVORY, S. L., N. Y.—The Procter & Gamble Manufacturing Company, Richmond Terrace and Morningstern Avenue, is building a new generating station, about 40 ft. by 150 ft., and a shop building, to cost about \$40,000. Port Ivory has not a post office.

HADDONFIELD, N. J.—The erection of a municipal electric-light plant on a site on Evans Pond is under consideration by the City Council. The construction of a concrete dam, spillway and bulkhead, which makes this body of water available, has been completed.

LODI, N. J.—The Town Council is considering the erection of a new pumping station at the waterworks, plans for which are being prepared by Thomas F. Rowe of East Rutherford.

MADISON, N. J.—For the purpose of conserving fuel the Council has applied to the Board of Public Utility Commissioners for permission to combine the municipal lighting plant with the municipal lighting plant at Chatham, the latter to carry the entire load of the two municipalities from midnight until noon, and the former to carry the heavier load from noon up to midnight. The Council estimates that a saving approximately of 40 per cent of fuel would result from this combination.

MATAWAN, N. J.—The Borough Council is considering the installation of new street lamps in Monroe, Jackson and Center Streets, and equipping the pumping plant of the water-works system throughout for electrical operation.

PERTH AMBOY, N. J.—The City Council is considering extensions and improvements to the electric street-lighting system.

CHAMBERSBURG, PA.—Application has been made to the City Council by J. H. Mowery, manager of utilities, for an appropriation of \$60,000 to purchase a 1000-kw. generator and accessories for the municipal electric-light plant.

COATESVILLE, PA.—The Chester Valley Electric Company has issued bonds to the amount of \$45,000 for extensions, improvements, etc.

ERIE, PA.—Contract has been awarded by the Erie Forge Company for the construction of a new power plant and substation, 90 ft. by 140 ft., to the James R. Gloyd Company, Hippodrome Annex Building, Cleveland, Ohio.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

HARRISBURG, PA.—The City Council is planning extensions and improvements to the electric street-lighting system in the Riverside district.

HARRISBURG, PA.—Bids will be received by the board of school directors until Dec. 21 for electrical work in the new school building to be erected on Sixteenth Street.

HARRISBURG, PA.—Application will be made to Governor Brumbaugh on Dec. 17 by Morgan D. Kalbach, William Kalbach and Allison Z. Kalbach for three charters, covering Bernville and the townships of Penn and Jefferson, to supply electricity for lamps, heaters and motors.

HARWOOD, PA.—Work has begun on the erection of a new electric transmission line from Harwood to Bethlehem. The new line will be used to serve as an emergency for the connecting link that now extends from Harwood to Hauto and on through the Lehigh Valley to Bethlehem.

HAZLETON, PA.—The Harwood Electric Company has begun work on the erection of an electric transmission line from Free-land to the Pond Creek colliery for the purpose of supplying electricity to operate the works at the latter place. The company is also extending its transmission lines to the plant of the Bethlehem Steel Company.

LANCASTER, PA.—The property of the Lancaster Electric Light, Heat & Power Company has been purchased by the Lancaster County Railway & Light Company. The plant of the former, located at Wabank, which was practically destroyed by fire on Nov. 25, causing a loss of about \$15,000, will be rebuilt at once by the Lancaster County company.

LANSDOWNE, PA.—The Delaware County Electric Company, 1000 Chestnut Street, Philadelphia, has issued \$2,693,800 in capital stock, the proceeds to be used for extensions, improvements, etc.

NORRISTOWN, PA.—Plans have been prepared for the erection of a new battery house, two-story signal tower and new signal bridge at the Norristown works of the Philadelphia & Reading Railway Company, Reading Terminal, Philadelphia, Pa. Samuel T. Wagner is engineer for the company.

PHILADELPHIA, PA.—The Philadelphia Electric Company has taken over the power house of the Edison Electric Light Company at 904 Sansome Street. The consideration is said to be about \$180,000.

PHILADELPHIA, PA.—The Midvale Steel Company has awarded a contract to Barclay, White & Company for the construction of a one-story power house and storage building, 75 ft. by 50 ft., at its plant at Nicetown.

PHILADELPHIA, PA.—Property has been acquired by the American International Shipbuilding Corporation from the Chester branch of the Philadelphia & Reading Railroad Company, beginning at Alburger Lane, on which it will erect a high-tension transmission line to the new Hog Island shipyard to supply electricity for power purposes.

PHILADELPHIA, PA.—The H. Belfield Company, 435 North Broad Street, Philadelphia, Pa., has awarded a contract to the William Steele & Sons Company, 30 South Fifteenth Street, for construction of additions to its plant, including a one-story foundry, 100 ft. by 280 ft.; five-story manufacturing plant, 100 ft. by 280 ft.; one-story power plant, and a one-story warehouse, 100 ft. by 280 ft., to cost about \$100,000.

PITTSBURGH, PA.—Notice has been filed by the Consolidated Traction Company with the Public Service Commission of a bond issue of \$200,000, to provide funds for extensions and improvements to its system.

ROARING SPRINGS, PA.—The Roaring Springs Light, Heat & Power Company has increased its capital stock by \$50,000, the proceeds to be used for extensions, improvements, etc.

SCOTT HAVEN, PA.—Plans have been prepared by W. H. Hill of Pottsville for the erection of a new power house, 40 ft. by 50 ft., one story high, at the plant of the Scott Haven Light Company.

SCRANTON, PA.—The Maccor Truck Company has awarded a contract for the construction of a new power house, 29 ft. by 33 ft., to L. T. Stipp of Scranton.

SCRANTON, PA.—The Jefferson Electric Company has filed notice of a bond issue

of \$29,000, the proceeds of which are to be used for the purpose of acquiring the plant and property of the Reynolds (Pa.) Light & Power Company.

TACONY, PA.—Permit has been granted to the Tacony Ordnance Company for the erection of a one-story power house, 40 ft. by 50 ft., and for a storage house, one story, 30 ft. by 50 ft., to cost about \$12,000. Contract for construction of both buildings has been awarded to Barclay, White & Company.

BALTIMORE, MD.—Most of the machinery to be installed in the new shipbuilding works of the J. Henry Smith Company of Baltimore will be equipped for electrical operation.

BALTIMORE, MD.—The United Railway & Electric Company is planning for the immediate extension of its electric railway system from Curtis Bay line, Stonehouse Cove, to Fairfield, East Brooklyn, and Masonville, near Baltimore.

TRAPPE, MD.—Arrangements have been made for the installation of an electric-light plant in Trappe. Frank Baker and Harry A. Nevius of Trappe are interested.

FAIRMONT, W. VA.—Plans are being considered by the Greater Fairmont Investment Company for the construction of a 10,000-kw. electric generating station.

HARTLAND, W. VA.—The French Coal Company of Hartland is in the market for electric hauling locomotives.

HOPEWELL, VA.—The City Council is considering an issue of \$75,000 in bonds for the installation of electric-lighting, water and sewer systems and to equip a fire department.

LYNCHBURG, VA.—The Retail Merchants' Association is considering the installation of an electric-lighting plant.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for 500,000 ft. of twisted telephone wire to be delivered at the Brooklyn Navy Yard, as per schedule No. 1619.

WASHINGTON, D. C.—Authority has been given the Potomac Electric Power Company by the Public Utilities Commission to change the date of issue of \$127,000 of its general improvement debenture bonds from Jan. 2, 1915, to Jan. 2, 1918. The proceeds are to be used for improvements.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 17 for furnishing two 300-kw. motor-generator sets and switchboards at the navy yard, New York; four 300-kw. motor-generator sets and switchboards at the navy yard, Philadelphia, Pa.; four 300-kw. motor-generator sets and switchboards at the navy yard, Norfolk, Va., and three 500-kw. motor-generator sets at the navy yard, Washington, D. C. Drawings and specifications (No. 2711) may be obtained on application to the above bureau or to the commandants at the navy yards named.

North Central States

GRAND RAPIDS, MICH.—Bonds to the amount of \$1,500,000 have been authorized by the United Light & Railways Company, Michigan Trust Company Building, Grand Rapids, which owns and operates 21 utility properties and serves 53 communities with gas, electric, street or interurban railway service in the states of Iowa, Illinois, Indiana, Michigan and Tennessee. Of the proceeds \$750,000 will be used to retire outstanding notes and the remainder for additions, extensions and improvements to its properties.

LUDINGTON, MICH.—Application has been made to the City Commission by Frank Hawley, who was for 16 years manager of the Steam, Lighting & Power Company, for a franchise to operate an electric light and power plant in Ludington. The commission has granted the franchise subject to the approval of the voters. Mr. Hawley resigned from the steam company when an interest was sold to the Commonwealth Light & Power Company of New York.

MONROE, MICH.—Electricity for operating the local system is being supplied by the Detroit Edison Company, which secured a franchise in Monroe a few months ago. The old municipal electric plant will be dismantled and the property turned over to the city.

CLEVELAND, OHIO.—Contract has been awarded by the Ideal Tire & Manufacturing Company, 385 Guardian Building, for the erection of a factory building. Equipment, including boilers, generator and machinery for the manufacture of rubber goods, is to be purchased.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until Dec. 21 for switchboard, oil switches and reactors for the division of light and heat. Specifications may be obtained upon application to the division of light and heat.

LIMA, OHIO.—Business men and property owners on Main Street and the public square have petitioned the City Council for the installation of an ornamental lighting system for that district similar to that on West Market Street.

OXFORD, OHIO.—Bids will be received by F. L. Packard, architect, of Columbus, until Dec. 22 for in addition to the chemistry building for Miami University at Oxford. Plans are on file at the office of the architect, Columbus, and at the office of Walter L. Tobey, chairman of special building committee at Oxford.

ST. CLAIRSVILLE, OHIO.—The property of the Sunnyside Electric Company, which furnishes electricity in five counties including Belmont, Stark, Jefferson, Harrison and Carroll, has been taken over by the Central Power Company of Canton.

YOUNGSTOWN, OHIO.—The Public Utilities Commission has granted the Mahoning & Shenango Railway & Light Company permission to issue \$500,000 in bonds, to be sold at not less than 90.

FRANKFORT, KY.—Bids will be opened about Jan. 1 for the construction of the Frankfort & Shelbyville Electric Traction Company's railway from Frankfort to Shelbyville, about 19 miles long. The P. C. Phillip Engineering Corporation, Real Estate Trust Building, Philadelphia, Pa., has charge of the surveys. P. C. Phillip is vice-president and general manager.

MAYKING, KY.—Plans are being considered by W. C. Daniels & Son of Whitesburg for the erection of an electric transmission line to Mayking, a distance of 5 miles.

MAYSVILLE, KY.—The Cochran Brothers Corporation, recently incorporated with a capital stock of \$100,000, is planning to build an electric plant in Maysville. R. A. Cochran, H. J. Cochran, J. H. Cochran and A. M. J. Cochran are the incorporators.

PINEVILLE, KY.—The Williams By-Product Coal Company, recently incorporated, is planning to install new electrically operated machinery at its plant. J. W. Williams of Corton is president.

MOORESVILLE, IND.—C. E. Layton of Sheridan has purchased the electric water, ice and heating plants of the Mooresville Public Service Company.

NAPANEE, IND.—The municipal electric-light plant has been purchased by the Napanee Utilities Company for \$50,000.

OAKLAND CITY, IND.—The Ayrshire Coal Company is considering the purchase of an electric generating unit of from 150 to 200 kw., 250 volts.

SHERIDAN, IND.—The Sheridan Water, Light & Heat Company has recently purchased a 150-kva. Ames-Stumpf uniflow engine unit. C. E. Layton is secretary and treasurer.

CARTHAGE, ILL.—The Central Illinois Public Service Company of Mattoon has asked the City Council for permission to construct high-tension transmission lines through Carthage in order to connect the Augusta, Beardstown and Macomb circuit with a complete circuit, and which would permit getting into the Beardstown district by two routes. E. V. Graham, 116 South Sixteenth Street, Mattoon, is secretary of the company.

CHICAGO, ILL.—A permit has been granted to McCord & Company, 847 West 120th Street, West Pullman, a suburb of Chicago, for the erection of a one-story foundry, 72 ft. by 214 ft., to cost about \$30,000; a transformer room, to cost \$2,300, and a blower house, to cost \$1,700.

URBANA, ILL.—The capital stock of the Urbana Light, Heat & Power Company has been increased from \$150,000 to \$200,000.

JANESVILLE, WIS.—The Janesville Electric Company is considering the installation of a 150-hp. water turbine unit at its hydroelectric plant on Rock River.

LA CROSSE, WIS.—Within 30 days, it is stated, power will be received from the Wissoda dam to operate the local plant of the Wisconsin-Minnesota Light & Power Company.

STEVENS POINT, WIS.—Work will be finished on the new transmission line between Mosinee and Stevens Point about Jan. 1. The new line is 22 miles long and will connect up the water powers of Whiting-Plover and Mead-Witter in the Stevens Point district, and the power of Mosinee, Merrill, Rothschild and Wausau.

PILLAGER, MINN.—The new dam of the Cuyuna Range Power Company at Pillager is practically completed. The structure is 750 ft. long and has a 15-ft. head and cost about \$600,000. The plant will supply electricity for lamps and motors to the iron mines on the Cuyuna Range.

DAVENPORT, IOWA.—Plans are being considered by the Brady Street Merchants' Association for securing an improved lighting system on that thoroughfare.

DES MOINES, IOWA.—The Inter-Urban Railway Company is building 10 miles of second track between Des Moines and Camp Dodge and 13 miles of yards and sidings.

IOWA CITY, IOWA.—The erection of a hydraulic experiment station on the other side of the river near the west end of the large dam, to cost about \$15,000, is reported to be under consideration.

McCAUSLAND, IOWA.—A special election has been called to be held on Dec. 17 to vote on the proposal to grant a franchise to William Stutzel, R. D. Anderson and F. E. Ringley to construct and operate an electric-lighting system in McCausland.

CAMERON, MO.—The City Council is contemplating improvements to the municipal electric light plant.

FOREST CITY, MO.—Steps have been taken by local business men for the installation of an ornamental lighting system in the business district. Electricity for operating the system will be obtained from St. Joseph.

LEITH, N. D.—Machinery has been received for the new electric-light plant at Leith, which will be operated by a company organized by local citizens.

NEW ENGLAND, N. D.—The Sterling Electric Company has recently completed the installation of a 37½-kw. and a 7½-kw., 2300-volt, alternating-current generator, driven by Muncie oil engines, in New England.

FALLS CITY, NEB.—The City Council is considering calling an election to submit the proposal to issue \$75,000 in bonds for remodeling the municipal electric-light plant.

LINWOOD, NEB.—The property of the Stava & Franklin Electric Company has been acquired by William Lowman.

OCONTO, NEB.—At an election recently held the proposal to issue \$3,900 in bonds for a municipal lighting plant was defeated.

ORD, NEB.—The Ord Telephone Co. is contemplating erecting a telephone line from Ord to Sargent, a distance of 30 miles.

ABILENE, KAN.—The Riverside Light, Power & Gas Company, it is reported, is contemplating the purchase of a new turbine.

AGENDA, KAN.—Electricity for operating the proposed municipal electric-light plant will be secured from the plant of the Concordia (Kan.) Electric Light Company.

KANOPOLIS, KAN.—Funds have been raised by the business men for the installation of an ornamental lighting system on Main Street.

KANSAS CITY, KAN.—Plans are being considered by the City Council for issuing \$200,000 in bonds for extensions and improvements to the municipal electric-light plant.

LIBERAL, KAN.—The property of the Liberal Light, Ice & Power Company, consisting of an electric plant and ice factory, has been purchased by the Commonwealth Light & Power Company.

POTWIN, KAN.—At an election to be held Dec. 18 the proposal to issue \$3,000 for the installation of an electric-lighting system in Kansas will be submitted to the voters. Electrical service will be obtained from the Kansas City Gas & Electric Company of Wichita.

Southern States

MONROE, N. C.—The installation of a new street-lighting system in Monroe is under consideration.

ROUEMONT, N. C.—W. A. Carver is contemplating extensions to his plant to transmit electricity from 1 to 2 miles. Mr. Carver would like to receive prices on a new and a second-hand electric generator of from 5 to 100 kw.; motors 10 to 30 hp.; wire, fittings, etc., (excepting poles, for transmission line), 1 to 2 miles, and lamps for residences; also prices on iron or steel pipe 24 in. to 30 in. in diameter.

SPARTANBURG, S. C.—Contract has been awarded by the Piedmont & Northern Railway Company of Charlotte, N. C., for

the construction of a spur from Spartanburg to Camp Wadsworth, a distance of 2 miles, to the Porter & Boyd Construction Company. E. Thomason of Charlotte, N. C., is vice-president and general manager.

CORDELLE, GA.—The property of the Cordelle Electric Company has been purchased by the Georgia Public Service Company of Tifton.

DECATUR, GA.—The City Council has awarded a contract to the Georgia Railway & Power Company for equipping the pumping station of the water works for electrical operation. The plans provide for the installation of new electrically operated triplex pumps and auxiliary equipment.

TIFTON, GA.—The Georgia Public Service Company has purchased the property of the Tifton Ice & Power Company. The company has also bought the plant and holdings of the Cordelle (Ga.) Electric Company.

LEESBURG, FLA.—O. S. Lang, it is reported, would like to receive information on an electric-light plant for a \$7,000 clubhouse.

COAL CREEK, TENN.—Preparations are being made by the Black Diamond Coal Company of Knoxville for the installation of a new electric generating plant (alternating current) at its local plant.

FOUNTAIN CITY, TENN.—Plans are being considered for the installation of an electric-lighting system in Fountain City.

KNOXVILLE, TENN.—The John G. Duncan Company of Knoxville, it is reported, would like to receive prices on a double-cylinder, double-drum hoisting engine and boiler, 8½-in. by 10-in. cylinders, about 30 hp.; also for a similar engine, 5½ in. by 7 in., or 6½ in. by 8 in.

BIRMINGHAM, ALA.—Prices are being asked on a 350 to 400-kva., 3-phase, 60-cycle, 2300-volt generator directly connected to a cross compound generator, complete with exciter and switchboard. Howard H. Glassman, Brown-Marx Building, Birmingham, is consulting engineer.

BIRMINGHAM, ALA.—Plans are being prepared by the Alabama Interurban Corporation for the construction of an electric railway from Gadsden and Mobile on one end and to Albany and Sheffield on the other. The present plans, it is understood, provide for the Albany-Sheffield branch to extend through Jasper and connect with the Mobile-Gadsden branch at Greensboro.

DOTHAN, ALA.—The Houston Power Company, recently incorporated with a capital stock of \$25,000, it is reported, contemplates the construction of a hydroelectric plant in Dothan. H. F. Deal of Dothan is interested.

GADSDEN, ALA.—Plans are being considered for the installation of electric motors, shafting, etc., in the Davis-Alcott Hosiery Mills at once.

EARLE, ARK.—The Arkmo Lumber Company is contemplating improvements to its plant, including equipping the machinery for electrical operation. The cost is estimated at \$6,000.

JUNCTION CITY, ARK.—The City Council has appointed a committee to take up with the Arkansas Light & Power Company the matter of extending its electric transmission lines from El Dorado to Junction City to supply electricity for lamps and motors in the latter city.

NEW ORLEANS, LA.—The Machinery Exchange Company of New Orleans is reported to be in the market for 2000 hp. in boilers, a 1500-hp. condensing engine and other machinery.

ALINE, OKLA.—The installation of a municipal electric-light plant is under consideration. Bids are being received by the city of Caldwell for material for the construction of a power house, which probably will be erected by day work. Burns & McDonnell, Interstate Building, Kansas City, Mo., are engineers.

LAVERNE, OKLA.—At an election held recently bonds to the amount of \$13,000 were authorized for the purchase of the property of the Laverne Light, Power & Ice Company.

OKMULGEE, OKLA.—The Omaha Lead & Zinc Company of Okmulgee, recently incorporated with a capital stock of \$350,000, is reported to be in the market for mining and power plant equipment. E. J. Dick of Okmulgee is one of the incorporators.

WOODWARD, OKLA.—An election will soon be held to vote on the proposal to issue \$20,000 in bonds for an electric-light plant and \$7,000 for water works.

ABILENE, TEX.—The West Texas Utilities Company of Abilene, recently organized with a capital stock of \$400,000, has taken over the properties of the Abilene Gas & Electric Company, the Baird (Tex.)

Gas & Electric Company and the Hamlin (Tex.) Gas & Electric Company. It is understood that the plants will be enlarged and new machinery installed. The incorporators are: George W. Williamson of Chicago, Ill.; J. M. Dickie, J. F. Meadows and F. A. Matthes, all of Abilene; A. Hargrave and Sidney Vigo of Dallas.

FORT WORTH, TEX.—Preparations are being made to double the output of the power plant of the Fort Worth Power & Light Company, located at the foot of the Paddock Viaduct. Orders have been placed for a 23,000-kw. steam turbo-generator set. Work has already begun on the erection of the addition to the power house. The company has increased its capital stock from \$3,860,000 to \$4,360,000. A. J. Duncan is president.

MARSHALL, TEX. The East Texas Utilities Company of Marshall, recently organized with a capital stock of \$300,000, has taken over the plant holdings of the Marshall Electric Company, the Marshall Traction Company and the Marshall Ice Company; the Jefferson (Tex.) Ice & Light Company and the Longview (Tex.) Ice & Light Company. The plants, it is understood, will be enlarged and new machinery will be installed. Among the incorporators are: George W. Williamson of Chicago, Ill.; J. M. Dickie of Abilene and Sidney G. Vigo of Dallas, Tex.

PORT ARTHUR, TEX.—The Port Arthur Laundry Company, Fourth and Fort Worth Streets, would like to receive prices on electrical equipment.

Pacific and Mountain States

BELLINGHAM, WASH.—The Olympic Portland Cement Company is considering changing its oil-burning plant to a coal burner, which will include the installation of coal-pulverizing machinery.

PORT FLAGLER, WASH.—The Arrow Electric Company of Seattle has been awarded the contract for installing all electric wiring, transformers, street-lighting systems, etc., for the United States Army contingents at Forts Flagler, Casey and Worden. About 40 buildings will be erected.

KELSO, WASH.—The North Coast Power Company is contemplating an extension of its transmission line from Kelso to the new pumping plant to be erected near Freeport, to reclaim several hundred acres of land lying within the bend of Horseshoe Lake.

PROSSER, WASH.—The City Council has decided to accept the proposal of the Pacific Power & Light Company to have the street arc lamps replaced by incandescent lamps.

RENTON, WASH.—Plans have been completed by the Chicago, Milwaukee & Puget Sound Railway Company for the construction of a substation at Walla Walla Avenue and Cedar Street in Renton, to cost about \$75,000, in connection with equipping the railroad over the Cascade Mountains for electrical operation.

SHELTON, WASH.—Application has been made to the County Commissioners by the Shelton Light & Power Company for a franchise to erect and operate electric transmission lines from its plant at Goldsborough Creek over the county roads.

TACOMA, WASH.—The Tacoma Railway & Power Company is planning to extend its lines directly into Camp Lewis, a distance of about 5 miles.

TACOMA, WASH.—The City Council has voted to extend the municipal car line from the present terminus at Eleventh Street and Taylor Way to Lincoln Avenue, a distance of 1 mile, to cost about \$20,000.

TACOMA, WASH.—The shops of the Chicago, Milwaukee & St. Paul Railway at Tacoma, it is reported, will be enlarged. Equipping the railroad to Puget Sound for electrical operation will soon be completed.

TACOMA, WASH.—A power site on the headwaters of the Cowlitz River, about 58 miles from Tacoma, upon which about \$260,000 has been expended for preliminary surveys and construction work, has been offered to the city of Tacoma by J. H. Cunningham, hydraulic engineer of Portland, Ore. F. K. Devens and Fred Murray, representing the Skyhomish Power Company, have also offered a site on the Stillagnamish River site and have outlined a plan whereby the city of Tacoma could secure the site and a plant complete at \$4,000,000.

VANCOUVER, WASH.—The City Council has adopted the contract submitted by the Portland Railway, Light & Power Company for lighting the streets of the city.

BEND, ORE.—The Deschutes White Water Electric Company is planning to start construction of a power plant at

Pringle Falls, to have a capacity of 80,000 to 100,000 ft. to start with, in the spring. The plans provide for a hydroelectric power development of about 2250 hp., the entire river to be diverted through a 1000-ft. canal with an 8-ft. fall at the end.

PORTLAND, ORE.—The Commission of Public Docks has authorized Chief Engineer Hegardt to ask for bids at once on motors and transformers for the St. Johns terminal project, which includes municipal grain elevator and additional dock space.

ALAMEDA, CAL.—The city of Alameda has entered into a contract with the Great Western Power Company of San Francisco to furnish the city with electricity through marine cables from the Oakland lines for a period of five years.

BAY POINT, CAL.—Surveys are being made by the Great Western Power Company, 14 Sansome Street, San Francisco, for the purpose of supplying energy to the plant of the Pacific Electro Metal Company at Bay Point. The power company has a contract to furnish 4000 kw. to operate the first unit of the chemical plant now in course of construction.

ESCONDIDO, CAL.—Plans are being prepared by the San Diego Consolidated Gas & Electric Company for the erection of a three-phase electric transmission line into San Pasqual Valley in the near future.

LOS ANGELES, CAL.—Through F. M. Merrill and W. B. Baker of Los Angeles the Coachella Power & Irrigation Canal Company has filed application with the State Water Commission to install an irrigation system in the Morengo Valley, San Bernardino County, to cost about \$4,900,000. The company proposes to irrigate 25,000 acres and to develop a hydroelectric project of 30,000 hp. from two power plants, to be located above the Whitewater River Valley, to which the waters will be carried for irrigation purposes in 65 miles of canals and pipe lines. Morengo Valley will be used as a storage reservoir with a capacity of 10,000 acre ft.

MERCED, CAL.—Steps have been taken by the City Trustees toward taking over the electric-light, gas and water systems in the city, to be owned and operated by the municipality.

OROVILLE, CAL.—The Great Western Power Company has purchased a site of 1255 acres having a frontage of 2½ miles on the Feather River, which will be used as a site for its proposed \$6,000,000 power plant. The water for the new plant will be diverted from the North Fork of the Feather River immediately after it leaves the Las Plumas plant of the company. It will be carried in a large concrete canal to a point about 2 miles north of Oroville, where it will be dropped a distance of 500 ft. down the mountainside into the power plant. Rights of way for the canal have already been obtained. The proposed plant, it is estimated, will develop about 60,000 hp.

PASADENA, CAL.—The City Commissioners have made an arrangement with the city of Los Angeles for the purchase of electricity to be used by the lighting department. It is understood to be purely a war measure subject to recall at any time.

REDDING, CAL.—A permit has been granted to William A. McEwan of Redding to use 25 second-ft. of water of Boulder Creek and Little Boulder Creek in Trinity County.

SAN DIEGO, CAL.—Plans are being considered to equip the La Jolla Beach Railway line for electrical operation.

SAN DIEGO, CAL.—Plans for the construction of an electric railway into the Mountain Empire from Lakeside to Santa Ysabel, a distance of about 22 miles, is under consideration by the San Diego South-eastern Railway Company. E. J. Burns of San Diego is manager.

SANTA ROSA, CAL.—Application has been made to the State Railroad Commission by the California Telephone & Light Company of Santa Rosa for permission to extend its transmission system in order to serve Summer Home Park and vicinity in Sonoma County.

STOCKTON, CAL.—The Tidewater Southern Railway Company is planning to complete its extension to Livingston, 10 miles long. It also contemplates equipping the line southward from Modesto for electrical operation.

UKIAH, CAL.—The Snow Mountain Water & Power Company of Ukiah, which operates a hydroelectric power plant in Mendocino, Lake, Sonoma and Napa Counties, has filed an application for an extension of time within which to comply with the statutes concerning the standardization of pole lines.

COEUR D'ALENE, IDAHO.—The City Council has voted to offer the Consumers'

Power Company and the Kootenai Power Company, which furnishes electricity for lamps and motors in Coeur d'Alene, a contract to furnish the service for six years, instead of twelve years as asked by the companies.

HALLEY, IDAHO.—At an election held recently the proposal to issue \$100,000 in bonds to establish a municipal electric-light plant was defeated.

PRICE, UTAH.—At an election to be held Dec. 22 the proposal to lease the municipal electric-light plant to J. H. Manson for a period of 25 years will be submitted to the voters. Mr. Manson, who has managed the plant for the past two or three years, has submitted a proposition to the Council to lease the plant, offering to pay off the bonded indebtedness (\$25,000), furnish electricity for lighting the streets and public buildings in the city free of cost, and to make all needed extensions and turn the plant back to the city in first-class condition and free from indebtedness at the expiration of the lease.

SALT LAKE CITY, UTAH.—Steps have been taken to create a special lighting district on Regent Street. It is proposed to use 6.6-amp. lamps, somewhat similar to those in use on Main Street. Each standard will carry one lamp.

YUMA, ARIZ.—Plans for voting \$200,000 bonds, the proceeds to be used in the construction of municipal electric light and water works plants here, have been blocked by the refusal of Mayor George Michelson to sign the ordinance calling the election.

KALISPELL, MONT.—The property of the Northern Idaho & Montana Power Company has been sold at public auction to Robert J. Graf, representative of the stockholders of the company.

KALISPELL, MONT.—City Council has adopted a resolution, on the recommendation of the light and water committee, to provide the city with a special lighting district that will embrace the whole city. The cost of the improvement is placed at \$14,500, and the cost of maintaining the lamps and supplying the electrical current therefor for the first year is estimated at \$11,900. R. E. Rollins, city clerk.

GREELEY, COL.—The car barns and power house of the Greeley & Denver Railway Company were recently destroyed by fire, causing a loss of about \$35,000. Electricity for operating the system was obtained from the Western Light & Power Company of Boulder.

Canada

PORT MOODY, B. C.—The Aetna Steel Works here will install a six-ton electric smelter furnace, which is expected to be in operation in January.

VICTORIA, B. C.—J. C. Corbin, Arcade Building, Seattle, Wash., has been engaged by a Canadian firm to prepare plans for changes in its refrigerating plant in Victoria, to cost about \$25,000. The capacity of the plant will be increased and it will be equipped for electrical operation. Special motors and machinery will be installed.

CHATHAM, ONT.—The T. H. Taylor Company of Chatham, it is reported, would like to receive prices on a complete outfit of Jones underfeed stokers for two boiler installations, including engine, fan, etc.

GOWGANDA, ONT.—Plans, it is understood, are under way for the development of a hydroelectric plant at Big Bend Falls to supply electricity in Gowganda and the new mining district of Matachewan. It is estimated that between 5000 hp. and 6000 hp. can be developed at Big Bend Falls.

OMEMEE, ONT.—A by-law will soon be submitted to the ratepayers asking for an appropriation of \$9,000 for installation of a hydroelectric plant.

OTTAWA, ONT.—Bids will be received by John A. Pearson, architect, Ottawa, until Dec. 17, for electric conduits, outlets and fittings required in the reconstruction of the Parliament Building at Ottawa. Specifications and other information may be obtained at the office of the P. Lyall & Sons Construction Company, Ottawa.

SAULT STE. MARIE, ONT.—The connecting link between the upper St. Mary's River and the new power canal at the St. Mary's River has now been broken; the water which will increase the supply of power for this city has been let into the new canal, and it is expected that the first unit in the new power house will be put in operation about the middle of January. Thereafter units will be placed in commission until the whole 34 units will have been put in operation, which it is expected will take about five months longer.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN

Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, DECEMBER 22, 1917

No. 25

Give Good Service

SERIOUS as coal conditions are, it is not a time for recrimination. We are at war; the demand for energy is tremendously intensified by the military needs of the nation. It is not a question of what might have been done, the problem is too insistent for that. Coal famine stalks throughout the land. What is the central station going to do about it now? Knowing the temper of operators and executives and holding to the best traditions of the industry, the ELECTRICAL WORLD feels confident that superhuman efforts will be made to maintain good service.

In the last week we have seen the outward manifestation of what every observing man in the industry knew must come to pass unless the situation was controlled by a strong hand. Coal production is far short of consumption, and poor quality is responsible for further expansion in the distressing total of what we have not got in efficient heat units.

Given volume of coal of the right quality, it is unbelievable that the electric utility will not furnish service as good as that with which its high reputation has been won. But the prerequisites are that coal shall be mined and that coal shall be transported to the plant. For the performance of these two duties the central station is at the mercy of private agencies in ordinary times, at the direction of government agencies in these extraordinary times. The private agencies have not demonstrated what they can do unhampered under war stress conditions, for they are not free to act except in accordance with rigid governmental regulations. As a substitute for the free play of economic forces we have set up government control over price and distribution. It is not in criticism that we point out this fact. Perhaps coal shortage would have been still more acute if all of the agencies of production and distribution involved had remained in private hands. But at the moment responsibility lies squarely at the door of the federal authorities. They have the law behind them, they have public sentiment overwhelmingly with them in any vigorous strokes necessary to speed industry. We look to them to make straight and easy the path of coal tonnage from pit mouth to boiler room. It is not selfish dependence, it is reliance upon the full force of government to provide the coal which alone can keep electric systems in operation.

Without coal service stops. It has stopped already in certain cities for some consumers. The point that is of deepest concern to central stations is to make sure that service does not stop because of anything which they do or omit to do. It is first principle with them to render uninterrupted service—not merely to keep in

desultory operation but to give efficient service. They may have to discriminate between consumers because the government will require such action. They may have to withhold service at times from one manufacturer in order to give more power to another manufacturer engaged on government work. But it is clearly up to them to maintain the high standard—it will be better for them to give no service at all to parts of communities than to lower the standard.

The Oil Engine as a Prime Mover

IN THESE days of very serious coal shortage one instinctively turns to oil as a source of power. It is at the present time relatively cheap on the basis of thermal values, can be transported over long distances in pipes, and certainly makes, per thermal unit, very much lower demand on freight-hauling facilities than does coal. Moreover, it can be utilized in oil engines at a much higher efficiency than can be reached with steam engines, and hence gains still further as a practical source of power. In the current issue W. L. H. Doyle describes an interesting small plant for the electric driving of a woolen mill which was originally driven by a pair of slow-running Corliss engines operating long line shafting. As the first step toward economy in enlarging the plant this shafting was cut up into convenient lengths, each of which was motor-driven, and then a power plant was installed to take care of the electrical load. The striking part of the situation from the economic standpoint is that the plant as first installed was on a diminutive scale, with a generator capacity of only 64 kw. in a single direct-connected unit operated by a single-cylinder oil engine. This engine was arranged to operate on any reasonable sort of crude or fuel oil under a guarantee of consumption not to exceed half a pound (0.23 kg.) per brake-horsepower-hour of oil having a thermal value of 1800 B.t.u. per pound (1000 cal. per kg.).

The log sheets for the year 1916 are now fully available and show rather a remarkable result. The load factor was a scant 59 per cent and fairly constant. Including all items of expense, the cost per kilowatt-hour ran to 2.11 cents, of which nearly half belonged to the overhead charges, the oil itself being a little less than a quarter of the total. This is a remarkably satisfactory figure for so small a plant, in which the attendance was a greater item of expense than the fuel. In this instance the oil actually used was a distillate, costing 4¼ cents per gallon (1.1 cents per liter) in carload lots. More recently another three-cylinder engine of 450 hp., direct-connected to a 380-kva. generator, has been in-

stalled, with preliminary results even more promising than those just quoted. The enlargement of the plant obviously tends to keep down the labor costs as well as to raise the general efficiency through the use of larger units. At the present cost of coal fuel oil is likely to prove a very important item in power production where conditions are reasonably favorable. No small advantage is the ease with which oil can be stored and delivered to the engines. In ordinary times the high cost of the oil engines has tended to restrict their use in spite of their fuel economy. As coal rises in price the situation rapidly changes, and when one also considers the difficulties of transportation it would seem that the oil engine has a better chance than ever before. Certainly the results from this small plant are sufficiently encouraging to awaken unusual interest in the subject.

Engineering Research

THE present age of specialization is revealing its influence both in war and in peace. Military and naval officers are called upon to specialize in their duties as never before in the history of war. Indeed, the private soldiers and sailors are required to train as specialists.

Specialization either in war or in peace is the great stimulus to intensive study and research. The closer that an intelligent man becomes acquainted with a single subject, the more likely he is to feel his limitations of knowledge, and the more desirous he becomes to know more and do more. When, therefore, scientifically trained men are set to work along special lines in industry, they will, under any reasonable encouragement, tend to work out developments and improvements by scientifically directed research. National and industrial progress, therefore, depends upon the intelligence of those who enter it, as well as on their scientific training and on the encouragement of their efforts at the hands of their environing communities. If these communities despise applied science, discourage investigation and frown upon invention, the progress of industry is likely to be slow. On the contrary, when the communities appreciate scientific methods of inquiry and reward successful attempts at improvement progress is likely to be rapid.

The paper of C. E. Skinner on engineering research presented before the A. S. M. E. was a plea for the systematic study of processes and materials, as exemplified by the particular case of alloys. Enormous advances have been recently made in machining and machines through researches in alloys, yet the field of research work in that direction has only just been opened up. The more we can learn from physics and chemistry about the laws of metals and their solutions and combinations, the more likely we are to be able to predict the proper proportioning of alloys, in order to produce metallic machine parts of definitely assignable characteristics at least expense. It is well within the bounds of reasonable probability to say that if our theoretical knowledge of metals were only a little further advanced the economic value to the world of

the metals and alloys thereby attainable might exceed the present total world-war debt.

It is, therefore, of the highest importance to all the nations of the world that science, both pure and applied, should be cultivated extensively in our universities, colleges, schools, factories and industrial plants. Those who show any talents or abilities for scientific investigation should be encouraged by every means to develop and then to apply them.

Engineering Students in Military Service

IT HAS so many times been remarked that this is a war of engineering that the allusion has become trite. The conduct of operations on so vast a scale as the world war displays brings engineering and applied science into continual demand. Every military officer must be to some extent trained in applied science if he is to fill his post effectively. Consequently the need for technically trained men in the army for all kinds of specialist work is very great.

But it is not merely in the front line that the engineers are needed. In the base organizations and in the rear of the fighting men technically trained officers and men are needed for a great variety of special services. Road making and repairing, machine construction, civil engineering, surveying, map making, chemical engineering, electrical engineering and sanitary engineering are but some of the occupations that an army requires right behind it.

A still larger need for technically trained men in the conduct of the war exists in the numerous factories and plants where munitions and war material have to be produced. Specialists in mechanical engineering, in structural design, in chemical production, in optical and electrical instrument making, must be kept constantly employed in the army of fighting producers behind the army of fighters in the field. It takes at least three fighting producers working hard all the time to keep one fighting man supplied at the front.

In order to cope with the demand for technical training it is vitally necessary to canvass our applied scientists and place them where the need for their services is most urgent, whether in the field or in the factory. Moreover, we must press forward the training of the students in the technical colleges as rapidly as possible. If young men are diverted from entering technical schools in sufficient numbers, there will surely be an alarming deficiency of trained men before the war has gone on many months. Time is all-important. Trained men in scientific work cannot be produced overnight. The communication addressed to the Secretary of War on this subject by the Association of American Universities will be found on another page of this number. It urges that technological students, of a certain standing in their training, should, after being drafted, be assigned to the military duty of completing their studies, in order that their capability for service to the country may be thereby correspondingly increased.

The War Department has very wisely consented to act in this matter. A new ruling has been issued by the Provost Marshal General. It was published in the *ELECTRICAL WORLD* for Dec. 8, 1917, page 1116. The chief of engineers is empowered to assign to the reserve corps of the engineering department, for the proper completion of their training, a suitable proportion of the students pursuing an engineering course in approved technical schools.

The effect of this ruling, if judiciously administered, will undoubtedly be to stimulate the work of the technical students of the country to earnest accomplishment. Young men who are able to reach the upper third of any good technical college are sure to be no slackers, and they can study with the assurance that they serve their country best by acquiring an engineering training.

On the other hand, it is clearly the duty of the technical colleges to co-operate with the War Department, by carrying on their training all the year round, advancing the work and diminishing the vacations, as far as effectiveness will permit.

Speeding Up Freight Handling

THERE is no more serious need just now than for hurrying up the freight service. Every commodity in every part of the country is suffering from lack of transportation. Part of this is due to the actual lack of the rolling stock necessary to take care of the volume of traffic involved. This results from lack of foresight and lack of funds on the part of the railways. The actual physical shortage in cars, too, cannot be made up quickly on account of the necessary time required for deliveries. A much larger factor in the difficulties of the situation is the proportion of cars kept inactive by the time required for loading and unloading them. By reason of bad habits of long standing freight cars by the thousand lie idle, waiting to receive their cargoes, or serve for temporary storage at the convenience of shippers. Even when there is no conscious delay on the part of anybody the actual time consumed in loading and unloading cars is often many times greater than is in the least necessary.

A brief paper in our columns this week describes the method adopted now in numerous places to facilitate this work of loading and unloading, and thereby to increase the average number of cars actually in use. The source of relief in this case is the electric industrial truck specialized for running around terminals with loads of freight, coming or going. For this service the electric truck has unique advantages. It is handled with extreme ease even by comparatively inexperienced

men. It is economical in service, quick in operation and entirely free from the fire dangers which tend to discourage the use of gasoline trucks in and about buildings. The truck for this purpose is developed in the form of a tractor which picks up loaded trailers and transfers them from cars to storage or vice versa, thereby dispensing with a very large amount of manual labor and a corresponding amount of expense. It should be noted in this connection that electric power is one of the few things which have not advanced materially in price, while war conditions have greatly enhanced the wages of even the most inexperienced workers. Most of the work around terminals has customarily been done by hand trucks, slowly and at large expense. The tractors, handling loads up to about 25 tons, do the large amount of actual haulage necessary with far greater rapidity and at a much lower cost, requiring a reduced number of men for the actual work of transferring the goods from the tractor loads to the cars. In half an hour the tractor can do the same haulage that would require six men for three hours, while itself requiring the services of only two men, leaving the rest of the gang free to speed up the actual work of loading.

The result is not only a great saving of time, but economy in cost of handling to the extent of not far from 50 per cent, sometimes even more, including, of course, the cost of motive power, wear and tear, and depreciation of the tractors themselves. The larger the area covered by the terminals, and consequently the longer the hauls required in dealing with the freight, the greater the advantage of mechanical traction. But even in comparatively small freight stations the tractor "makes good" in the work of efficient and economical speeding up. Inasmuch as a very material part of the freight delays come from this local work, the improved method becomes more than ever desirable. As the war goes on labor will become scarcer and scarcer, for obvious reasons, and the advantage of mechanical traction more and more marked. The present unsatisfactory situation in freight handling has its origin in complex causes which resulted in a terrible mix-up the moment unusual demands had to be made on the transportation systems, and it is only by falling back upon labor-saving devices wherever practicable that the situation can be fairly met. Even now the gasoline truck is being tried on long hauls with considerable advantage in the saving of time and money. The electric truck has its special field in local work, and if the figures given in our article are carefully studied they will show that just here the electric truck has a wide field of practical usefulness.

IN THE next issue of the *ELECTRICAL WORLD* A. O. Austin will have another article on factors that should be considered in selecting insulators. He will point out the advantages and disadvantages of ground wires, the effects of operating surges on insulators and the attention that parallel circuit operations as well as local con-

The Coming Issues

ditions should receive. Some more suggestions will be presented on how to obtain the maximum benefit from existing equipment. In addition there will appear the ninth installment of the series on industrial motor and control applications, dealing with engineering aspects of motor-driven lathes.

Industrial Trucks in Freight Congestion Relief

Use of Electrically Propelled Carriers Has Been Found to Effect a Considerable Saving in the Time of Unloading, Besides Materially Reducing the Labor Required to Perform the Work

BY F. C. MYERS, SOCIETY FOR ELECTRICAL DEVELOPMENT

WITH an excess of unfilled freight-car orders on Nov. 1 last amounting to 140,012 cars, which is 25,104 more than at the same time a year previous, and, now that winter is here, with the assurance that external conditions will be worse for some months, it is evident that strenuous methods must be employed to relieve the freight situation. Undoubtedly one of the best remedies is a quicker unloading of cars at terminals. This in turn to some extent means more efficient and time-saving methods. As a method of this kind the use of the electric industrial truck recommends itself.

It has been estimated by an engineer of considerable reputation that if one mile is added to the daily flat-car travel average it will be equivalent to 100,000 cars, which are now needed and cannot be delivered. This increase can be made by shortening the time in terminals; that is, by speeding up freight-handling methods. At the same time there will not be the necessity for added facilities for the additional cars. In this connection, of course, the industrial truck is found well qualified to produce results. Not only does the industrial truck save time and money, but it accom-

plishes the same work with less labor, and labor of a character no more skilled, than that employed in manual operations. This last consideration in itself is extremely important to-day.

TABLE I—COMPARISON OF PERFORMANCE OF TRACTOR OPERATIONS AT STATION IN TOWN OF 70,000 DURING AUGUST, 1917

DAY OPERATION (TWO TRACTORS), ELEVEN GANGS, FORTY TRUCKERS	
Total amount of tonnage handled, lb.....	1,624,733
Average tonnage per gang, lb.....	147,703
Average truckers per gang.....	3.6
Average number of pounds per trucker.....	41,029
NIGHT OPERATION (FOUR TRACTORS), FIVE GANGS, THIRTEEN TRUCKERS	
Total amount of tonnage handled, lb.....	643,058
Average tonnage per gang, lb.....	128,611
Average truckers per gang.....	2.6
Average number of pounds per trucker.....	49,466

plishes the same work with less labor, and labor of a character no more skilled, than that employed in manual operations. This last consideration in itself is extremely important to-day.

Table I shows some statistics on electric industrial-truck freight moving taken from one of the most representative steam railroads operating east of the Mississippi. There are shown the saving in time and the reduced amount of labor required—both of which spell money, the money that railroads need and are begging for. Other data show some typical instances of economy in labor and time in freight handling of various commodities.

The figures show that in the day operation with eleven gangs, assisted by two tractors indiscriminately helping, the average tonnage per trucker was 41,029 lb. (about 18,600 kg.), or 20.5 tons per day. In the night operation, which was made a full tractor operation with four tractors doing all the work for five gangs and a man less per gang than in the daylight, the average tonnage per trucker was 49,466 (about 22,400 kg.), or

24.7 tons per night. From these figures it will be observed that for this day's work full tractor operation shows an increased tonnage per man of 4.2 tons over that of mixed hand and tractor operation.

The tractor in one-half hour does the work of six laborers in three hours, or in the ratio of thirty-six to one. In minor operations, such as towing large machinery on a six-wheel truck, dragging heavy cable chains into and from cars, pulling in shore gangplanks and moving large crates of 5000 lb. to 10,000 lb. (2267 km. to 4535 km.) each, the tractor did the work of twelve men. Two men were required for rollers.

The labor saving is shown by the comparative figures on labor requirements to move miscellaneous freight given in Table II.

In one instance with hand trucks on a short haul a load of 49,881 lb. (about 22,600 kg.) required twenty-four men two hours. With a truck and trailer 73,097 lb. (about 33,110 kg.) required but ten men two and one-quarter hours. On a 200-ft. (60.9-m.) longer haul 106,700 lb. (about 48,200 kg.) used the services of twenty-four men ninety-three hours with hand trucks, while with a truck and trailer 173,353 lb. (about 78,500 kg.) took only ten men sixty-two hours. With one tractor 48,876 lb. (about 22,150 kg.) can be hauled 600 ft. (182.8 m.) in twenty-five minutes, but a hand truck requires one and one-half to two hours.

In the case of freight packed up on various piers on trailers waiting for tractor, the tractor does in one-half hour what otherwise required two laborers three hours each. Only two men, a chauffeur and a conductor, are required with electric transportation.

At one place of 10,000 population this railroad is using one tractor with two men to move barrels weighing 260 lb. (118 kg.) each 450 ft. (137.1 m.) from a barge to cars up the ramps. The tractor moves thirty barrels in three minutes, where formerly one man with assistance up the ramps moved one barrel in six minutes on a hand truck.

At another point the road formerly employed 132 truckers. Now it is doing this work with tractors and trailers with seventy-three men and is handling 500 tons a month more freight than formerly.

On July 16 at one transfer point there were employed 165 men; on July 17 tractors and trailers were installed and the number of men was reduced to 117, while the freight was handled more expeditiously than formerly. Since this date the tonnage has increased approximately 500 tons, and the number of men has not been increased.

The following data were taken from installations which have proved the industrial truck to be both a time-saving and labor-saving device:

In the handling of lumber 12 in. by 12 in. and 14 ft. to 20 ft. long (0.3 m. by 0.3 m. by 4.2 m. to 6 m.) fifty pieces were carried on each load, a total round-trip distance of 600 ft. (182.8 m.) with two trucks. Two



THE SOLUTION OF THE TRANSPORTATION LABOR PROBLEM

Fig. 1 shows three men with hand truck moving four bags of tobacco. At the right, in Fig. 2, one man hauls ten bags electrically. Below, in Fig. 3, one man per bale of cotton is employed with the hand truck, while the electric method of transportation in the

opposite illustration (Fig. 4) uses one man for about sixteen bales. Furthermore, as shown in Figs. 5 and 6, enormous loads of boxes, bales and barrels can be hauled electrically with labor no more intelligent than is used in the manual operation.

round trips were made and required four men and took thirty minutes' time. This amounted to a total of 2000 ft. (609 m.) of board lumber, weighing about 3500 lb. to 4000 lb. (1578 kg. to 1814 kg.) per 1000 ft. Four men's time at thirty minutes, at the rate of 30 cents an hour, would be 60 cents. The charge for running this machine a full working day of ten hours is \$1.25, or 6 cents for half an hour. This, added to labor cost, would be a cost of 66 cents to move 2000 board feet a total distance of 600 ft.

In another operation where lumber was handled, the size of which was 12 in. by 16 in. by 11 ft. (0.3 m. by 0.4 m. by 3.3 m.) long and the total weight 600 lb. (272.1 kg.), six pieces were carried on each load, making a total weight of 3600 lb. (1632 kg.). In one hour, two trucks and eight men moved ninety-six pieces of lumber, a total weight of 29 tons, a round-trip distance of 800 ft. (243.8 m.). The recapitulations of this show that 29 tons of lumber, or 16,900 board feet (5151 m.), were moved a distance of 12,800 ft. (3901 m.) by eight men and two industrial trucks in one hour. The labor, at the rate of 30 cents, amounted to \$2.40. Wear and tear, depreciation and charge for running truck, at the rate of \$1.25 for a ten-hour day, would amount to 25 cents for two hours, which, added to the above cost, would amount to \$2.65. This is at the rate of 9 cents per ton.

In the handling of miscellaneous freight three electric trucks and ten men moved 53 tons a round-trip distance of 450 ft. (137.1 m.) and required five and one-half hours' time. This, at the rate of 30 cents an hour, amounts to \$16.50, and, added to charges against the truck of 28 cents, amounts to \$16.78, or at the rate of 32 cents a ton.

In the same operation the following was the cost of handling miscellaneous freight by hand trucks. Thirty-three tons were carried by six men with hand trucks, four men being required to load and unload, a total distance of 375 ft. (114.3 m.) in five and one-half hours' time, and this, at the rate of 30 cents an hour, amounted to \$16.50 to move thirty-three tons, or a total of 50 cents per ton, showing a saving of 16 cents a ton in the use of electric trucks, which covered one and a fifth times the distance of the hand trucks.

In the handling of coffee in bags, the weight of each

TABLE II—COMPARATIVE LABOR SAVING, TRAILERS OVER HAND TRUCKS

	Lb.	Trailers	Hand Trucks, Men
40 boxes oranges.....	3200	3	10
102 half chests tea.....	7680	5	25
12 casks tobacco	2320	3	12
63 chests tea.....	4390	4	17
85 pig tins.....	8975	2	21
146 barrels groceries	3400	4	29
66 boxes oranges.....	5280	3	17

bag being 240 lb. (108.8 kg.), a total of 118 tons was carried on two electric trucks, which made ninety-eight trips, each 200 ft. (60.9 m.) long, and required the service of fourteen men for five hours. This, at the rate of 30 cents per hour, amounted to \$21, or allowing \$1.20 for wear and tear and depreciation of trucks, to \$22.20 to move 118 tons, or at the rate of 18 cents a ton.

Coffee in 135-lb. (61.2-kg.) bags for distances up to 160 ft. (48.7 m.) is being handled in one place by electric trucks for 6 cents a ton. Rags in 500-lb. (226.7-kg.) bales cost up to 18 cents a ton with hand trucking. Sixty-four 800-lb. (362.8-kg.) barrels of plumbago were moved 60 ft. (18.2 m.) in twenty-five minutes for 5.3 cents per ton with electric trucks, while sixty-three

TABLE III—COMPARISON OF LABOR REQUIREMENTS, TIME OF OPERATION AND LOAD WITH HAND TRUCKS AND WITH TRACTORS AND FOUR-WHEEL TRUCKS

	Hand Trucks, Aug. 14, 1917	Tractors, Aug. 21, 1917
Trucks in line 4 p.m.....	30	19
Trucks in line 4.30 p.m.....	22	22
All backed up	6.19 p.m.	5.15 p.m.
All unloaded	6.30 p.m.	5.40 p.m.
Total number of packages handled.....	3875	5350

800-lb. barrels of plumbago were moved the same distance in two hours, costing 14 cents a ton, by hand trucking. Four men were required to guide and push the hand trucks up an incline.

One hundred and fifty 300-lb. (136-kg.) boxes of rubber were moved 75 ft. (22.8 m.) in fifty minutes for 8¼ cents per ton. By hand trucks the cost was 18 cents per ton at an Eastern terminal.

Power Transmission Through Separating Diaphragms

The invention of Benjamin Graemiger of Zurich, Switzerland, patent No. 1,233,569, relates to apparatus for driving machines by means of purely magnetic forces such that the driving and driven members are separated from each other in a gas-tight manner without the provision of a stuffing box by a partition or wall. Accordingly metal alloy of great strength and which is a very bad electrical conductor is employed for the separating partition between the driving and driven members.

The power-driven machine inclosed in a casing is driven, for instance, from the exterior without involving the use of a stuffing box by inclosing the rotor of an electromotor of any suitable construction coupled to the shaft of the machine in the casing and by separating the driving member—that is to say, the stator of the motor—in a gas-tight manner from the rotor by a wall or partition forming a part of the casing.

On the shaft driven by a prime mover is keyed the driving member, consisting of two disks between which is arranged the winding required for excitation purposes. The two disks have cylindrical polar surfaces arranged facing each other and formed with projections. The driven member is keyed on a shaft of the machine to be driven and consists of a bell-shaped disk the cylindrical portion of which extends between the two polar surfaces of the driving member and is also formed with projections on the inside and the outside. The separating partition arranged between the two members is in the form of a ring of U-section and is connected in a gas-tight manner to the parts of the casing. The action of the drive is due to the magnetic flux lines generated by the energizing winding.

Adapting 220-Volt Circuits to 110-Volt Lamps

Reduced Lamp Costs and Higher Efficiencies, Together with Other Advantages, Pointed Out as Favoring This Practice—The Lower-Voltage Lamps Constitute 85 per Cent of Factory Output

BY J. R. COLVILLE

IT IS a matter of common knowledge that incandescent lamps which are rated at 110 volts or 125 volts are more satisfactory than those designed for 220 volts or 250 volts. Lamps designed for the lower voltage range are more efficient, give a more satisfactory life performance and are lower in price

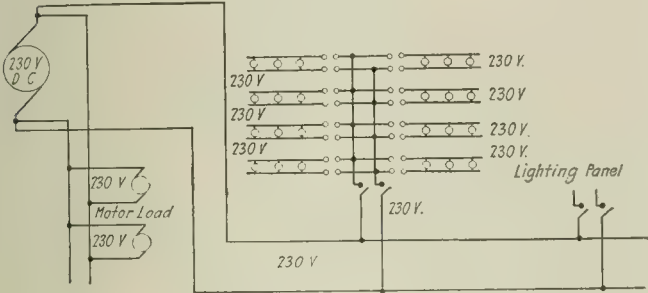


FIG. 1—UNDESIRABLE METHOD OF DISTRIBUTION OFTEN USED FOR LIGHTING IN INDUSTRIAL PLANTS

than the higher-voltage units, for the reason that the higher voltages are nearer the upper limit at which it is possible to manufacture incandescent lamps that will be commercially satisfactory. Notwithstanding these facts and that there are simple expedients, such as the installation of a balancer coil or a motor-generator set, whereby most installations where 220-250 volt circuits are used for lighting can be changed

TABLE I—DIFFERENCE IN COST OF 110-125 VOLT AND 220-250 VOLT LAMPS WHEN LAMPS ARE PURCHASED ON CONTRACT
Based on Schedules in Effect June 15, 1917

Lamp Size in Watts	DIFFERENCE IN COST ON PURCHASE BASIS OF								
	List	Std. Pkg. Quantity	\$150 Contract	\$300 Contract	\$600 Contract	\$1,200 Contract	\$2,500 Contract	\$5,000 Contract	\$10,000 Contract
Vacuum-type tungsten lamps:									
25	\$0.0600	\$0.0540	\$0.0498	\$0.0474	\$0.0456	\$0.0438	\$0.0426	\$0.0414	\$0.0402
40	0.0600	0.0540	0.0498	0.0474	0.0456	0.0438	0.0426	0.0414	0.0402
60	0.0900	0.0810	0.0747	0.0711	0.0684	0.0657	0.0639	0.0621	0.0603
100	0.1500	0.1350	0.1245	0.1185	0.1140	0.1095	0.1065	0.1035	0.1005
Gas-filled-type tungsten lamps:									
200	0.2000	0.1800	0.1660	0.1580	0.1520	0.1460	0.1420	0.1380	0.1340
300	0.6000	0.5000	0.4980	0.4740	0.4560	0.4380	0.4260	0.4140	0.4020
400	0.8000	0.7200	0.6640	0.6320	0.6080	0.5840	0.5680	0.5520	0.5360
500	0.9000	0.8100	0.7470	0.7110	0.6840	0.6570	0.6390	0.6110	0.6030
750	1.2000	1.0800	0.9960	0.9480	0.9120	0.8760	0.8520	0.8280	0.8040
1000	1.4000	1.2600	1.1620	1.1060	1.0640	1.0220	0.9940	0.9660	0.9380

over so as to use 110-125 volt lamps, there are still a great many of the higher-voltage lamps in use. It is to be assumed, therefore, that the cost in money or inconvenience is the one obstacle that has continued to stand in the way of changing these systems over. If this be true, the conclusion follows that the greater economy effected by adapting 220-250 volt circuits to lamps of the 110-125 volt class—a saving that will in general pay in a few months the cost of

changing the system—is not so generally recognized as it might be.

The difference in cost between lamps of the 110-125 volt class and those of the 220-250 volt class when purchased on different contract bases, according to schedules in force June 15, 1917, are given in Table I. It

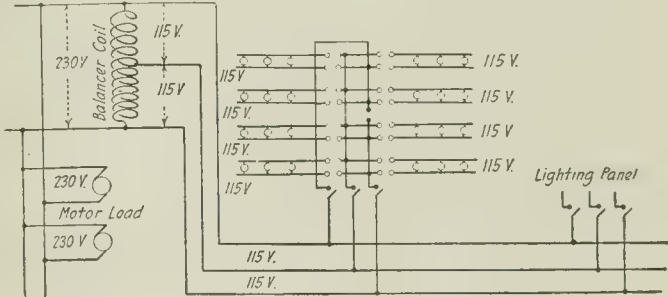


FIG. 2—ONE METHOD OF ADAPTING 230-VOLT SYSTEM TO 115-VOLT LAMPS

may be noted that the difference in cost ranges from about 4 cents per lamp for the smaller lamps when purchased on large contracts to as much as \$1.40 when the largest lamps are purchased at list price.

Table II shows the difference in luminous output of corresponding wattages of lamps of the two voltage classes. It is seen from this table that on the average the higher-voltage lamps give only about 90 per cent of the light which corresponding sizes of the lower-voltage lamps give. Hence for equal illumination in-

TABLE II—COMPARATIVE DATA ON 110-125-VOLT AND 220-250-VOLT MAZDA LAMPS
Based on Schedules in Effect June 15, 1917

Size of Lamp in Watts	VACUUM-TYPE TUNGSTEN LAMPS (WATTS)				GAS-FILLED TUNGSTEN LAMPS (WATTS)							
	25	40	60	100	100	200	300	400	500	750	1000	
List price, 115-volt.	\$0.27	\$0.27	\$0.36	\$0.65	\$1.00	\$2.00	\$3.00	\$4.00	\$4.50	\$6.00	\$7.00	
List price, 230-volt.	\$0.33	\$0.33	\$0.45	\$0.80	.....	\$2.20	\$3.60	\$4.80	\$5.40	\$7.20	\$8.40	
Approximate cost of 230-volt in per cent of 115-volt..	122	122	125	123	.....	110	120	120	120	120	120	
Lumens, 115-volt..	226	372	575	995	1260	2920	4850	6150	8050	12,800	18,000	
Lumens, 230-volt..	190	330	515	900	.....	2520	4100	5600	7400	11,500	16,100	
Light of 230-volt in per cent of 115-volt.....	84	89	90	90	.....	86	85	91	92	90	90	

tensties more wattage is required with the 220-250 volt lamps.

In the design of new installations the number of units which may be used advantageously is sometimes closely limited by the constructional features of the building. In such cases 220-250 volt lamps of higher wattage, and frequently the purchase of more expensive reflector equipment, are required. On the other hand, if considerable latitude in the location of the units is

afforded, a greater number of the higher-voltage lamps of a given wattage will have to be installed to obtain the same degree of illumination as might be obtained with the 110-125 volt lamps. This will mean the installation of more outlets, the purchase of a greater number of reflectors, sockets, etc., and a heavier maintenance expense. The difference in cost of lamps of the two voltages, together with the fact that fewer 110-125 volt units are required—that is, the difference in first cost of the installation—is often of sufficient magnitude in itself to pay for the installation of equipment to provide the lower voltage for the lighting circuit. The yearly saving in lamp renewals and energy is then pure profit.

A disadvantage of simply operating two low-voltage lamps in series is that failure of one means the outage of both; thus a relatively large area is left without sufficient light and the time of several persons may be lost while the defective lamp is being located and the replacement made. Obviously in industrial plants and shops accident risk under these conditions is increased over that when only one lamp is out. Furthermore, slightly less than normal life is to be expected from lamps burning in series, since one lamp naturally fails sooner than the other, and when a replacement is made the resistance of the old lamp

will be higher than that of the new one. Hence the new lamp will receive slightly less than normal current and will give less than normal candlepower, while the old lamp will be forced to carry a somewhat heavier current than it would normally carry at that period of its life and will therefore fail earlier than it otherwise would. The better way of obtaining the advantages of the lower-voltage lamps is to provide 110-125-volt circuits through balancer coil, motor-generator set or other voltage-bisecting device.

Attention is called to the fact that, in addition to effecting maximum lighting economy and obtaining superior service performance, the user of 110-125 volt lamps receives the benefits resulting from the use of a more highly standardized product. Lamps of the 220-250 volt range are manufactured primarily to supply a small demand which does not justify the stocking of quantities of lamps to fill emergency requirements. Furthermore, improvements are less readily incorporated because of the greater manufacturing difficulties presented by high-voltage conditions. Lamps of the 110-125 volt class compose at present approximately 85 per cent of the output of Mazda lamp factories, exclusive of miniature lamps, as compared with a figure of less than 7 per cent in the case of 220-250 volt lamps. For this reason emergencies may be more readily met.

Some Fundamental Problems of Industrial Control

Introduction to More Specific Discussions of Machine-Tool Control Which Will Follow—Principal Functions of Controllers Outlined—Sequence of Switch Operations

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

SYNOPSIS.—In this discussion the controller is considered as an integral part of the industrial motor. Various methods of speed adjustment are outlined in some detail and this is followed by a discussion of the practical reasons for the use of controllers. From this standpoint it is pointed out that many other functions besides speed adjustment must be performed by the modern controller. Some of the fundamental principles in the operation of the controller are touched upon and notes are added regarding elementary wiring diagrams and the graphical representation of the sequence of switch operations.

ALL motors possess inherent operating characteristics which adapt them to some extent to the changing conditions during the acceleration period or throughout a given duty cycle. Usually, however, some auxiliary assistance in the form of control apparatus is necessary to adapt the motor completely to these changing conditions, therefore the two must be considered together in determining the adaptability of any motor to any load.

In the simple direct-current shunt motor, for example, an increased load slightly retards the motor, thus reducing its counter emf., so that with a given supply voltage more current and a greater torque result with increase of load. This automatic action of the motor, although a common every-day experience with operating engineers, is sometimes lost sight of in the larger aspects of control. In other words, the motor inherently takes care of some but not all of the

requirements that are imposed upon it by the load.

In other cases, while a motor might adapt itself to conditions without a controller, for example during starting, to throw the motor directly on the line might result in an acceleration rate to which the driven machinery might not be adapted. Thus auxiliary devices would be required for producing a smoother acceleration than would be possible with the motor alone. Or, again, the starting current in throwing the motor directly on the line might be so great as to cause excessive variations in the line voltage, or with large induction motors driven by a relatively small generator the heavy starting currents might result in such excessive armature reaction as to prevent starting at all.

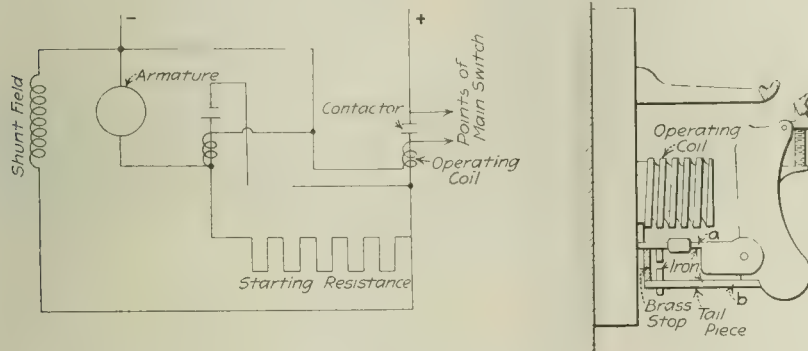
These few considerations show, therefore, that even where various motors might be depended upon to start automatically without controllers and might even meet the requirements of some load changes by reason of their inherent characteristics, conditions outside of the motor often make the use of a controller an essential part of the equipment.

In addition to these elementary factors, which intensify the importance of control in the industrial-motor problem, many other examples might be given to show that the exacting requirements imposed by various operating duty cycles could not possibly be met without the help of controllers.

In many factory operations the part of the motor

equipment included by the term control often becomes very complex, because of the number of functions the control equipment is required to perform, these being amplified in numerous cases by the substitution of automatic control for the older forms of manual operation.

Considering, first, the control of the rotational speed of the motor, three general schemes or methods are in



FIGS. 1, 2 AND 3—PRINCIPLE OF MOTOR STARTING BY COUNTER-EMF. METHOD; ELEMENTS IN SERIES LOCK-OUT MAGNETIC CONTACTOR, AND PRINCIPLE OF MOTOR STARTING BY SERIES RELAY

In Fig. 1 the right contactor switch closes as soon as the main switch is thrown. Current is then supplied through the starting resistance to the motor armature. At the time of starting the drop in voltage through the starting resistance is large and the emf. across the motor armature small. The operating coil for the left-hand contactor switch is connected across the armature terminals, and as the motor speeds up its counter emf. increases, and hence a higher and higher emf. is effective across the terminals of the coil which actuate the left-hand contactor. When the emf. across the armature terminals reaches a certain value for which the controller may be adjusted, the left contactor closes and the entire starting resistance is short-circuited. In this case the starting resistance is short-circuited in one step.

The series lock-out method depends for its action on the saturation

of the magnetic field (Fig. 2) due to the operating coil in the path *a* and the forcing of some magnetic flux through path *b*. As the current through the operating coil decreases, the flux through path *b* decreases and at that value for which the switch is set the tailpiece can no longer hold the contactor in its open position and the contactor closes. This switch requires no separate relay as in method *b* (see text), and it depends on the successive values of armature current during the acceleration period.

In Fig. 3 the starting resistance is short-circuited in one step. However, the closing of the second or left contactor takes place owing to the dropping of the series relay at that point when the current falls to some prescribed value, thus closing the left contactor and short-circuiting the starting resistance.

common use with direct-current motors, namely, (a) the use of auxiliary resistance in series with the armature whereby the emf. impressed across the armature terminals, and consequently the speed, may be adjusted, a method sometimes called armature control; (b) the use of auxiliary resistance in the shunt field circuit of direct-current motors (for varying the field current, and hence the field flux, usually with inverse variations in the speed, that is to say, higher speeds with weakened fields and lower speeds with the higher values of the field current); and (c) the use of variations in the voltage supplied to the motor armature terminals by methods other than that of method (a).

Of these three methods of speed control, method (b) is obviously the one of chief importance since it covers the modern adjustable-speed motor which forms such a widely used unit in factory drives. Armature control is used to a considerable extent in motor starting, although variations in speed under service conditions by auxiliary armature resistance has the twofold objection that excessive heat losses are likely to occur in the armature rheostat and the speed regulation of the motor be greatly impaired. Moreover, the practice of starting small direct-current motors by throwing them directly on the supply mains eliminates the necessity of using the armature-rheostat method for starting with small motors.

Method (c) includes the older scheme of multi-voltage control, which, partly because of its greater expense and partly owing to the extra generator equipment and extra wiring it makes necessary, has been replaced generally by the use of the adjustable-speed motor. However, in certain cases, such as large hoists and for special types of steel-mill drives typified by the reversing mill, there has been an increasing tendency to use method (c), in which the variations in the

low internal resistance) varies almost directly with the emf. impressed across its terminals, this scheme not only results in very wide speed adjustment but also makes possible very finely graduated speed increments and an effective method of reversing the direction of rotation.

For alternating-current motors of the induction type, which are also used very extensively for factory power applications, the chief scheme for obtaining speed variations is that of changing the number of poles either through the medium of a special switch in the primary circuit or by the cascade method of connections. Another scheme is to operate a polyphase slip-ring type induction motor with one phase of its secondary open-circuited. Under such conditions the motor operates

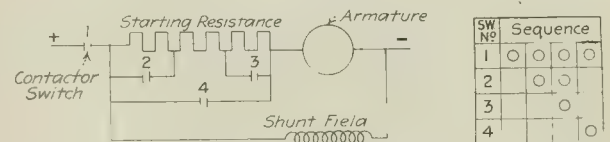
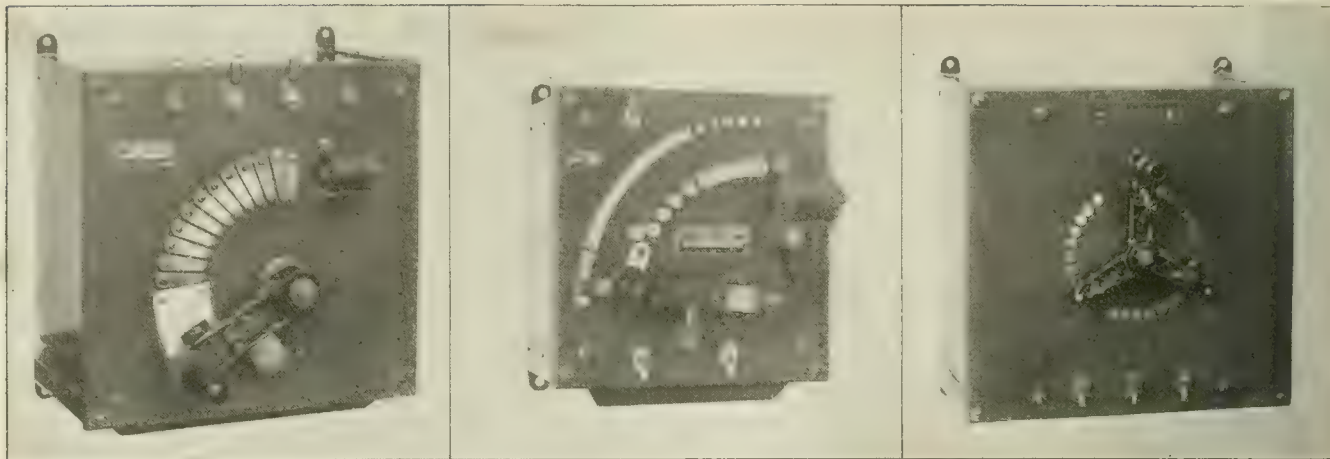


FIG. 4—SIMPLIFIED SCHEME FOR SHOWING THE MAIN CONNECTIONS OF MAGNETIC-CONTACTOR CONTROL PANELS AND SEQUENCE OF SWITCH OPERATIONS

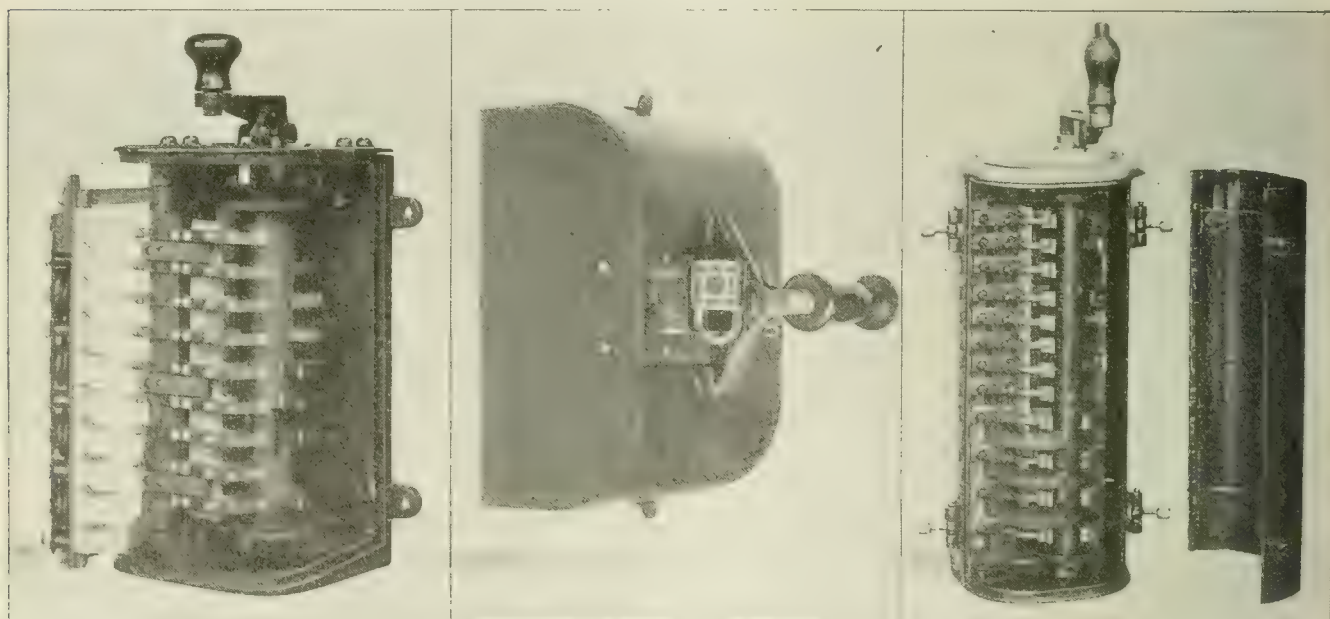
over a fairly wide range of reduced speeds, and it might be used for a type of load where the torque depends largely upon the speed of driving.¹

As pointed out before, speed control is only one of a number of functions for which controllers are employed. Some of these other functions, as outlined in the following paragraphs, constitute most important

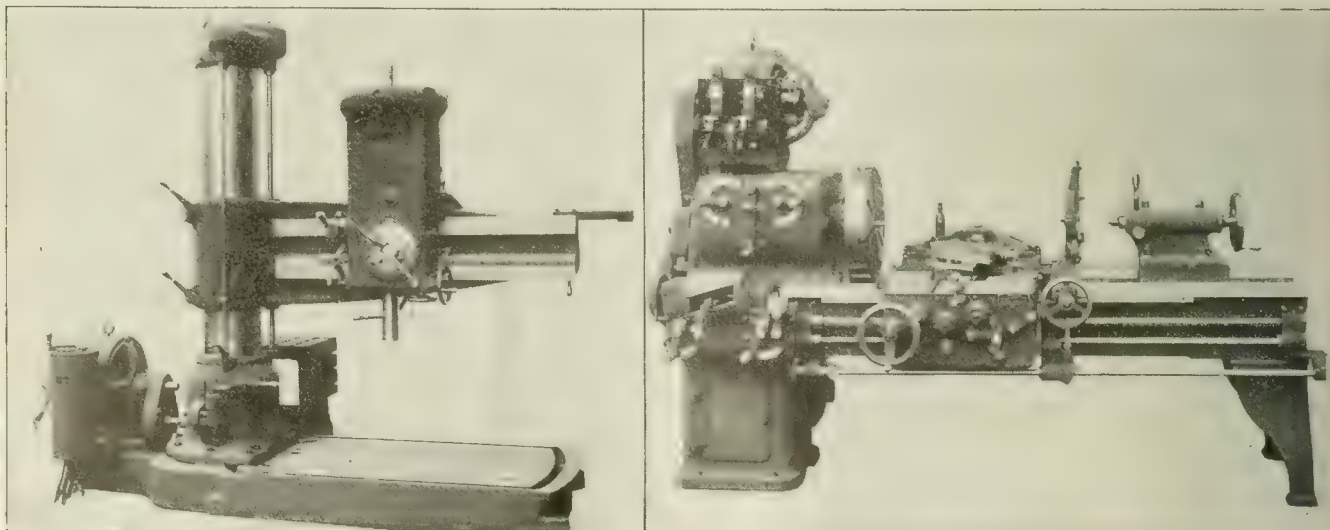
¹See article by H. D. James, *Electric Journal*, Vol. XIV, No. 4, p. 153. In the preparation of the present article various sources of information have been consulted, notably a series of articles on industrial controllers by H. D. James in the *Electric Journal* for 1917 and data of the Westinghouse Electric & Manufacturing Company. The photographic illustrations are shown by courtesy of the General Electric Company, the Crocker-Wheeler Company and the American Tool Works Company.



FIGS. 5, 6 AND 7—HAND-STARTING RHEOSTAT (20 HP., 550 VOLTS), AND TWO SPEED-REGULATING RHEOSTATS, ONE FOR DIRECT-CURRENT MOTORS AND THE OTHER FOR INDUCTION MOTORS



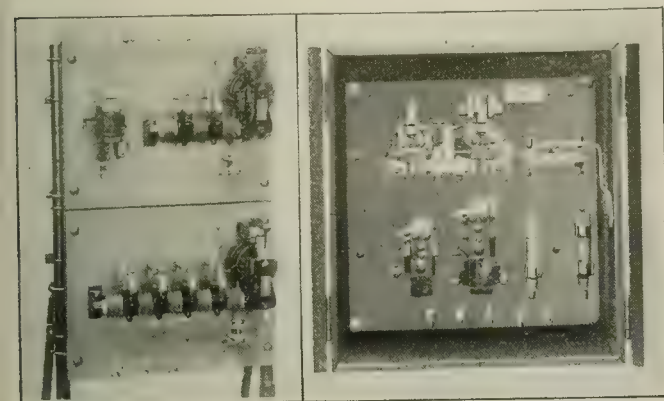
FIGS. 8, 9 AND 10—EIGHT-POINT DRUM CONTROLLER FOR POLYPHASE SLIP-RING INDUCTION MOTORS (USED FOR PRINTING PRESSES, IN STEEL MILLS, ETC.); MOTOR-STARTING SWITCH EQUIPPED WITH A LOCK AS A SAFEGUARD, AND INTERIOR OF DRUM-TYPE INDUSTRIAL CONTROLLER



FIGS. 11 AND 12—RADIAL DRILL WITH ADJUSTABLE-SPEED MOTOR AND A DRUM-TYPE CONTROLLER MOUNTED ON THE MOTOR FRAME, AND LATHE ARRANGED FOR MOTOR DRIVE WITH CONTROL HANDLES ON THE LATHE APRON AND WITH CIRCUIT BREAKER AND OVERLOAD RELEASE MOUNTED ON THE MOTOR

additions to the operating characteristics of the motor, not only contributing to its life and the protection of the load mechanically, but also forming some of the basic reasons for the economic advantages of motor drive in contrast to that by line shafting.

As indicated by the tabulated data, at least eight points may be mentioned in addition to the feature of



FIGS. 13 AND 14—PANEL FOR SELF-STARTING AUTOMATIC COMPENSATOR, AND MACHINE-TOOL PANEL FOR CONSTANT-SPEED NON-REVERSING SERVICE

speed control, all of which constitute important functions of the control equipment. Thus, from the standpoint of safety, the use of the special forms of remote control in the operation of machine tools removes entirely the necessity for the operator to come into contact with the driving mechanism. Items 2, 3, 6 and 7 are concerned partly with the protection of the motor and partly with that of the driven machinery, which might be injured by excessive mechanical strains due to unlimited torque at starting.

It is apparent, perhaps, that the points covered by items 4, 5, 8 and 9 are related very closely to the problem of efficient factory production. In fact, these four items illustrate very forcibly the important part which is filled by the controller when its design is such as to meet the conditions imposed by these items in the best possible manner.

While the control of speed is an item of fundamental importance during the period of normal operation, motor starting, or acceleration² from rest to normal speed, is likewise an item which calls for careful attention in controller design. With direct-current motors auxiliary resistance is placed in series with the armature and cut out or short-circuited as the motor speed increases. This may be done by hand with ordinary hand-starting rheostats like the one in Fig. 5, or with some automatic device that short-circuits the resistance in one or more steps as the motor speed increases. Several methods of accomplishing the short-circuiting automatically are now in common use, the principal ones being (a) the counter-electromotive-force method; (b) the series relay method; (c) the series lock-out switch method, and (d) the time-element method. The first three methods are illustrated in Figs. 1, 2 and 3. Method (a) is used for direct-current motors only, while method (b) may be used for either direct-current or alternating-current motors.

In the time-element method a timing device such, for example, as a dash-pot on each contactor, is employed³

IMPORTANT FUNCTIONS OF CONTROL EQUIPMENT

1. Provides safety for the operator by remote control.
2. Makes it possible to disconnect the motor automatically in case of the failure of the supply voltage.
3. Places a limit, by the use of fuses or circuit breakers, upon the mechanical load which can be thrown on the motor.
4. Makes possible the reversal of the direction of rotation.
5. Makes possible the speed control of the motor through any of the common methods:
 - (a) Armature resistance (direct-current).
 - (b) Field control (direct-current).
 - (c) Variations in the voltage applied to the motor armature (direct-current).
 - (d) Changing the number of poles (alternating-current).
6. May be made to limit the current during the period of motor acceleration.
7. May also be made to limit the torque during the acceleration period.
8. Facilitates stopping the motor either by a magnetically operated mechanical brake or by the method of dynamic braking.
9. Contributes to the ease with which the motor may be started from or stopped at a given point in any duty cycle or at the so-called limit of travel in such cycles.

for introducing a retarding effect in the action of the contactors producing smoother acceleration if set properly.

SEQUENCE OF SWITCH OPERATIONS

It is very convenient in studying controller diagrams to employ a simplified diagram of the main connections in conjunction with a tabulation of the switch positions during the acceleration of the motor. For example, the table in Fig. 4 indicates that at first contactor 1 is closed, next contactors 1 and 2 are in the closed position, then contactors 1, 2 and 3, and finally 1 and 4. By referring to the main connection diagram

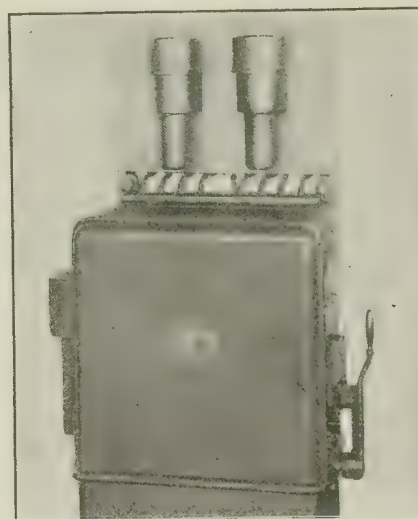


FIG. 15—STARTING COMPENSATOR WITH RELAYS FOR AUTOMATICALLY OPENING CIRCUIT ON OVERLOAD, INTERRUPTION OF SERVICE, ETC.

it is a simple matter to see the exact conditions of the circuit for each of the four settings of the contactors indicated in the table.

These notes have given a general outline of the fundamentals of the controller problem and will serve as an introduction to the more specific discussion of given machine-tool drives in subsequent articles.

²Quite an extended discussion of the methods of accelerating motors is found in the *Electric Journal*, Vol. XIV, No. 3, p. 102.

Providing the Power for Increased Production

How a Textile Mill Has Taken Care of Larger Output by Converting from Mechanical Drive to Electric Drive, Using Oil-Engine-Driven Generators

BY W. L. H. DOYLE

WHEN the Thomas Oakes Company, Bloomfield, N. J., had to enlarge its factory facilities to care for the increased demand for woolen fabrics such as are used in uniforms it was confronted with the problem of providing more power to drive the machinery. As is typical of mills of this kind, all the woolen card looms and various other machines were at that time driven by belts from parallel rows of line shafting extending lengthwise of the various buildings. The shafting in turn was driven by two 18-in. and 30-in. by 36-in. (45.7-cm. and 76.2-cm. by 91.1-cm.) cross-compound Corliss steam engines, each engine being installed as nearly as possible central as to its load.

After a careful study of conditions it was decided to change to electric drive and cut the great lengths of shafting up into individual motor-driven sections. Each section was arranged to care for ten to twenty looms or threading machines, depending on the size, while each wool-cleaning and carding machine was equipped with its own separate motor. These motors are all 240-volt, three-phase, 60-cycle induction machines with ratings ranging from 5 hp. to 15 hp. each.

The next problem was to decide on the source of power. The merits of central station service, steam-engine-driven and oil-engine-driven generators were carefully investigated. While the initial cost of the last was the highest of the three, yet when all the factors that go to make up the resultant average yearly unit

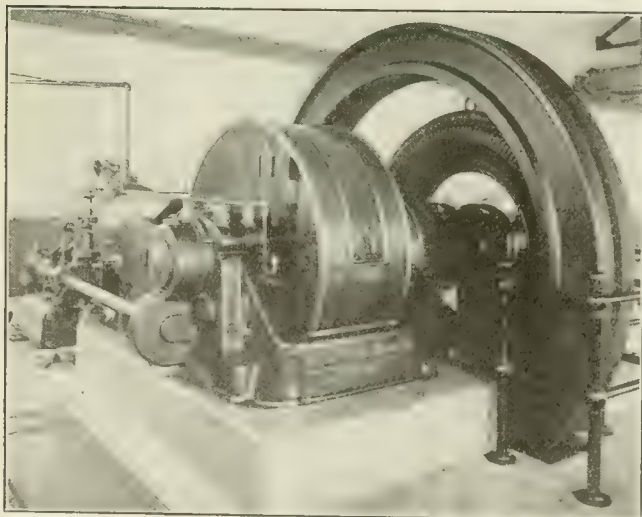


FIG. 1—CRUDE-OIL ENGINE INSTALLED IN TEXTILE MILL TO PROVIDE ELECTRICITY FOR INCREASED PRODUCTION

power cost were taken into consideration, it was decided by the Oakes company that the last mentioned source of power would be the most desirable. Accordingly a single-cylinder De La Vergne Type FH oil engine, operating at 200 r. p. m. and directly connected to a 64-kw., 0.8-power-factor, 240-volt, three-phase, 60-cycle alternator with a belted exciter, was installed.

The complete unit as finally erected is shown in Figs. 1 and 2. The engine is of the horizontal, four-cycle, medium-compression type and is guaranteed to operate on any grade of commercial crude or fuel oil containing less than 1 per cent water, irrespective of its actual

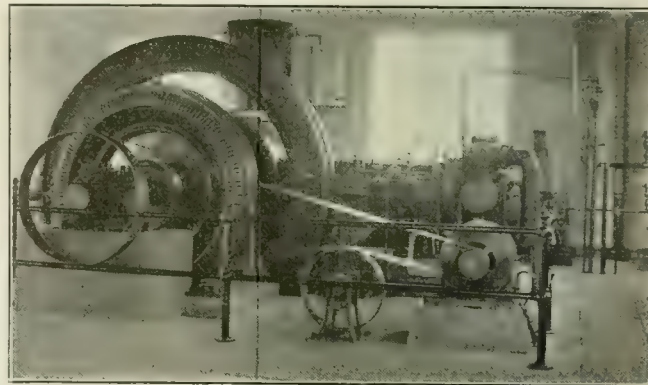


FIG. 2—GENERATOR BELT CONNECTED TO EXCITER; AIR INTERCOOLERS IN BACKGROUND

asphaltum or sulphur content. Fuel consumption, based on an oil having a heat content of 18,000 B. t. u. per pound, was guaranteed not to exceed 0.5 lb. (0.22 kg.) per brake-hp.-hour, or 0.74 lb. (0.33 kg.) per kilowatt-hour at the switchboard.

The piston is of the trunk type and has a cone-shaped head instead of the more usual flat head. The fuel is injected across the end of the cylinder into an uncooled vaporizer chamber. To facilitate injection of the oil and to insure the greatest possible atomization, air at from 800-lb. to 900-lb. pressure (56.2 kg. to 63.3 kg. per cm.) is used. This pressure is developed in a two-stage tandem single-acting air compressor driven by an eccentric on the crankshaft. The cylinder liner is removable, the head end being held rigidly in place by the cylinder head, while the crank-case end passes through a water-tight expansion joint in the main frame. The cylinder head is so designed that the valves act vertically, all valves being contained in individual and quickly removable cages.

Mounted on the foundation pedestal near the governor bracket is a small plunger pump which lifts the fuel oil from a 10,000-gal. (37,850-l.) storage tank buried in the ground just outside the engine room to a small standpipe. From here it flows by gravity to the engine pump mounted on the governor bracket. Both pumps are operated by cams on the camshaft. The oil bypassed by the governor overflow valve is returned to the standpipe. A constant level is maintained in the standpipe, and any excess oil is returned through a separate pipe to the storage tank.

A sight-feed pressure oiler supplies lubrication to the motor and low-pressure compressor pistons, the oil being fed in at the top through a quill to a point near the center of the piston travel. All other bearings are sup-

plied with oil under gravity head from a storage tank mounted on the wall. Oil for the crank and wrist-pin bearings drops into a collector ring on the crankshaft and is fed to the center of the crank pin and from there through the center of the connecting rod to the wrist-pin bearing.

All the oil from the various bearings eventually finds its way into a drip tank under the engine. From here it is lifted by air under pressure to a clarifier shown mounted on the wall near the center of Fig. 2. This is a Type "B" oil reclaimer and was especially designed to remove the impurities and fine carbon precipitate which occur in the drip oil. With this apparatus installed the lubricating oil consumption is guaranteed not to exceed 0.5 gal. (1.89 l.) per 1000 brake-hp.-hour.

To the right in Fig. 2 will be seen two large air tanks. These are used both as intercoolers between the low-pressure and high-pressure stages of the compressor and as the source of air supply when starting the engine. A constant pressure of 100 lb. (7.03 kg. per sq. cm.) gage is maintained in these tanks, this being ample for starting purposes.

The water for cooling the engine is drawn from a nearby mill pond. It enters the jacket with an average temperature of from 60 to 70 deg. Fahr. (15.6 to 21.1 deg. C.) and leaves at a temperature of 160 deg. Fahr. (71.1 deg. C.). From here it flows through a heater in the exhaust line of the engine, where it attains an approximate temperature of 200 deg. Fahr. (93.3 deg. C.) and is then delivered to the dye house.

The log sheets for the year 1916 show that the total output of this unit as delivered at the board was 167,340 kw.-hr. This makes the load factor 0.58, based on the total number of working hours. Despite this rather poor load factor, the cost of power for the year was remarkably low, as will be noted from the following data taken from the yearly report:

	Annual Expense per Kw.-hr.
Attendance	\$0.00528
Supplies	0.00115
Repairs	0.00083
Fuel oil	0.00444
Overhead charges, consisting of interest, taxes, depreciation and insurance	0.00940
Total	\$0.02110

In this connection it may be pointed out that the load during the month of December, 1916, averaged 54.5 kw., ranging from 49.2 kw. (minimum) to 59 kw. (maximum). Except on Saturdays, when the mill operates five and one-half hours a day, the generators are operated ten hours a day. The load is fairly constant. For fuel distillate oil is used which costs 4¼ cents per gal. (1.10 cents per litre), delivered in car-load lots.

The very satisfactory performance of the first unit led to the subsequent installation of a three-cylinder engine of the same make shown in Fig. 3. This is a 450-hp. type FH engine running at a speed of 164 r.p.m., and is direct-connected to a 380-kva. alternator of the same characteristics as the former unit. A 25-kw., belt-driven generator delivering energy at 110 volts is used to excite the field of the alternator.

This engine is of rather unusual and unique design. The cylinder jacket, as is usual in the larger-powered present-day oil engines, is cast integral with the main frame, but the latter has an interlocking construction which permits the annexation of other cylinders. By

this means horizontal engines of three and four cylinders can readily be built. This makes a very compact powerful unit which occupies a minimum amount of floor space. The new unit is controlled by a fly-ball governor which regulates the timing of the oil-pump suction valves, there being one pump for each cylinder. In the case of the small unit the governor controls the

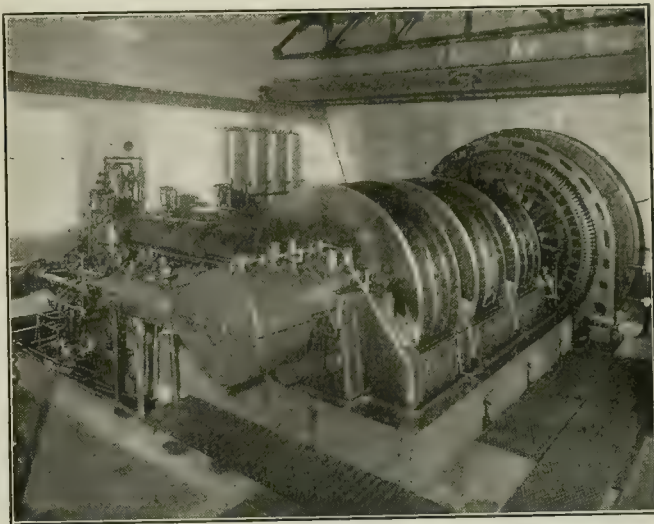


FIG. 3—THREE OIL ENGINES WITH INTERLOCKING BASES AND ONE CRANKSHAFT

quantity of oil delivered to the spray valve by acting on a by-pass valve in the fuel-oil pipe leading from the pump. Normally each machine carries a separate load, but the speed regulation of the two units is so close that no difficulty is experienced in operating the two units in parallel long enough to shift the load from one to the other when occasion demands.

The last unit referred to in the foregoing has only been in operation a short time, but the log sheets indicate that it will show an even lower power cost than the single cylinder unit. The over-all efficiency of a plant of this kind is about 30 per cent, or from 20 to 25 per cent better than the typical steam-driven plant of the same size. This difference means a big saving in fuel cost alone, and now that coal is so high the owners are congratulating themselves on having installed this more economical type of prime mover.

France Promoting Hydroelectric Development

Questions relating to the utilization of the power of non-navigable rivers and streams in France have been transferred for the period of the war from the Ministry of Agriculture to the Ministry of Munitions, according to the London *Electrical Review*. The Minister of Agriculture has stated to the French Parliament that plants rated at 400,000 hp. have been established or are in course of construction in the Alps, the Pyrenees and central France. He also said that the generating stations were under agreement to supply for a number of years after the war a certain proportion of the energy generated at a cheap rate. Several of the plants in question were in connection with factories making explosives with a calcium carbide base. With the cessation of hostilities, it would not be difficult to convert such plants to cyanamide manufacture, which would be of great benefit to French agriculture.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

MONEY-SAVING METHOD IN MANHOLE CONSTRUCTION

Use of Previously Molded Reinforced-Concrete Slabs Made in a Standard Size Makes a Better Job at a Smaller Cost

Considerable expense in manhole construction is being saved on the boulevard lighting system at Lincoln Park, Chicago, by using an already-molded reinforced-concrete slab on top of each manhole instead of drawing in the brick walls from a square to a circular plan to fit the cast-iron cover frame. The slabs, which measure 52 in. by 52 in. by 3 in. (132 cm. by 132 cm. by 7.6 cm.), are easily handled by means of a small jib crane attached to the rear platform of a 5-ton

C. H. Shepard, electrical engineer for the Lincoln Park Commissioners, is better than brick, because the slabs may be used easily again and again if it becomes necessary to change or to move the manholes, whereas the use of old bricks in reconstruction is of doubtful economic value when the loss of cleaning them in small quantities is considered.

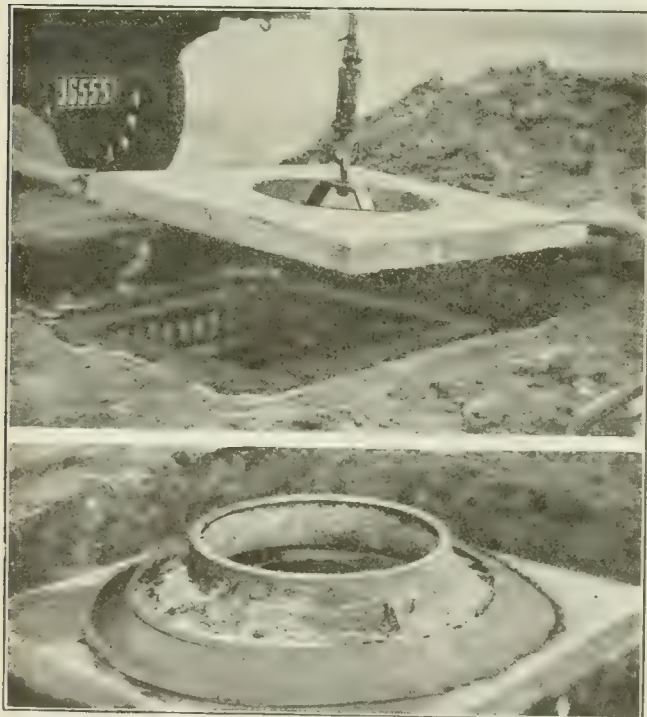
FUEL ECONOMY SUGGESTIONS FOR EMPLOYEES OF PLANTS

To Effect a Saving in Furnace Expense Requires, as Does War, United Effort and Determination on the Part of Those Involved

Following are ten suggestions* for saving fuel. They were published in a recent issue of the *Doherty Daily News* and should prove of practical helpfulness to other plants:

1. Watch conditions in the boiler room, as that is usually the place where the biggest opportunities to make fuel savings occur.
2. Keep the boilers in fit condition by thorough systematic inspection, cleaning and repairing. A boiler should never be put back in the line after being down for cleaning or repairs until it has been completely inspected and all of the defects have been remedied. The inspection should be thorough and rigid and should cover not only the internal and external surfaces of the boiler, but the baffles, settings, piping, valves and all appurtenances.
3. Blow the soot from the tubes daily.
4. Keep the hand-fired grates or automatic stokers in a good state of repair or they cannot be operated very economically and may become extremely wasteful. Thorough inspection and repairs are absolutely necessary if economical stoker operation is to be obtained.
5. Assist the fireman to get proper combustion and boiler operation by (a) analyzing the flue gases, (b) determining the percentage of combustible in the ash, and (c) analyzing the fuel.
6. Study the drafts and flue temperatures in the boilers and see that the baffles, bridge-wall, dampers, etc., are properly maintained.
7. Keep no more boilers "hot" than are absolutely necessary to carry the load during the peak, and make sure that the most efficient method of banking is being used during off-peak periods.
8. Keep the steam leaks about the plant down to a minimum and give special attention to small steam valves to keep them tight. See also that the steam traps and drip system are in proper condition.
9. Make sure that the exhaust steam from the auxiliaries is being used to heat the feed water in the most efficient manner. See (a) that there is no free exhaust not going to the heater, (b) that there is no steam exhaust from the heater with a water temperature of less than 210 deg. Fahr. (100 deg. C.), (c) that there is not an unnecessary amount of hot water overflow from the heater (if so investigate thoroughly), and (d) that the oil separator is properly piped up.
10. Do not overlook plant cleanliness.

*It was pointed out that if every Doherty power plant could save 10 per cent of its fuel through more efficient methods the coal saving to the country would be approximately 7500 tons a month.



FIGS. 1 AND 2—LOWERING THE SLAB FROM THE PLATFORM OF THE TRUCK BY MEANS OF A JIB CRANE, AND THE CAST-IRON COVER SET OVER THE HOLE IN THE SLAB

(4.53-t.) electric truck. When the slab and the frame are in place earth is shoveled over the slab and sod is laid flush with the 24-in. (60.9-cm.) cover.

Slabs of the size mentioned are used on manholes of all sizes between 2 ft. (60.9 cm.) square and 4 ft. (121 cm.) square. This practice permits the slabs for all but special jobs to be bought in quantities, with the result that it has been possible to get the standard size for \$3 per slab. The average cost of setting a slab is about \$1. At a total cost of \$4 the slab construction is much cheaper than brick, chiefly on account of the extra labor required in building the rounded neck of the hole. Moreover, the slab construction, according to

MAXIMUM EFFICIENCY IN BURNING FUEL OIL

Method of Limiting Steam Used for Atomization— Regulation of Air Supply and Proper Arrangement of Checkerwork

BY FRANK W. SMALL

Electric Generating Department Pacific Gas & Electric Company

Several factors determine the successful burning of oil, some affecting the reliability of the system and others its efficient operation. Those reducing the reliability of the system have been overcome so that at present oil-burning apparatus is as reliable as any other part of an electric service plant. The factors affecting the efficiency of operation vary a great deal, every large oil-burning plant having various innovations for obtaining the most economical results throughout a wide range of operating conditions. Some of those found in a large oil-burning installation on the Pacific Coast are described briefly in the following paragraphs.

The plant under consideration operates in parallel with a hydroelectric system, and owing to the varying demands upon the station it is necessary to operate the

boilers anywhere from 33⅓ per cent to 180 per cent of rating. At first, in attempting to atomize the oil thoroughly, the firemen very often used much more steam than was necessary. In fact, by test it was found that what appeared to the fireman as the proper amount of steam for atomization was in reality in the neighborhood of 5 per cent of the total steam generated instead of being between 1 per cent and 2 per cent. To limit the amount of steam used for this purpose the arrangement shown in Fig. 1 was devised. The flanges in the upper of the two parallel-pipe sections have a steel disk inserted between them, this disk having a small hole, from 5/16 in. to 7/16 in. (0.8 cm. to 1.12 cm.), depending on the size of the boiler, drilled through it. When the boiler is running at rating all the steam for atomizing passes through this hole, the lower valve on the by-pass around the disk being closed. When it is necessary to carry a heavy load on the boiler the lower or by-pass valve is opened and enough steam can be obtained for any overload desired. The valves having rising stems, it is possible to tell at a glance whether the by-pass is open or closed. By this method of operating the steam for atomization is restricted to about 1 per cent when operating at rating.

The principal consideration affecting the efficiency of an oil-burning installation, other than the choice of an

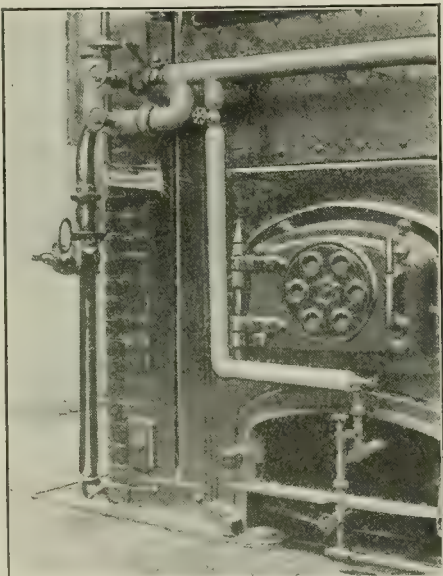


FIG. 1—VALVES AND PIPE CARRYING
STEAM FOR ATOMIZING OIL

oil burner which is economical in the use of steam and gives the proper shape of flame, is the proper control of the air supply. One of the advantages of burning oil is the possibility of reducing the excess air, and, conversely, one of the principal losses is the ease with which excess air can be admitted. For any particular installation, assuming that the setting is tight and the checkerwork properly arranged, the best draft should be determined by means of a differential draft gage connected to the furnace and to the top of the last pass of the boiler. At the same time analyses of the escaping gases should be taken to assure proper supply of air.

To regulate the draft in this plant a damper rod extends to the front of the boiler, as shown in Fig. 1, and is arranged so that the damper can be opened or closed in very small increments. For the benefit of the fireman the damper lever is marked in three places which indicate the position in which the damper should be when operating one, two or three fires. The swinging doors in the ash-pit openings are also adjustable and are used to obtain closer draft regulation at light loads.

The checkerwork under each burner, which is arranged as shown in Fig. 2, is made to conform to the shape of the flame. The openings are so proportioned that the total free area shall never be more than 3 sq. in. (19.3 sq. cm.) per rated boiler-horsepower, as it has been found that this ratio is sufficient to allow the boiler to be operated at 200 per cent of rating. Between each group of checkerwork is a dividing wall extending from the bottom of the ash pit to the floor of the furnace and from the front wall to the bridge wall. The chief advantage of this arrangement is that when any burner is not in service and the ash-pit door in front of it is closed the air entering through the other doors cannot enter the furnace through the checkerwork in front of the burner which is "out."

Each oil burner is set in a recess in the bridge wall so that any air entering around the burner will be drawn into the furnace by the inspirating action of the burner. The height of the burner above the checkerwork received attention, and after various experiments it was found that a height of from 4½ in. to 6½ in. (11.4 cm. to 16.5 cm.) above the checkerwork gives the

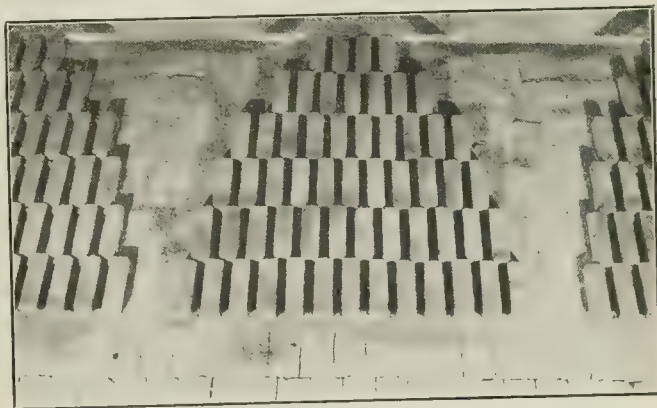


FIG. 2—ARRANGEMENT OF BRICK CHECKERWORK

best results. It was thought at first that the amount of soot and ash deposited on the tubes of a boiler burning oil as fuel could be blown off with a hand steam lance, but it was found that in large-sized boilers this method was not effective, and it is now the practice to equip the boilers with mechanical soot blowers.

TAPPING A 13,200-VOLT THREE-CONDUCTOR CABLE

Specifications for Making Straight Joints Followed
Except for Details Outlined—Method Used
by the New Jersey Company

BY E. B. MEYER

Assistant to Chief Engineer Public Service Electric Company,
Newark, N. J.

When it is necessary to make branch and Y joints on three-conductor, 13,200-volt cables the method described below, which has been found satisfactory in practice, may be used.

The specifications for making a straight joint are followed, except that a 6-in. by 28-in. (15.2-cm. by 71.1-cm.) sleeve is used instead of a 4-in. by 20-in. (10-cm. by 50.8-cm.) sleeve. A copper connector of a sufficient size to accommodate two conductors laid side by side is employed. The ends of the through cable are cleaned in the same manner as usual. After the end of the tap is cleaned in a similar way it is bent slightly and laid parallel to one of the through cables, which have been butted together. A connector somewhat larger than the conductors is spread over them and all are sweated together. Then each leg is insulated in the usual manner, and in addition the tape is threaded through the Y-shaped branch formed by the tap and conductors. In belling the end of the lead sleeve at the double end it will be found necessary to cut away a portion of the lead to conform to the shape of the two cables leading into the splice. A small piece of sheet lead may be required to form a backing for the lead between the cables. Filling of the joint is done in the usual manner.

RECORDING VOLTMETERS ARE USEFUL AT FEEDER CENTERS

Used to Keep Check on Service Rendered—Avoid
Error Caused by Depending on Station Instru-
ments with Line-Drop Compensators

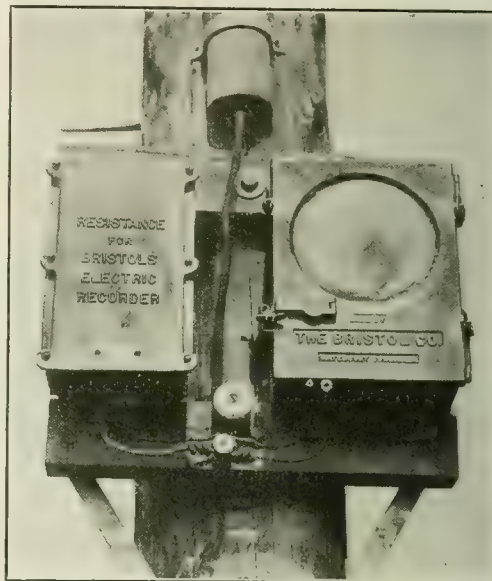
Complaints may be divided into two classes, those that are justified and those that are not. It should be the endeavor of every central station to prevent or correct the first class and to have at hand evidence to disprove the latter, especially before regulatory bodies.

Poor service from the lighting customer's standpoint usually means abnormal voltage, fluctuating voltage or no voltage. Although voltmeters equipped with line-drop compensators may be employed at station or substation switchboards to indicate the primary voltage at the feeder center, shifting load centers and power-factor conditions on each feeder tend to cause errors in the readings. Even if readings are noted at half-hourly intervals, momentary fluctuations are ignored, and the result is not so clear and permanent a record as the continuous chart.

For these reasons and in order to perfect its service and to keep a record of the quality of service rendered, one company has found it desirable to place a seven-day recording voltmeter at the load center of each of its lighting feeders. While a curve-drawing meter at such positions affords no indication of the individuals who suffer from inadequate transformer or secondary installations, nevertheless it constitutes an excellent index to the quality of service rendered the great bulk of

customers. It also aids considerably in the proper setting of contact-making voltmeters on the regulators.

From the illustration it may be noted that the meter and resistance used are of the weatherproof type. In overhead districts the instruments are mounted directly on the pole on short crossarms, low enough to be reached by a man with a stool or short ladder. Ordinary distribution-type transformers rated at 0.6 kw. or 1 kw. are used in conjunction with the meters, the voltage ratios being checked against standards before



DETERMINING VOLTAGE FLUCTUATIONS AT FEEDING CENTER

installation. The vertical leads to the meter are covered with a wood molding. In underground districts meters are installed in private transformer vaults, where available, rather than in manholes. The meters are wound and checked with a portable standard at weekly intervals.

PULLING IN LEAD-SHEATH CABLE WITH A TRUCK

Operations of an Iowa Company Give Proof that
Lead-Covered Cable Can Be Pulled at Speeds
Higher than Those Attained by Winches

The Iowa Railway & Light Company of Cedar Rapids recently pulled in 2800 ft. (853.4 m.) of 2300-volt, 600,000-circ. mil. two-conductor, concentric, varnished-cambric, lead-sheath cable with a truck without interposing a winch in the pulling-in line. An ordinary wire cable grip was used. The manholes were each fitted with pulling irons. Sheaves were used to guide the cable into the hole and prevent damage to the sheath. When a pull was made the truck was operated in reverse to get more power and less speed. It was necessary to put a 25-kva. and a 37.5-kva. transformer on the truck to keep the wheels on the ground.

The longest single pull measured 440 ft. (134.1 m.). This length of cable was pulled in just eight minutes, which was as slow as the truck could be successfully operated. Ordinarily it requires twenty-five minutes to make a pull of this length with a winch, even though it be power-driven. The engineers of the company, while firm in the belief that the cable was unhurt, think the speed too great for general recommendation.

CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

VALUE OF PUBLICITY OF A DISTINCTIVE CHARACTER

Wholesomeness of Effect of Quality Advertising
Material as Exemplified by the Work of the
New York Edison Company

Publicity of a distinctive character designed to appeal to the finer instincts of the reader is generally recognized as the best in the long run. Its first appearance might not be so fruitful of results as something more spectacular. The lasting results, however, and the wholesome effect made on the reader are rather the angles from which publicity, especially that put out by an electric lighting utility, should be viewed.

One of the best examples of this kind of advertising matter is that issued by the New York Edison Com-

pany for which the customer first asks are printed. The effect on the reader, therefore, is one of sympathy toward the utility.

While it is true that most other utilities may not be able to afford a service of such quality, it is certain that much could be done to improve the character of the advertising material now distributed. It is well known that central station managers as a rule give much less thought and attention to their publicity efforts than they should. In fact, a utility by its very nature is more affected by impressions made on the public than are most other businesses, and consequently it has more reason for taking great pains with its publicity.

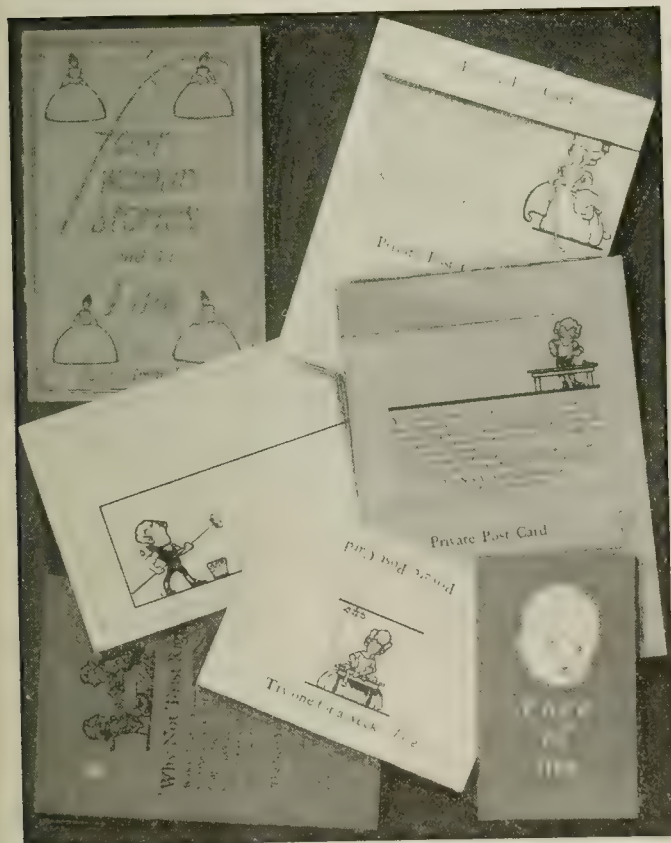
MODIFY EXTENSION RULES TO CONSERVE THE CAPITAL

Chicago Companies Petition Commission to Suspend
Provisions Relating to Free Line Extensions
Under the Prevailing War Conditions

The Commonwealth Edison Company of Chicago and the Public Service Company of Northern Illinois have petitioned the Illinois Public Utilities Commission to suspend during the war provisions of the rule covering electric service line extensions. The petition points out that the cost of copper wire and other materials, as well as of labor, has advanced abnormally, and that the necessity of conserving capital resources is of even greater importance in the present emergency. It says:

Owing to war conditions the cost of copper wire and other supplies and materials and of labor entering into the making of electric line extensions has advanced in an abnormal degree, and petitioner therefore has found the provisions of said Rule 31 to be unreasonably and unjustly burdensome. While the actual cost of petitioner of making electric line extensions in the territory served by petitioner has vastly increased as aforesaid, the average annual income per customer has not increased, with the result that the cost of making such an extension, which cost at the time of the adoption of said Rule 31 bore a fair and proper relation to the average annual return or income to be derived therefrom, has now increased to an extent which is out of all proportion to such return or income.

Furthermore, and of even greater importance than the excessive advance in the cost to petitioner of materials and labor, there is the fact that the country, while it is in the grip of war, is confronted with the necessity of rigidly economizing and conserving its resources, not only materials and labor such as enter into line extensions of this character, but capital. In view of this need of conserving the capital of the country for the prosecution of the war, as well as because of the scarcity of capital and the prevailing excessively high rates of interest on money borrowed, petitioner believes that during the period of the war it should be relieved, except in emergency cases, from making any capital expenditures for line extensions; that no line extensions whatever should be made except where absolutely necessary; and that where such an extension appears to be absolutely necessary the cost of such extension should in the first instance be advanced by the applicant for service.



LITERATURE THAT GETS THE PUBLIC'S ATTENTION

pany. Throughout the territory served the New York Edison "colonial men" are known and recognized as standing for a certain service.

Besides, all of the circulars and catalogs distributed by the company have a quality appearance. The workmanship is perfect in its simplicity. No attempts are made to burden the reader with a mass of descriptive detail, but only a few of those sales facts

THE ILLUMINATION OF AN ATHLETICS FIELD

Natural Amphitheater, 450 Ft. by 270 Ft. in Size,
Lighted to Average Intensity of 1.5 Ft.-Candle
with Angle Reflectors

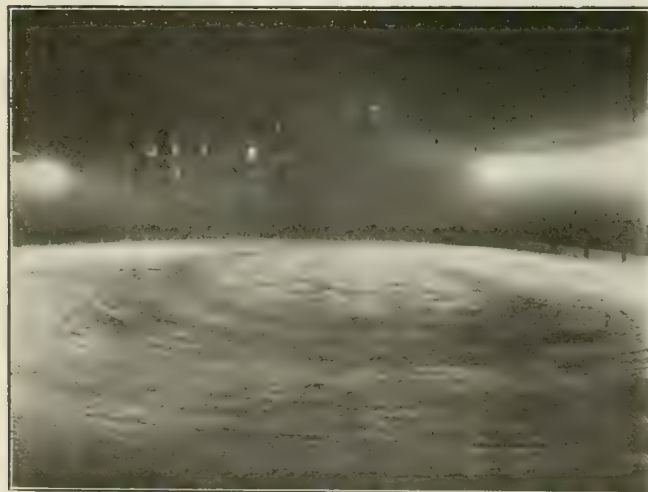
BY F. H. MURPHY

Illuminating Engineer Portland Railway, Light & Power Company

Multnomah Field, belonging to the Multnomah Amateur Athletic Club of Portland, Ore., is situated in a natural amphitheatre and is admirably located for the staging of outdoor evening entertainments. However, until recently it lacked proper lighting facilities for making this possible. A feeble attempt had been made to furnish some light by suspending two steel cables across the center portion of the field about 60 ft. (18.2 m.) apart and about 35 ft. (10.6 m.) above the ground. From each of these cables were hung four carbon arc lamps. The result was a poor and uncertain light immediately underneath the lamps, while at either end of the field virtual darkness existed and the glare of the arcs was continually within the range of vision. It was, in fact, unsatisfactory for any purpose.

At the beginning of the present summer it was decided to stage a "Western Round-Up," giving both afternoon and evening exhibitions. This necessitated relatively uniform illumination over the entire field, as there was no way of foretelling in what part of the grounds an exciting event might be staged, and there must be sufficient light to see clearly what was taking place everywhere.

Because the field is used at times for football and baseball games, overhead cables of any nature were prohibited; furthermore, the funds available for the installation were somewhat limited. The problem, therefore, resolved itself into one of lighting the field from the sides. The area to be lighted was approximately 450 ft. long by 270 ft. wide (137.1 m. by 82.2 m.). An average illumination of 1.5 ft.-candles was considered

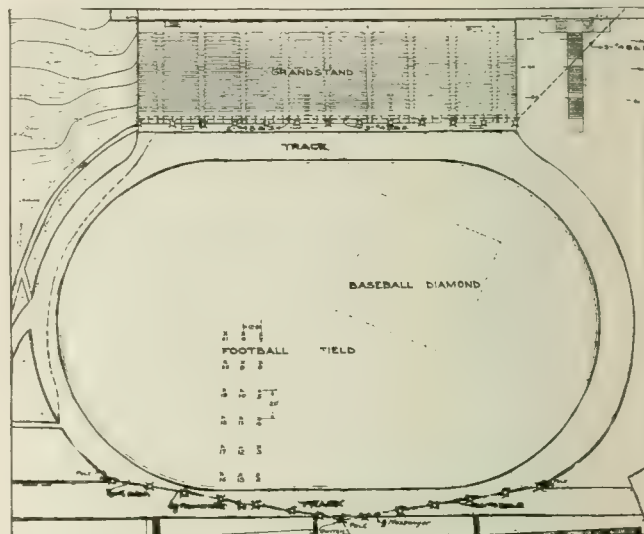


ILLUMINATION OF SPORTING FIELD IN PORTLAND, ORE.

the minimum that could be satisfactorily used, with considerably higher intensities where special events were to be staged, such as fancy roping, etc. Assuming that the reflectors to be used would under the conditions have a utilization coefficient of 40 per cent, it would require twenty-six 1000-watt units to give the desired illumination. Floodlighting units were at first

considered, but these were soon eliminated because of their cost, and the installation was made with B. E. L.-1000 Ivanhoe angle reflectors. The total cost of the installation was \$612, which represented approximately \$23.55 per unit.

Along the grand-stand side of the field the units were mounted just underneath the edge of the roof. On the



PLAN OF THE FIELD ILLUMINATED

opposite side of the field three poles were erected and the units were mounted on a $\frac{5}{8}$ -in. (1.6-cm.) messenger cable supported by the poles. The units are all maintained at a uniform height of approximately 45 ft. (13.7 m.) above the field and are spaced about 25 ft. (7.6 m.) apart along either side.

About two months after the installation was completed an illumination test was made at the stations shown on the map. This particular strip was taken as representing an average condition of the field. A Sharpe-Millar portable photometer was used and the test was made upon a 36-in. (0.9 m.) plane. Three readings were taken at each station. The values given in the table represent the average of the readings. They have also been corrected for the screen used in

TABLE OF ILLUMINATION READINGS

Station	Ft.-Candles	Station	Ft.-Candles	Station	Ft.-Candles
1	3.830	8	0.422	15	4.090
2	2.700	9	0.480	16	3.250
3	1.690	10	0.628	17	1.740
4	0.911	11	0.957	18	0.940
5	0.657	12	1.525	19	0.610
6	0.492	13	2.810	20	6.358
7	0.432	14	4.440	21	0.394

some of the lower readings. The average illumination as shown by these readings is 1.55 ft.-candles, which is probably approximately correct for the entire athletics field.

The area immediately in front of the grand stand where the fancy roping events were staged has an average illumination of 2.786 ft.-candles. This proved sufficient to enable these events to be seen in a very satisfactory manner.

The field is now used almost every night as a drill

ground for the home guard. When used for such purposes the lighting system on one side of the field only is turned on. This gives very satisfactory lighting for such work, although it naturally decreases from a comparatively high value on one side to a relatively low one on the other side. While at first thought it might seem that the extreme shadow condition resulting from lighting one side only might be objectionable, yet this has not proved to be the case, owing to the fact that the lighting is carried out over such a relatively great distance horizontally. Better lighting for this purpose would undoubtedly have resulted from turning every other light on each side of the field, but the additional cost necessary to secure this control has not yet seemed justified.

Here, as in many places, it was necessary to compromise between first cost and illumination results. The lamps as seen across the field are too low for absolute comfort, but the objection has not been so serious as was at first anticipated, and the public generally is very well pleased with the result.

SHALL THE EMPLOYEES BE TAKEN OVER WITH THE PLANT?

The Public Good Will Is Conserved by Choosing the Proper Men to Act as Local Managers for Interconnected Properties

In discussing his methods of handling men an executive of a Middle Western company recently stated that he had been able to notice in several instances the effect on the public occasioned by different methods of handling employees. The companies with which this executive is connected operate mostly in small towns and medium-sized cities which are interconnected by transmission lines. He stated that in the handling of these properties as a result of his experience he has adopted a policy of utilizing as far as possible all forces of men who have been employed by a company which is taken over.

Only in extreme cases, where it is impossible to teach these men new ideas and new methods, does he believe it wise to dispense with them altogether. Even before taking this step he sometimes finds it expedient to remove the man and his family to another community to discover whether or not the change will effect the proper awakening in the man himself.

In most cases it has been found that not only does the policy of retaining the old employees conserve the good will of the general public for the new company, but that the employees thus secured make good men for the larger concern. It is, of course, necessary to spend some money in educating the men, and to this end meetings at the headquarters of the company are held once a month for the local managers of the subordinate concerns.

Moreover, local managers for these small properties may be found in almost any position in the company taken over. In some instances it has been found that men who are working as linemen make good local managers. These men are gathered together once a month, when the detailed problems of operation are discussed, and a specific effort is made to see that they become more enthusiastic about the interconnected company than they were about the concerns which formerly

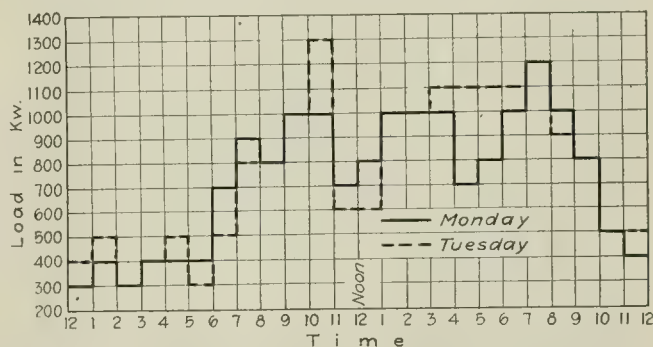
operated in the towns they now manage. That this plan works out well may frequently be inferred from the attitude of pride which these local managers exhibit in being connected with one of the largest industrial enterprises in their section of the country.

EFFECT OF FLATIRON LOAD ON THE CURVE FOR TUESDAY

Typical Plant Records from an Ohio Town of 5000 Show Clearly the Reasons for Small Towns Going After This Class of Business

The illustration herewith shows typical load curves taken from the plant of the Northwestern Ohio Light Company at Delphos, Ohio, a town of 5000 inhabitants, on a Monday and on a Tuesday. In this plant are two alternating-current turbo-generators totaling 2250 kw. and operating at 220 volts, three-phase, 60 cycles. The plant not only supplies electric service for Delphos but also sends out energy over a 33,000-volt high-tension line and a 13,200-volt feeder to a stone quarry. In Delphos the company is particularly fortunate in having an electric iron in the residence of practically every one of its 800 domestic customers.

The load produced by these 800 flatirons on Tuesday, which is the common ironing day, is clearly visible on the curve. These curves were not selected as those



COMPARATIVE CURVES OF SMALL COMPANY FOR MONDAY AND TUESDAY, SHOWING FLATIRON LOAD

which showed the worst possible exaggeration of conditions, but were taken as typical of the usual Monday and Tuesday curves. It will be observed that in the morning between 10 and 11 o'clock there is a peak extending 300 kw. above the usual station load. It will also be observed that the afternoon valley is more than filled on Tuesday. These two characteristics, according to H. W. Brunell, local manager of the property, are attributable entirely to the ironing load. It will be seen, of course, that the station load factor is somewhat lower on Tuesday than on Monday, owing to the increase in the station peak. It is probable, however, that if the flatiron load of Tuesday were added to the Monday curve the resulting load curve would be somewhat better.

There are some points on Tuesday's curve for which there is no explanation or which can hardly have any bearing on the flatiron load; for instance, the drop in load between the hours of 6 and 7 a. m., 7 and 8 a. m. and 11 a. m. and 1 p. m. It is true, however, that, as shown by the curves, the Tuesday kilowatt-hour output is larger than that for Monday.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Checking Induction Motor Connections.—F. D. NEWBURY.—The author points out that the possible mistakes in connecting a three-phase winding are: (1) wrong number of coils in group; (2) a reversed group caused by interchanging the cross-connections of the group; (3) a reversed phase caused by interchanging the start and finish of the phase. The author proceeds to show how these mistakes may be detected and located by (1) their effect on the form of the magnetic field produced by the winding when single-phase current is passed through it; and (2) their effect on the impedance of the winding.—*Elec. Journal*, December, 1917.

The Development of Direct-Current Motors.—A. BRUNT.—The author discusses the subject of heating and ventilation, rating, efficiency, motor weights and economic features.—*Elec. Journal*, December, 1917.

Lamps and Lighting

Operation of Series Incandescent Lighting Circuits with Series Transformers.—E. C. TREANOR.—The author describes the open-circuit and short-circuit characteristics of the series transformer and shows how these have been brought into agreement with the necessary and the desirable characteristics of the series incandescent circuit. The combined subject of grounding, operation and protection is analyzed.—*Gen. Elec. Review*, December, 1917.

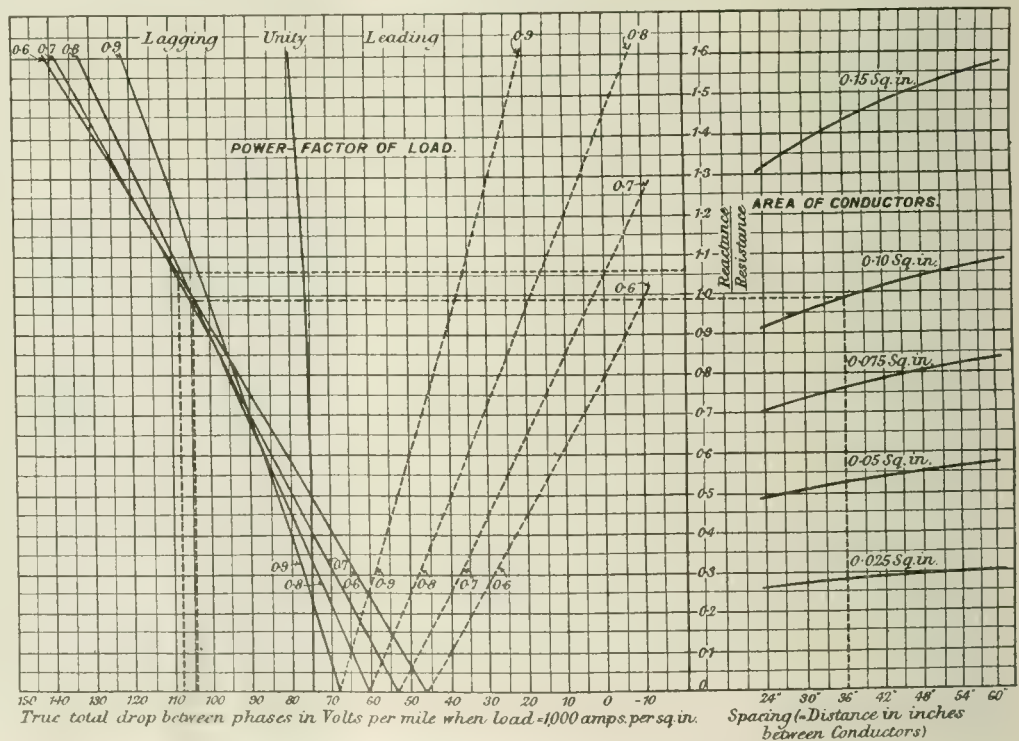
Mazda Lamps for Motion Picture Projectors.—L. C. PORTER.—An analysis of the difficulties encountered in successfully developing an incandescent lighting system to replace the arc-lighting system which has been commonly used. A description is given of the manner in which these difficulties have been surmounted, the development of a special incandescent

lamp and condenser and the addition of a spherical mirror being emphasized. The article is concluded by a table comparing the detailed operating cost of the new incandescent lamp with that of the arc lamp and showing that the former type is more economical than the latter.—*Gen. Elec. Review*, December, 1917.

Generation, Transmission and Distribution

The Design of High-Voltage Insulators.—C. E. OLSON.—First of three installments calling attention to the requirements of insulators and discussing the dielectric strength of porcelain, surface resistance and the proportioning of parts.—*Sibley Journal of Engineering*, November, 1917.

Pressure-Drop Curves for Copper Overhead Lines.—G. N. WRIGHT.—The curve shown in the accompanying figure was drawn so that the true pressure drop (that is, the difference between the voltage at the generating end and the voltage at the receiving end) on a three-phase, 40-cycle overhead line at any load can be found readily and without complicated calculation. By working out numerous examples it has been proved that, though these curves were drawn for a 3000-volt line two miles (3.2 km.) long, with conductors symmetrically arranged and loaded to 1000 amp. per square inch (155 amp. per sq. cm.), the error for other commercial lengths and loading of line and other voltages is quite negligible—in fact, greater inaccuracy might



TRUE POTENTIAL DROP FOR CONDITIONS MENTIONED IN TEXT

be expected in taking a reading from the curve itself. The true drop when the load is other than 1000 amp. per square inch may be found by simple proportion. The curves will be found to be absolutely correct for a 3000-volt line two miles (3.2 km.) long, an 11,000-volt line $7\frac{1}{3}$ miles (11.8 km.) long, a 20,000-volt line $13\frac{1}{2}$

miles (21.7 km.) long, or a 440-volt line 0.3 mile (0.5 km.) long, loaded to 1000 amp. per square inch (155 amp. per sq. cm.), or for double these lengths loaded only to 500 amp. per square inch (77.5 amp. per sq. cm.), or for half these lengths loaded to 2000 amp. per square inch (310 amp. per sq. cm.). Where the length of line is less or the current density lower, the curve reading will be slightly high, and, conversely, when the length is greater or the current density higher the curve reading will be slightly low; but, as mentioned above, the error is negligible, being less than 1 per cent for any commercial proposition. Alfred Hay's formula for inductance was used in the calculations, namely, inductance per mile of single-phase line in henries = $14.8 \times 10^4 \log_{10} (d/r)$. Capacity has been regarded as negligible, it being assumed that the curves will not be used for voltages higher than those likely to be adopted in England. Besides being useful for calculations of voltage drops, the curves bring clearly to light the fact that though smaller conductors give higher inductance than larger ones for the same spacing, the ratio of reactance to resistance for small conductors is less, and therefore the actual drop is less at the same loading per square inch for loads with lagging power factors.—*London Engineering*, Nov. 9, 1917.

Repulsion Between Busbars.—S. G. LEONARD and CHARLES R. RIKER.—A chart of busbar characteristics is presented and correction factors for repulsion between strap conductors are given. All of the formulas given and the charts are for round conductors only. They are, however, sufficiently correct for practical purposes with rectangular conductors where the separation between straps is greater than the width. This covers nearly all commercial conditions, as a spacing to this extent is required to limit the safe arcing distance in high-voltage plants and in low-voltage plants of any considerable capacity.—*Elec. Journal*, December, 1917.

Installations, Systems and Appliances

The Relative Merits of Steam-Driven and Electrically Driven Station Auxiliaries.—V. PICKLES.—The author points out that the two chief factors deciding the choice of steam-driven and electrically driven generating station auxiliaries are reliability and running costs. Difference in capital cost scarcely affects the question, as expenditure on auxiliary plant forms a small proportion of the total cost. The merits of individual auxiliary apparatus are taken up and considered from both standpoints. The author concludes from his reasoning that, on the whole, an independent steam drive is generally better than an electric drive for generating station auxiliaries.—*London Electrician*, Nov. 16, 1917.

New Way to Burn Crude Oil.—W. A. JANSEN.—During the past year there has been developed a system of oil burning wherein the oil, instead of being atomized or vaporized, is gasified in a special designed vaporizer outside of the furnace. The gaseous product is forced into a combustion chamber under positive pressure. The air for combustion is delivered by a compressor at about 2 lb. (0.14 kg.) pressure and a velocity of 150 ft. (45.7 m.) per second. With the admixture of oil in the vaporizer, a gaseous product is formed which is delivered to the combustion chamber under continuous pressure.—*Iron Age*, Nov. 1, 1917.

Opening Blast-Furnace Tap Holes with Electric Arc.—The use of an electric arc for the purpose of removing metal lodged in the tap hole of a blast furnace has been tried out with success in several of the big Krupp works. Where non-conducting masses plug the hole the current is shut off for a moment and a steel rod is pushed into the mass, which then acts as conductor; 800 amp. to 1000 amp. are required.—Abstracted from *Licht und Lampe in Frankfurter Zeitung*, Oct. 4, 1917.

Electric Dumping Platforms.—WINTERMEYER.—Electric dumping platforms are being installed throughout Europe in ever-increasing number, and an exhaustive study of the subject, with many illustrations and calculations, has been made in this article. Of the greatest interest are installations for dumping cars into ships and boats from the shore where the height of the water level changes continually with the tides. The largest of these dumping installations is in Duisburg-Ruhrort, where seven "dumpers" handle an aggregate of 1050 railroad cars in a day of ten hours. The cargo handled is chiefly coal and ores.—Abstracted from *Elek. Kraftbet. u. Bahn.*, Nos. 19 and 20, 1917, in *Elektrot. u. Maschinen.*, September, 1917.

Wires, Wiring and Conduits

Phasing Out of High-Tension Lines.—E. C. STONE.—The correct connection is predetermined from the existing connection by the combined indication of a single-phase synchroscope and an ordinary two-phase motor. The synchroscope is used to find corresponding individual phases, while the motor by the direction of its rotation indicates which of the two possible transformer connections exists in the particular case under investigation. For parallel operation the synchroscope shows synchronism, and the motor must rotate in the same direction when like leads are connected to corresponding phases of the line or busbars. Charts are given to show what connections should be made when the synchroscope reading and rotation of the induction motor are known.—*Elec. Journal*, November, 1917.

Telegraphy, Telephony and Signals

Effects of Changes in Diaphragm on the Characteristics of the Telephone Receiver.—The observations indicate that the natural frequency of the telephone receiver is not proportional to the diaphragm thickness for at least one reason, that the thin diaphragms are subject to greater magnetic distortion. The observed sensitiveness reached a maximum for the particular instrument under consideration near the thickness of 0.23 mm. The resonant range diminished as the distance increased.—Report of Research Division Electrical Engineering Department, Massachusetts Institute of Technology.

Long-Distance Duplex-Working Central Battery System.—R. L. MILBURN.—In this system the apparatus at the home station consists of a double-current key with nine terminals, three top, three bottom and three movable, a polarized G. P. O. 200-ohm relay, a rheostat with condensers up to 30 microfarads, and a sounder and local battery. At the out-station the apparatus consists of a key, Vyle sounder and rheostat without any condenser. Three relays joined in series locally were used in place of the key.—*London Elec. Review*, Nov. 16, 1917.

Communicating by Wire and by Wireless "at the Front."—Owing to the danger of wireless communications being captured by the enemy, the Allied armies at the front resorted to telephone lines, but on account of the heavy bombardment it was soon found necessary to place these underground instead of in the air, and the depth at which they are laid has been constantly augmented until the possible limit in that direction has been about reached. Even yet, however, interruptions at critical moments are frequent. It is therefore suggested that wireless telegraphy should, after all, be resorted to, and that such installations be modeled after the plan said to be used by the Germans. That is, the electric source differs according to the strength of the stations, the feeblest using a small storage battery charged every two days, the strongest being supplied with an electric generator. The antennas are fixed 4 m. (13 ft.) above the ground, to which they are connected by a bare wire buried for a certain distance. The antennas are about 100 m. (328 ft.) long, and the stations emit waves 500 m. to 600 m. (1640 ft. to 1968 ft.) in length, or of the same order as those sent by the aeroplanes. The stations are fully manned and an incessant listening is maintained in the hope of intercepting messages from enemy aviators.—*L'Industrie Elec.*, Oct. 10, 1917.

Miscellaneous

Public Utility Service Standards of Quality and Safety.—This paper contains a brief outline of the public service activities of the Bureau of Standards, together with lists of subjects on which publications have been issued by the bureau. Among the public service activities are standards for electric service, national electric service codes and data on electrolysis indication, and the program of future activities covers a number of other compilations and investigations that will be of value to the electrical industry.—*Circular No. 68*, Bureau of Standards.

Capitalized Value of One-Tenth of an Inch Vacuum.—C. H. BAKER.—Formulas and charts are given for calculating the capital that may be economically invested in condenser equipment for each 0.1 in. (2.5 mm.) of vacuum gained with steam turbines. Problems are also worked out to show the application of the charts.—*Power*, Dec. 4, 1917.

Heat Calculations for Baking and Drying Oven.—WIRTS and STODD.—In the baking and drying process heat must be supplied for the following purposes: raising the temperature of the work; raising the temperature of the part which is supporting or carrying the work; raising the temperature of the ventilating air; supplying the losses which occur from radiation, and in case of continuous operation, such as a kiln-type oven or the semi-continuous conveying type of oven, raising the temperature of oven walls, racks, etc., after each period of cooling. The author illustrates how each one of these calculations is made by assuming specific conditions and working out the example.—*Elec. Journal*, November, 1917.

Storage of Coal in Bulk.—The British Fire Prevention Committee has issued a special warning with regard to the storage of coal in bulk, with especial reference to spontaneous combustion. The following are some of the precautions that should be taken: (a) Stacks should not be higher than 10 ft. (3 m.). (b)

Iron perforated pipes 3 in. or 4 in. (7.6 cm. or 10.2 cm.) in diameter, or, in the absence of these, either suitable earthenware pipes or ducts formed of incombustible material, should be inserted vertically in the stacks as they are built up. The lower ends of these pipes or ducts should be at different heights from the ground throughout the stacks. There should be one pipe or duct to about every 300 sq. ft. (27 sq. m.) of surface. (c) A thermometer should be lowered occasionally through these pipes or ducts to ascertain the temperature of the center of the stack. (d) If wet, very small, very soft or impure coal is received, it should be dumped around the edges of the stack, or in some location where the air can get to it freely and where other coal will not be packed on top of it.—*London Elec. Review*, Nov. 9, 1917.

Causes of German Coal Shortage.—Among the causes given for coal shortage in Germany are the underfeeding of the miners, their lack of experience and training, the unsatisfactory terms of the collective piece-work contracts, lack of zeal in the workers, defective ventilation, poor blasting materials, defective tramway lines, and general shortage of cars, timber and other materials. At the present time about one-sixth of all employed in and about the mines are women and boys, lacking both in physical strength and training; but even among the men a large proportion are unskilled and have been recruited from every conceivable vocation. If the prisoners of war be included, the effect is to reduce the average efficiency of the mass still further.—*Die Konjunktur*, Aug. 30, 1917.

Water Power and Agriculture.—H. CAHEN.—This publication in full of a paper presented to the water-power congress held at Lyons, France, in 1914, is still pertinent in considering the problems involved and interesting as an exposition of what was being done in Europe in the application of electricity to agriculture before the war. Its principal uses are summarized as lighting, electroculture, applications in the work of raising crops, in the interior work of the farm and in pumping and irrigation. Under the head of electroculture proper comes the use of electric energy to stimulate vegetable growth and to enrich the soil by the chemical decomposition of elements contained in it. Results thus obtained have been contradictory and all the factors are not yet sufficiently known, but it is established that nothing can be hoped for from atmospheric electricity, which is too hard to capture and too intermittent. Only from the application of manufactured energy at high tension can success be expected. In the practical work of sowing and harvesting, plowing and thrashing progress is constant and assured, and the same thing is true as regards the varied work carried on in barns, dairy work, the ventilation of hothouses, refrigeration and ice-making. Other projected or incompletely developed uses are in sterilization, rectification of alcoholic liquids, whitening of grain, extraction of casein from milk, incubation and the treatment of cows. The value of electricity for pumping and irrigation is, of course, incontestable. A detailed account of what has been accomplished along all these lines in various parts of Europe, of tariffs and costs, and of the part that should be played by organized groups of agriculturists, by the distributors of energy and by the government is given.—*Revue Gén. de l'Elec.*, Nov. 3, 1917.

NEWS OF THE INDUSTRY

*Chronicle of Important Events and General Activities in the Technical,
Commercial and Manufacturing Fields*

GENERAL POWER SITUATION

BECOMING MORE SERIOUS

**Government Work Hampered in Many Localities and
Priority Orders for Power Likely to Be
Issued in Congested Districts**

Owing to the concentration of war orders in the Middle Atlantic and Middle States, electric power supply in those sections is rapidly nearing exhaustion because of lack of coal, generating equipment or a combination of both. Isolated plants having proved unequal to the emergency, the government has asked one large New England central station, for instance, to connect an important munitions plant to its system. This will involve quite an outlay for a transmission line, inasmuch as the munitions plant is some distance from the lighting company's circuits.

For some time the power situation at Niagara Falls has been acute. The government has made an arrangement with the Canadian authorities whereby the threatened curtailment of electrical energy from Canada will not take place, and conferences are now proceeding at Niagara Falls between American and Canadian authorities with a view to distributing the electrical energy generated along the Niagara frontier equitably.

PRIORITY ORDERS FOR POWER

Orders have been issued to public utilities and power plants in the Pittsburgh district to give preference to plants engaged in war work. The priorities committee of the War Industries Board of the Council of National Defense has issued certificates which in effect constitute the establishment of a preferred class of industries and follow closely the lines of the requests of Dr. Garfield of the Fuel Administration that coal operators supply certain consumers first. The power companies are expected to serve last those plants to which certificates are not granted. In this way it is hoped that the slowing up of the manufacture of munitions through lack of adequate power will be averted.

The preferred list of consumers will be subject to constant revision by the priorities committee as local conditions change. The priorities certificates were issued in the Pittsburgh district only after careful study had shown that they were absolutely essential to the national interest. It is anticipated that the order will probably cause some inconvenience at first but that a judicious allotment of electric power and proper adjustment on the part of the industry to meet the new conditions will prevent any hardship.

The large amount of war order business turned out near the great seaport cities on the Atlantic Coast north of Washington, it is anticipated, will call for some government action to conserve the power supply there. In many instances the shortage has been due to lack of fuel, while in some other instances the shortage has been due to lack of generating equipment. Serious

shortage of power for war work has also been experienced in the eastern section of Ohio, due chiefly to lack of fuel. So far the government has not been seriously hampered for want of electricity south of Maryland or west of Ohio, except at one of its own plants in the Middle West. It is of interest to note that the district where power shortage has been most acute is also the district suffering most for lack of fuel. Extensions called for by the government have resulted in at least two utilities asking for government help in securing necessary capital to make the extensions, the utilities themselves not being able to raise the funds.

There now exists also great confusion among the manufacturers of steam generating equipment owing to the congestion of priority orders from military authorities. Manufacturers of steam turbines have been in consultation with the government on this matter, and it is the expectation that conditions of congestion may be remedied by a co-ordination of the work and by closer co-operation between the various military departments. Difficulty has been experienced in meeting all of the power requirements of war industries owing to the lack of large transformers and in some cases of large motors. Steps have already been taken to remedy this matter, and manufacturers of this equipment have willingly placed all of their facilities at the service of the government. It is expected, however, that by a proper allotment of the work the ordinary business of electrical manufacturing companies, which is also now at its height, will not be seriously interfered with.

LISTING POWER USERS

In many instances power companies appealing to the Fuel Administration for fuel have been requested to list all of their power users in the order of their importance to the government in the successful prosecution of the war. This listing has been made in anticipation of possible curtailment of service to those industries which might be considered less essential. Power companies in many sections have approached this task with hesitancy and have been loath to accept the responsibility of deliberately cutting off the supply of electrical energy to any industry without proper governmental authority. The companies seek to be protected against lawsuits owing to non-fulfillment of power contracts.

It is very generally felt in Washington that the priorities committee which has issued certificates for power is without authority to issue such orders formally and legally, but there is understood to be an official view that if the power companies do not meet its wishes and recognize the certificates there is the possibility that the districts affected will fail to get future government contracts and coal.

Every manufacturing plant on the high-tension lines of the Georgia Railway & Power Company received a telegraphic request from that company to shut down

entirely for twenty-four hours beginning midnight Tuesday and continuing until midnight Wednesday. President P. S. Arkwright explained that the shortage of coal and the low stage of water in the streams feeding the company's great hydroelectric plants made this step imperative. It is the expectation that a complete shut-down for twenty-four hours will enable the power company to store sufficient water back of the dams and in the reservoirs to enable it to tide over power shortage temporarily at least. It will also enable the power company to get sufficient coal for its auxiliary steam plants.

WATER-POWER ACT IS PASSED BY UNITED STATES SENATE

Bill Providing for the Improvement of River Navigation by Private Capital and Utilization of Resulting Water Power Is Carried

On Dec. 13 Senator Shields of Tennessee presented a report from the committee of commerce accompanying a bill to amend the act to regulate the construction of dams across navigable rivers. The report said in part:

The bill provides primarily for the improvement of navigation in rivers under the jurisdiction of Congress with private capital, as distinguished from appropriations by Congress for that purpose, and secondarily for the development and utilization of the water power of those rivers resulting from such improvement, as well as that created by dams constructed and to be constructed under the authority of Congress. The secondary purpose of the bill is the inducement for the investment of private capital in the improvement of navigable streams and without which it would not be so invested or improvements made.

It is estimated that there is in the navigable rivers of the United States, exclusive of Alaska, and also of what may be developed by feasible storage projects, over 61,000,000 hp. of water-power energy, not more than one-tenth of which is now improved and utilized.

The economic and industrial advantages to the people of the United States that will result from the development of hydroelectric energy produced by utilization of water powers are difficult to overestimate.

It is believed that under the provisions of this bill the water-power resources of the country will be developed and utilized and future waste prevented, which is conservation in its highest and truest sense.

The bill was debated on Dec. 14 for about three hours, many of the Senators, especially those from the water-power States, indorsing it. It was passed by a vote of forty-six to eighteen, thirty-one not voting.

The principal objects of this bill are thus summarized by Senator Jones of Washington:

1. For the improvement of the navigation of rivers without cost to the government in connection with dams constructed for hydroelectric purposes in navigable streams.

2. For grants by the Secretary of War of authority to private parties for the construction and maintenance of such dams when navigation facilities can be improved thereby, such authority to extend for fifty years and until the property necessary for such a development is taken over and just compensation paid for it either by the government or a duly authorized new grantee.

3. For diligent construction, completion and operation of such dams, subject to market conditions.

4. For the construction by the grantee of suitable locks, without cost to the government, when required by the Secretary of War.

5. For payment to the government by the grantee of the cost of any investigation necessary to the issuing of the grant and the cost of such supervision of construction as may be necessary; and also the payment by the grantee of

reasonable charges for benefits resulting from headwater improvements installed by the government and payment to the government of a reasonable price for the use of any public land taken.

6. For the regulation of the rates and service of the grantee by state authority, or, if the business is interstate, by the Interstate Commerce Commission, thereby assuring to consumers efficient service and fair, just and reasonable rates.

7. For reserving to the state authority over the waters and water powers subject to the paramount power of Congress over navigation, and for reserving also all the taxing powers of the states in relation to the properties.

8. For uniform accounting and examination of the books of grantees by the Secretary of War.

9. For leasing under similar conditions the right to utilize surplus water generated at dams constructed by the government.

METHOD OF PROCEDURE IN WAR INDUSTRIES BOARD

A Plan for Satisfying War Needs Contemplates the Issue of a Daily List of New Government Requirements

The electrical division of the War Industries Board has issued the following bulletin, dated Dec. 15, dealing with questions of procedure:

In quick response to our bulletin indicating a shortage in capacity for production of large units, several companies have offered to expand their capacity. A plan for satisfying war needs contemplates sending a letter every day listing new requirements. These lists will be sent to all companies prepared to undertake any part of the requirements. If the inquiries develop in sufficient volume, a regular day for allocation each week will be named. As the inquiries come in by mail manufacturers are expected to review their shop schedules in the departments that would perform the work. Each manufacturer will exercise his own judgment as to sending a representative to Washington for the weekly meeting.

Mr. Collens, chairman of the war service committee, has been asked to complete the plan for these meetings and to be ready to place the plan in full operation next week should the volume then so justify. This procedure will not only prevent increase in congestion but will also indicate whether we now possess capacity equal to the demand.

The indications at present are that the situation as to large transformers and other substation apparatus is more congested than on motors. We may wish to add transformers for similar allocation as to sources of supply at these weekly clearance meetings. If so, transformer manufacturers will be asked to adopt similar procedure. Please note that adoption of this plan of clearing demands against supply does not obligate any company actually to attend if from its point of view the volume and its prospects with reference thereto do not justify. When you decide not to attend we ask that you give by mail the best picture or tabulation or answers you can, taking care to post your letters in time to reach us the day of the meeting, when that has been set by Mr. Collens.

On small motors in general we have developed stocks which will answer so large a portion of the immediate needs without requiring new manufacture that practically all appearance of shortage has disappeared. Such shortage as does exist is only spotty and will probably remedy itself by natural evolution. Possibly it may later on be advisable to assist certain machine-tool builders to secure alternate supply for motors. As this would require new development in most cases the move will only be made in case of absolute necessity.

Several companies have sent us no stock bulletins or statements as to shipment since July of orders intended for export. Others have sent us one bulletin as to equipments in stock, but have not sent revision weekly or at the latest bi-weekly. Their lists must be rejected entirely as unreliable after two weeks.

SPEEDING WORK OF THE WAR SERVICE COMMITTEES

Conference of Chairmen of Group Committees of Associated Manufacturers of Electrical Supplies to Help the Government

A conference of chairmen of the group war service committees of the Associated Manufacturers of Electrical Supplies and Robert K. Sheppard and J. R. McKee, the representatives of the association on the general war service committee of the electrical manufacturing industry, was held at the association offices, New York, on Wednesday of this week. It supplemented the meeting of members at Delmonico's, New York on Dec. 13, mentioned in last week's issue of the ELECTRICAL WORLD.

The conference this week was held for the purpose of speeding and successfully organizing the work of the individual committees. It is the intention of these committees, following the policy of the association, to give the government every possible assistance in getting in the shortest time the electrical supplies which it needs to prosecute the war to a victorious conclusion. Organization will be effected on the basis of patriotic service to the government. The services of the committees will be available to all manufacturers, without regard to whether they are or are not members of the association.

The spirit of the meeting of members of the association on Dec. 13 is shown by the following resolution, passed unanimously at that gathering:

Resolved, that we, the manufacturers of electrical supplies in special meeting assembled here, hereby approve the action of the board of governors of the Associated Manufacturers of Electrical Supplies in appointing representatives on the general war service committee of the electrical manufacturing industry.

We pledge our support to that committee.

We pledge our manufacturing facilities, for the welfare of the United States of America and shall seek through our several industry committees and the general war committee for methods to accomplish all that our individual and united facilities can contribute to the winning of the great war in which we as a nation are now engaged.

THE ENGINEERING COUNCIL URGES DRAFT LAW CHANGE

It Indorses the Movement to Modify Draft Law so as to Permit Students at Engineering Schools to Complete Their Studies

A meeting of the Engineering Council was held on Dec. 6 in the new board room of the American Society of Civil Engineers, New York.

A committee which has been searching for some time for a permanent secretary for the Engineering Council, for the United Engineering Society and for the Engineering Foundation unanimously recommended Alfred D. Flinn. The resignation of Calvert Townley, who had held office since the organization of the Engineering Council, was accepted with expressions of appreciation for services rendered, and Mr. Flinn was elected, effective Jan. 1, 1918.

The matter of the administration of the national selective draft law with respect to students in engineering schools having been recommended for consideration, a resolution was adopted and telegraphed to Secretary of War Baker and General Crowder.

WAR SERVICE COMMITTEES OF ASSOCIATED MANUFACTURERS

Various Groups Appoint Members of Committees to Co-operate with General Committee of the Electrical Manufacturing Industry

Following conferences of members of the Associated Manufacturers of Electrical Supplies with Robert K. Sheppard and J. R. McKee, the representatives of the association on the general war service committee of the electrical manufacturing industry, the various groups have appointed co-operating war service committees. These committees are:

Molded or Formed Insulation Group.—R. W. Seabury, chairman, Boonton Rubber Manufacturing Company; E. B. Hatch, Johns-Pratt Company; Joseph Rockhill, General Insulate Company; B. H. Howell, Garfield Manufacturing Company.

Panelboard and Switchboard Group.—Charles L. Eidlitz, chairman, Metropolitan Electrical Manufacturing Company; H. F. Krantz, Krantz Manufacturing Company; William T. Pringle, Pringle Electrical Manufacturing Company; F. T. Wheeler, Trumbull Electrical Manufacturing Company.

Line Material Group.—H. G. Lewis, chairman, Electric Service Supplies Company; J. W. Perry, H. W. Johns-Manville Company; A. L. Johnston, Electric Railway Equipment Company.

Porcelain Group.—H. R. Holmes, chairman, R. Thomas & Sons Company; B. B. Dinsmore, Imperial Porcelain Works; C. W. Kettron, Illinois Electrical Porcelain Co.

Carbon Group.—J. F. Kerlin, chairman, National Carbon Company; G. P. Fryling, Speer Carbon Company.

Metallic Flexible Conduit and Armored Conductor Group.—F. W. Hall, chairman, Sprague Electric Works; V. C. Gilpin, Triangle Conduit Company; G. F. Holly, Youngstown Sheet & Tube Company.

Non-Metallic Flexible Conduit Group.—W. H. Thornley, chairman, Tubular Woven Fabric Company; D. H. Murphy, American Conduit Manufacturing Company; Russell Dart, Alhaduct Company.

Rigid Conduit Group.—D. H. Murphy, chairman, American Conduit Manufacturing Company; F. C. Hodgkinson, Safety Armorite Conduit Company; J. S. Patterson, Enameled Metals Company.

Industrial and Street-Lighting Fixture Group.—H. W. Bliven, chairman, Harvey Hubbell, Inc.; A. D. Fishel, Adams-Bagnall Electric Company; D. K. Chadbourne, George Cutter Company.

Lighting Fixture Group.—Herman Plaut, chairman, L. Plaut & Company; F. W. Wakefield, Wakefield Brass Company; Albert Ullman, Scott-Ullman Company.

Wire and Cable Group.—LeRoy Clark, chairman, Safety Insulated Wire & Cable Company; Edward Sawyer, Atlantic Insulated Wire & Cable Company; Wallace S. Clark, General Electric Company.

Wiring Devices Group.—J. C. Dallam, chairman, General Electric Company; Attachment Plug Section, H. W. Bliven, Harvey Hubbell, Inc.; Fuse and Cut-out Section, J. W. Perry, Johns-Manville Company; Knife Switch Section, J. H. Trumbull, Trumbull Electrical Manufacturing Company; Snap Switch Section, Shiras Morris, Hart & Hege-man Manufacturing Company; Socket and Receptacle Section, F. V. Burton, Bryant Electric Company.

Outlet Box Group.—H. D. Betts, chairman, Thomas & Betts Company; A. I. Appleton, Appleton Electric Company; H. G. Knoderer, National Metal Molding Company.

Fan Motor Group.—W. W. Mumma, chairman, Robbins & Myers Company; A. D. Fishel, Adams-Bagnall Electric Company; M. C. Morrow, Westinghouse Electric & Manufacturing Company.

Metal Molding Group.—C. E. Corrigan, chairman, National Metal Molding Company; D. H. Murphy, American Conduit Manufacturing Company.

Insulating Materials Group.—J. B. Adams, chairman, Irvington Varnish & Insulator Company; W. R. Williams, General Electric Company; F. Y. Stewart, United States Rubber Company.

SUCCESSFUL MEETING OF A. I. E. E. IN NEW YORK

Features of Papers and Discussions Presented at
Three Hundred and Thirty-fifth Meeting of
American Institute of Electrical Engineers

Two papers were presented at the Dec. 14 meeting of the A. I. E. E., one of which was considered as contributing some valuable information on the flux and iron-loss distribution in steel laminas, while the other, on "Phenomena Accompanying Transmission with Some Types of Star Transformer Connections," was criticised rather severely by some members as not representing the average conditions which exist.

The first paper, which was entitled "Magnetic Flux Distribution in Annular Steel Laminas," was presented by Dr. A. E. Kennelly and Lieut. P. L. Alger, who explained how the experiments were conducted in studying this subject, what results were obtained and the causes of the phenomena noticed.

It was pointed out that the flux density in different belts of an annular lamina not only differ in r.m.s. magnitude but also in wave form. The distortion is very marked at low densities and is complicated at high frequencies by skin effect. Even if the total flux is sinusoidal the individual belt fluxes may be non-sinusoidal. In general, the external belt flux is the most distorted. The magnitude of the flux density distortion depends upon the width-radius ratio of the lamina (width of lamina plus geometrical mean radius).

The second-mentioned paper, by Lloyd N. Robinson, contained the following conclusions: Hysteresis, as well as variation of permeability, gives rise to harmonics of considerable magnitude in the exciting current of a transformer. For transmission lines of moderate lengths the effect of the line is to reduce the third harmonic voltage between neutral and line terminals of a star-star-connected bank of transformers having grounded neutral on the line side only.

In transmission with star-star transformer banks having grounded neutral on the line side only the interrelation of line susceptance from conductor to ground in series with the varying susceptance of the individual transformers may cause the total mmf. of one of the transformers to pass through zero at the same instant as the impressed emf., and thus give opportunity for a reversal of this transformer due to inertia, thereby producing a periodically reversing leg and abnormal voltages. In a similar system with high-quality line insulation the effect of atmospheric charges on the line conductors may be to cause the transformer of the bank to assume relations with one leg permanently reversed when energized from the station side, thus imposing unbalanced voltage conditions on the bank and producing in two of the units fundamental-frequency components of voltage 264 per cent of normal.

Combinations and accentuations of the above causes may, through natural requirements, give rise to a double-frequency pulsation of the potential of the hypothetical neutral of the line conductors, thus producing in the leg voltages second harmonic components of extremely large dimensions, perhaps limitless.

Both papers aroused considerable discussion. Among those taking part were B. A. Behrend, L. W. Chubb, V. M. Montsinger, J. B. Taylor, C. O. Mailloux, A. M. Dudley and F. W. Peek, Jr.

Mr. Chubb did not agree with many of the explanations made in Mr. Robinson's paper, notably that the harmonic components of the exciting current are not wattless, that the medial lines of hysteresis loops and the sine component of the exciting current represent variations in permeability, and that current resonates between the grounded conductor and the grounded neutral. He then presented his theory of the cause of the phenomena noted by Professor Robinson, saying that the inductance of a transformer varies with the flux density, and that if a condenser is connected across the terminals there may be resonance with certain flux densities. With resistance in series the current will continue to resonate even after the voltage has been reduced. He expressed the belief that the phenomena noted could not have been due to a reverse leg as an over-saturated transformer would have an excessive exciting current if this condition existed.

Discussing Dr. Kennelly's paper, Mr. Chubb said that he did not believe that the magnetic flux would divide according to the reluctance. Attention was called to the excessive iron losses which may be caused by bending lamina, a curvature equivalent to 60 deg. between tangents one inch apart increasing the apparent loss as much as 100 per cent. The eddy currents between lamina may be considerable, while paint may retard the flux and cause a sharp peak in the exciting current.

Mr. Montsinger outlined some of his investigations which were explained before the A. I. E. E. in 1914, calling attention to the fact that he had noted many effects that Professor Robinson had, but had failed to observe any reversed leg effects. Since triple-frequency voltages may be 60 per cent of the fundamental with ordinary flux densities, he contended that Professor Robinson failed to see the higher harmonics due to the low density used. The effect which Professor Robinson attributes to a reversal of transformer leg might be caused, the speaker pointed out, by the fact that the voltage between terminals is fixed, but unbalanced charging current flowing through the transformer might increase the voltage between one terminal and neutral enough to shift the phase relation between the neutral-to-terminal voltages, with a reversed-leg effect.

Mr. Taylor said that it is outside of comprehension how even harmonics can occur without a spark gap, magnetic bias, or a loose connection. He expressed the belief that Professor Robinson's paper was too wholesale a condemnation of the Y-Y connection. Professor Jackson took a more lenient attitude, and Mr. Dudley pointed out that figuring iron losses and segregating them is the most difficult task in design.

Dr. Kennelly pointed out that if flux is put into a circuit at a different rate from that at which it comes out even-frequency harmonics can be produced. Referring to his own paper, he said that the hysteresis loss in iron is not affected considerably by the wave form as long as the same maximum value exists. However, the eddy-current loss is increased with the number of kinks in the wave form. Thus the losses may be considerably greater than the calculated value.

In concluding the discussion in the absence of the author of the paper, Mr. Peek said he could not follow the part about the reversed-leg voltage, that there were not sufficient data to explain why the harmonics were even and that the author had, in his opinion, overestimated the troubles due to the new phenomena noted.

ELECTRICAL CONTRACTORS IN ARMY CONSTRUCTION WORK

General Littell of the Quartermaster's Department
Advises Conference Club Committee of New
Government Policy

BY L. K. COMSTOCK

In the issue of the ELECTRICAL WORLD for Sept. 8, 1917, an article was printed in which was given the electrical construction engineers' point of view in regard to the quartermaster's policy when requiring general contractors to perform electrical work.

There was nothing stated explicitly in the contract used between general contractors and the government requiring the execution of electrical work by general contractors, but the net effect of the rules of procedure promulgated by the Quartermaster's Department for the guidance of constructing quartermasters in the field amounted to a most explicit direction to general contractors to execute all electrical work involved in their contracts.

On Nov. 3, 1917, the Washington committee of the Conference Club addressed to General Littell of the Quartermaster's Department the following letter:

Acting on the advice of Major Marshall, with whom the undersigned committee had an interview on Nov. 1, we desire to bring to your attention and ask your consideration of some reasons why the Quartermaster's Department of the army should alter its policy with respect to the employment of sub-contractors in mechanical lines but more especially in electrical work.

First—Electrical equipment contractors are more familiar with the technique of the business than others, therefore,

Second—They can produce such equipment for less money, in less time and with less lost motion than any one else.

Third—The electrical equipment contractor can regulate and distribute the supply of labor with less disturbance to regular business than any one else.

Fourth—By placing such contracts with electrical contractors the government will avail itself of a highly organized department of business, and

Fifth—The government will cease to lend its influence to the destruction of a business and at the same time will encourage a business to which in normal times it has freely and profitably given its patronage.

We ask for an appointment with you to discuss these arguments and present others.

In reply to the above letter, General Littell wrote as follows:

1. Replying to your letter dated Nov. 3, 1917, asking for an appointment to discuss questions relating to policy with respect to employment of sub-contractors in mechanical lines, especially in electrical work, you are informed that the undersigned will be glad to meet your committee on Thursday afternoon, Nov. 8, at 2.30 p. m.

2. Advise at once whether you are coming.

By authority of the Secretary of War.

On account of the extremely short time between the writing of the above letter and the date of the appointment, only three members of the committee were able to reach Washington, but the appointment fixed by General Littell was kept, and the matter referred to in correspondence above was discussed at great length by members of the Washington committee and General Littell and members of his staff.

On Nov. 9, the next day following our meeting with General Littell and his staff, the chairman of the Washington committee received the following letter:

Referring to your letter of the 3d instant and the conference had with your committee yesterday, I have to thank you and your committee for the privilege of so freely discussing the questions referred to in your letter.

This office fully appreciates the arguments presented by your committee, and you are hereby assured that in future work the sub-contracting of electrical work will be favorably considered.

It is very gratifying to be able to state that the Quartermaster's Department has signified its intention to make use of the electrical contracting industry in future work required by the Quartermaster's Department.

"LIGHTLESS NIGHT" ORDER OF FUEL ADMINISTRATION

Amended Ruling on Sign Restrictions Prescribes
Sunday and Thursday as Nights for White
Ways to Disappear

The United States Fuel Administration in an amended order issued on Dec. 14 put into effect "lightless nights" on Sunday and Thursday of each week. The first "lightless night" was Dec. 16.

Under the new order the "white ways" of all cities are to disappear absolutely on the nights designated. The burning of lights contrary to the wording and spirit of the order will constitute a violation of law, and steps will be taken by the Fuel Administration to mete out punishment to offenders.

The only exceptions apply to lights used for governmental purposes only by the United States government or the government of any commonwealth or state and street lights used by any city or town or within any city or town under a contract with the official thereof for such maintenance. No "white way" or cluster lights may be used under any circumstances. State fuel administrators are directed and authorized to see that the provisions of the order are observed scrupulously.

In addition to the saving of a large quantity of coal, it is believed by the Fuel Administration that "lightless nights" will provide startling visual evidence that the United States is in the greatest of world wars. Letters received by the Fuel Administration from companies and individuals engaged in supplying illuminated signs and from manufacturers, merchants, motion-picture and other entertainment concerns which make large use of such signs give assurance that the new order will become fully effective without resort to prosecution. The original Fuel Administration order on the dimming of electric signs had failed of the coal-saving result expected.

Dr. Garfield in promulgating the new order said: "Use of fuel in this emergency for any of the purposes definitely prohibited in the order is wasteful and is prejudicial and injurious to the national security and defense." The Fuel Administration desired that, in compliance with the patriotic spirit of the order, householders shall observe the "lightless nights" by burning as few lights in homes as it is possible to get along with conveniently.

The order of the Fuel Administrator, which supplements the original order published in the ELECTRICAL WORLD of Nov. 17, 1917, follows:

The order of the United States Fuel Administrator, dated November 9, 1917, entitled "Order of the United States Fuel Administrator regulating the use of coal for the purpose of

generating electricity for use in operating illuminated advertisements, notices, signs, etc.," is hereby amended to read as follows:

It appearing to the United States Fuel Administrator that it is essential to the national security and defense, the successful prosecution of the war and the support and maintenance of the army and navy, and to lessen or prevent the waste of fuel which at the present time is and during the continuation of the war will be, in the judgment of the United States Fuel Administrator, needed for the purposes aforesaid, and to secure an adequate supply and equitable distribution, and to prevent, locally and generally, scarcity of fuel, and to facilitate the movement of fuel for the purposes aforesaid, that the use of fuel in the manner and for the purposes hereafter set forth, and that the employment for such use of the present facilities already inadequate for the prompt and sufficient shipment, transportation and delivery of fuel needed for the purposes aforesaid, should be limited and restricted, in order that the essential purposes first hereinbefore referred to may be carried out, and that so far as possible the production, sale, shipment, distribution and apportionment of fuel among dealers and consumers, domestic and foreign, may be maintained to the extent sufficient to meet the governmental, commercial and domestic requirements for fuel,

The United States Fuel Administrator, acting under authority of an executive order of the President of the United States, dated Aug. 23, 1917, appointing said administrator, and in furtherance of the purpose of said order and of the act of Congress therein referred to and approved Aug. 10, 1917,

Hereby adjudges that in his opinion the use of fuel for any of the purposes hereinafter described except to the extent hereinafter indicated is wasteful, and that any person using any fuel for such purposes except as aforesaid is engaging in a wasteful practice or device in handling or dealing with fuel, and that the use of fuel for such purposes except as aforesaid is prejudicial and injurious to the national security and defense and a cause of scarcity, locally and generally; and,

Hereby orders and directs that until further or other order of the United States Fuel Administrator, and subject to modification hereafter from time to time and at any time,

No corporation, association, partnership or person engaged wholly or in part in the business of furnishing electricity for illumination or power purposes, and no corporation, association, partnership or person maintaining a plant for the purpose of supplying for their own use electricity for illumination or power, shall use any coal, oil, gas or other fuel for the purpose of supplying electricity for illuminating or displaying advertisements, notices, announcements or signs designating the location of an office or place of business, or the nature of any business, for electric searchlights, or for external illumination for ornamentation of any building, or lights in the interior of stores, offices or other places of business when such stores are not open for business, excepting such lights as are necessary for the public safety or as are required by law; nor for excessive street lighting intended for display or advertising purposes, whether such lights are maintained by the municipality or by others.

These prohibitions and all of them are effective on Thursday and Sunday nights only of each and every week, subject to the following exceptions:

(a) This order shall not apply to light used for governmental purposes only by the United States government, the government of any commonwealth or state of the United States;

(b) This order shall not apply to the maintenance of street lights by any city or town or within any city or town under a contract with the officials thereof for such maintenance; except that no municipality may use fuel for the maintenance of lights commonly known as "white way" or cluster lights, or other decorative street lighting, or enter into a contract for the lighting of the same, except to such extent as such lights are necessary for the safety of the public.

(c) This order shall not apply to such porch lights upon houses or hotels or to entrances to buildings occupied or

open for ingress or egress during the night time, or to lights upon private driveways, walks, or in the grounds of any hotel, manufacturing establishment or residence, or upon the platform of railway stations, approaches thereto or in railroad yards or grounds, as are necessary to safety, or to lights for any similar purposes when authorized by any State Fuel Administrator of the State within which such lights are located. Provided, however, that such lights shall be only in such number or size as is necessary to meet the requirements of public safety, and provided that such lights shall be reduced at any time upon direction of the State Fuel Administrator of the State within which such buildings or grounds are located.

The state fuel administrators within the several States are hereby directed and authorized to see that the provisions of this order are observed and carried out within their several states, to report violations thereof to the United States Fuel Administrator, and to recommend to the United States Fuel Administrator action to be taken by him with respect to the sale, shipment, distribution and apportionment of coal to the corporations, associations, partnerships or persons so found to be acting in violation of this order.

FEDERAL LIGHTING ORDER AND HYDROELECTRIC POWER

National Fuel Administrator Suggests to California
Official Co-operation on Patriotic Basis to
Follow Spirit of Ruling

The Federal Fuel Administrator's recent order for two lightless nights weekly was not specific as to energy from hydroelectric sources, so the California State Fuel Administrator wired for further instructions and received the following reply:

"New electric sign ruling does not cover hydroelectric power, but suggest you strongly urge, on patriotic basis, co-operation of power companies and consumers to follow the spirit of the ruling to eliminate all unnecessary lighting on Thursday and Sunday nights."

DAYTON IS TO DISCONTINUE FLAT-RATE SIGN LIGHTING

Conditions Make It Necessary to Put Display Illumination on Separate Meter, in Some Instances
Adding Demands to Compute Rate

The Dayton (Ohio) Power & Light Company, previous to receiving the officially signed order regulating the use of electricity in illuminated advertisements, notices, etc., made a survey to ascertain the feelings of customers regarding such a restriction. While customers showed a readiness to co-operate with the government in any necessary measure, they expressed a recognition of the value of electric signs that will be a good sales argument when the war is over and the sale of electricity for this purpose can be pushed.

In complying with the order of the United States Fuel Administrator in a city the size of Dayton it has been found almost impossible to continue a flat-rate schedule for such lighting with patrolmen. The company has therefore requested permission of the Ohio Public Utilities Commission to withdraw its flat-rate schedule. It is the intention to bill customers for this service at the regular demand lighting rate. In instances where the sign is at the customer's usual place of business it has been proposed that the consumption of the two meters be added together and the two demands computed to arrive at the rate.

VOLUME OF 1917 ORDERS OF GENERAL ELECTRIC COMPANY

Estimated Amount of Orders Received During Current Year Now Stated at \$240,000,000—Stock Dividend Policy

From the official notice to General Electric Company stockholders of the special meeting to be held on Jan. 3, 1918, to authorize an increase in capital stock from \$105,000,000 to \$125,000,000, it appears that the estimated amount of orders for 1917 is now \$240,000,000. The previous estimate, given out in connection with the initial announcement of the new stock issue, was \$230,000,000. The company has now no orders for war munitions.

The notice to stockholders, signed by C. A. Coffin, chairman of the board, contains substantially the same particulars given in the early announcement, published in the *ELECTRICAL WORLD* of Dec. 1, 1917, page 1066. It says in part:

"The directors have preferred to adopt the policy of paying semi-annual stock dividends at the rate of 4 per cent per annum in addition to the regular 8 per cent cash dividends, rather than to increase the cash dividends or distribute a larger stock dividend at this time."

MILITARY SERVICE FOR ENGINEERING STUDENTS

Letter of Committee of Association of American Universities Preceding New Ruling by the Provost Marshal General

After careful consideration a new ruling has been made by the Provost Marshal General on the position of engineering students in military service. The ruling, published in the *ELECTRICAL WORLD* for Dec. 15, 1917, page 1161, places selected students in the enlisted reserve corps of the engineer department of the army.

Before this action was taken a committee representing the Association of American Universities appealed to Secretary of War Baker on the ground that it was to the national interest that specially trained men be reserved for special service. This committee consisted of Armin O. Leuschner, chairman; Ray L. Wilbur and Dr. Arthur E. Kennelly. The letter of the committee said in part:

The Association of American Universities requests that the privilege of enlistment accorded to the medical profession, including students and internes, under orders of the War Department, office of Surgeon General, dated Sept. 4, 1917, be extended as follows:

To the engineering professions—civil, mechanical, electrical, mining and metallurgical engineers and geologists—including junior and senior students and graduates in educational institutions, with the privilege of enlisting in the Engineers' Reserve Corps or in such other branch of the service as you may direct.

To chemists, including junior and senior students and graduates in educational institutions, with the privilege of enlisting in the Chemical Service Section of the National Army, or in the Ordnance Reserve Corps or in the Signal Reserve Corps or in such other branch of the service as you may direct.

To physicists, meteorologists and astronomers, including junior and senior students and graduates in educational institutions, with the privilege of enlisting in the Ordnance Reserve Corps or in the Signal Reserve Corps or in such other branch of the service as you may direct.

To bacteriologists, physiologists, physical chemists, biologists, zoologists, pathologists, anatomists, men trained in public health, hygiene or sanitation, including junior and senior students and graduates in educational institutions, with the privilege of enlisting in the Medical Reserve Corps or in such other branch of service as you may direct.

To agriculturists and botanists, including junior and senior students and graduates in educational institutions, with the privilege of enlisting in an Agricultural Service Section of the National Army or in such other branch of service as you may direct.

The Association of American Universities further requests that pending the elaboration of the details incident to the creation of these privileges the professional men under consideration be placed in Class 3 of the new classification of drafted men, or that agriculturists be classified as food producers.

These requests are prompted by the firm conviction that, if granted, the most efficient service of scientifically trained men will be secured for the conduct of the war, and that some of the unforeseen, unfortunate complications which have resulted from the first draft will be obviated.

During its recent session at Iowa City the Association of American Universities wired to the President a unanimous resolution expressing unswerving loyalty and support in the present crisis. The requests now made by the Association of American Universities are prompted by the same loyalty and devotion.

The committee of the Association of American Universities appointed to formulate and present to the Secretary of War the foregoing requests offers its services in working out the details necessary in creating the privileges asked for, if these privileges are not already provided for by intended interpretation of the new classification of drafted men.

These suggestions are prompted by the following observations:

(a) That there exists a strong popular feeling that the necessity of organizing the National Army with the least possible delay has prevented the application of the principles of selective draft as the public understood them. In general persons engaged in industrial enterprises have been discharged only if engaged in an enterprise contributing directly but not indirectly to the effectiveness of the military establishment. The maintenance of the national interest, other than purely military, does not seem to have been given sufficient weight by the district boards.

(b) That many highly trained professional, scientific men, such as engineers, chemists, physicists, etc., are now privates in the training camps of the National Army. These men could give more efficient service for the conduct of the war if they were assigned or held available for the exercise of such services as they are best fitted for by their training.

(c) That by voluntary enlistment of university men in service for which they are not best fitted the ranks of the educational institutions have already been alarmingly depleted as regards students, teachers and research men. The university men have shown the highest type of patriotism irrespective of their own interests and have probably responded to the call of the country more enthusiastically than any other class of men. There is immediate danger that without specific provision to the contrary the universities will lack the teachers and students necessary to provide the army and navy with the highly trained men who will be required for the successful conclusion of the war.

It is respectfully urged that professional students be instructed to enlist in the reserve corps of the various branches of the service, with the privilege of furlough for the completion of their training similar to that adopted to secure the most efficient service of medical men.

It is also suggested that only men of proved ability be given this opportunity. Students, teachers and research men should be given the opportunity of enlistment with the privilege of furlough or discharge only subject to the recommendations of the presidents of the institutions concerned. For others the decision should rest with the authorities designated by the Secretary of War.

A telegram on the same subject sent by John W. Lieb, president National Electric Light Association, to Dr.

George F. Swain, Massachusetts Institute of Technology, reads:

It is most urgent that the selective draft provisions should be so construed by the government that engineering and medical students at colleges and professional schools be allowed to finish their courses before being called for active military service. There is already a serious lack of technical men to do urgent government work and the public utilities of the country find it difficult to further deplete their already inadequate engineering staffs to meet the pressing needs of the various government departments for technically trained men.

The men from the public utilities have responded enthusiastically to the call of the nation, and these industries now find it impossible to fill their places and maintain a sufficient force to conduct their enterprises so as to respond to the rapidly increasing demands for heat, light and power to operate industries indispensable in the conduct of the war.

THE ACTIVITIES OF WAR INDUSTRIES DEPARTMENTS

Editors of Business Papers Hear Washington
Leaders on Different Phases of the Govern-
ment's War Program

The seriousness of the present government situation and the necessity for co-ordinated action at Washington were clearly indicated at the second editorial conference of business papers held at the New Willard Hotel in Washington on Dec. 13. This meeting was called in order that the business papers of the country might get first-hand from the makers of news details of the government war activities and such plans as were ready to be announced. In this way it is hoped that the business papers, through a sympathetic interest in the war activities of all of the different departments at Washington, may co-operate better with the government in the waging of a successful conflict.

In opening the meeting, F. W. Taussig, chairman of the United States Tariff Board, was careful to explain the exact status of the board and the scope of its operations. This board, he pointed out, was organized for the purpose of sifting and preparing information upon which Congress shall act. The board itself does not act on the various questions.

Of particular interest to the electrical industry was the address by Dr. Harry A. Garfield, Fuel Administrator.

Speaking of coal supply for utilities, Dr. Garfield said that the utilities should notify the state fuel administrator of their needs. The state administrator will then take the matter up with the federal administrator, who will send priority orders to certain mines to take care of that utility's supply. The utilities, however, should not wait until the last moment, but should put in their requisition far enough ahead to allow ample time for fulfillment. Dr. Garfield said that he was disappointed in the results of fuel saving from the curtailment of sign lighting. He thinks that less was saved than was anticipated and for that reason will change the order. (See ELECTRICAL WORLD, Dec. 15, page 1159.) The difficulty, he stated, was in cutting out the large display signs and therefore the general effect of curtailment was not very great; in fact, only certain kinds were missed. He stated quite emphatically that he did not intend to give up the idea of saving fuel through "white-way" lighting curtailment. He stated that undoubt-

edly prices have played a part in keeping production from being greater, but he stated that he was unable to prove this, for in fact proof lay in the other direction.

J. B. A. Morrow, secretary of the National Coal Association, told of the extent to which transportation was handicapping the country in the matter of fuel supply. Transportation, he said, was the primary cause of trouble. Furthermore, he pointed out, no effective action has been taken to relieve the situation up to date, and matters are hourly growing worse. There are now at the disposal of the operators about 350,000 cars, and for a short time, he believed, there should be 20 per cent additional.

In pointing out the condition that railroads now find themselves in, Senator Francis G. Newlands, chairman of the joint Congressional committee on interstate commerce, emphatically stated that the roads should have constructive legislation and not so much punitive and correctional legislation as in the past. Pre-war economies in rolling stock, etc., he believed, have resulted in the high cost of living and the high cost of the war, although, of course, they are not the whole cause, but the underlying one. The difficulty of the day is in meeting capital requirements. The relief from this must not come necessarily from rates. Senator Newlands stated that the government may either loan or purchase railroad equipment, and in the latter case lease it to the road.

The present status of the automobile truck industry was shown by Mr. Horning, chairman of the automotive section of the Council of National Defense. He was of the opinion that by cutting out short hauls and substituting therefor motor truck transportation the transportation problem would be solved.

A. W. Shaw, chairman of the commercial economy committee of the Council of National Defense, left with the meeting the thought that by standardizing output, less stock will have to be carried, thereby conserving both capital and raw materials.

Dr. Anna Howard Shaw, chairman of the women's committee of the Council of National Defense, pointed out very clearly the physiological and psychological status of women in the war.

C. A. Richards, chief of the Bureau of Exports, stated that no general embargoes are being issued.

ADVERTISING MATERIAL FOR THE ELECTRICAL CHRISTMAS

Society of Electrical Development Reports Success of
Its Campaign for the Giving of Practical
Gifts in the War Year

Returns indicate the success of the nation-wide "America's Electrical Christmas" campaign conducted under the general direction of the Society for Electrical Development, according to a report from the society.

Material supplied included 13,000 campaign announcements, 13,000 copies "November Sales Service," containing holiday sales suggestions; 5332 window posters, 5077 window cards, 2500 sets of price cards, sixteen to a set, or a total of 40,000 cards; 2082 door wreaths, 228,000 poster stamps, 200,000 suggestion folders and 36,000 circular letters. The campaign also resulted in many new members. Over thirty have joined the society within the last five weeks.

CALIFORNIA COMMITTEE ON INDUCTIVE INTERFERENCE

Final Report Is Issued After Five-Year Investigation Under Auspices of California Railroad Commission

With the presentation of its final report, dated Sept. 28, 1917, the joint committee on inductive interference, which has been investigating for the past five years, under the auspices of the California Railroad Commission, the disturbances in communication circuits caused by induction from neighboring power circuits, announces the conclusion of its work.

A preliminary report was rendered by the committee in 1914. Besides a discussion of technical features of the problem, rules were recommended to the California commission to regulate the practices of companies operating power and communication lines in proximity to each other. These recommendations were embodied in General Order No. 39 of the commission, which has been in force since August, 1914.

The final report, just issued and based on more extensive investigations conducted since 1914, includes:

1. A historical sketch regarding the formation, personnel, organization, investigations and finances of the committee.

2. A review of the basic principles, comprising a simple statement of the nature of the subject, a summary of the facts established or agreed upon and a concise statement of the guiding principles for the prevention of interference.

3. Recommendations for revised rules to govern the design, construction and operation of power and communication lines and associated apparatus, to prevent or mitigate inductive interference, followed by explanatory comments.

The new rules mark a considerable advance both in substance and form as compared with the 1914 rules. The principle of co-operation in determining means for avoidance or mitigation of interference is emphasized, in conjunction with definite guiding rules where such are practicable. Certain precautionary measures are made applicable to all new construction. The principle of employing the remedial measure involving least total cost for a given benefit, irrespective of whose plant is changed, is declared. The arrangement of the rules has been entirely changed. A detailed summary of the recommended rules is given below.

An exhibit accompanying the rules discusses the arrangement and spacing of power conductors.

4. Five appendices complete the report, dealing with:

1. Interference not covered by the recommended rules, which apply to constant-potential alternating-current power circuits of over 5000 volts between wires, or 2900 volts to ground, and exclude telephone subscribers' loops.

2. List of technical reports prepared by the committee as a record of its investigations.

3. Comments on the 1914 report.

4. A bibliography.

5. A chart showing the organization of the committee.

The detailed record of the investigations of the committee is contained in a series of seventy-one technical reports. Thirty of the reports have been selected as being of sufficient general interest to warrant publication along with the two reports of the committee to the California Railroad Commission. The reports include not only records of tests and their analyses but

give the methods of working, theoretical discussions, forms for systematizing experimental and theoretical work and data of general usefulness in predetermining the magnitude of induction to be expected under given conditions and in prescribing remedial measures. All these reports are on file at the offices of the Railroad Commission in California, but unless they are published the valuable information they contain will not be generally accessible. Their publication, however, is contingent upon the receipt of a sufficient number of orders substantially to defray the cost of printing and binding. All persons who are interested in procuring a copy of this publication are requested to notify Richard Sachse, chief engineer, Railroad Commission of California, 833 Market Street, San Francisco.

Conditions of proximity of power and communication lines that cause inductive interference are designated by the joint committee as "parallels."

In preparing the final report a large amount of study was given to the question of determining the conditions of length, separation, voltage, current, wave shape, balance, conductor arrangement, etc., that would constitute a "parallel." In order to set forth the relations in reasonably simple form, it was necessary to assign definite values to several factors which in practice vary widely in value and which it is usually not feasible to determine in particular cases. It was found that sufficient information was not at hand to satisfy all parties as to the assumptions regarding these factors. The committee feared that a definition of these relations, based on such assumptions, would be used in cases where the assumptions did not apply. Consequently the report does not include such a definition. The record of work done on this complex problem remains, however, of great value as indicating the general method of attacking the problem, the difficulties to be overcome, and the accomplishment of results up to date.

The report gives the following as the seven "basic physical principles which underlie the rules recommended and which should guide all efforts to prevent inductive interference":

1. Avoidance of close proximity.
2. Elimination or suppression of harmonics.
3. Limitation of residuals.
4. Reduction of intensity of induction by favorable arrangement of conductors.
5. Neutralization of induction by co-ordinated transposition systems.
6. Balancing of metallic communication circuits.
7. High grade construction and care in the operation and maintenance of power circuits.

A brief summary of the recommended rules follows:

The first section, entitled "General Provisions," provides for: (a) Applicability of the rules. Rules on operation and maintenance are to apply throughout; rules for specific parallels, to cases hereafter created; rules not limited to lines involved in a parallel, to new construction, and in the event of reconstruction. (b) Co-operation. (c) Method of remedy involving the least total cost. (d) Existing parallels are to be cared for with due diligence, depending on the seriousness of their effects.

The second section consists wholly of definitions.

The third section, entitled "Location of Lines," requires: (a) Avoidance of parallelism wherever practicable. (b) Advance notice of intention to construct a line which will create a parallel. (c) The distance between parallel lines to be made as great and as uniform as practicable. Where other remedies fail the separation is to be increased. (d)

and (e) Parallels shall be as short and as free from discontinuities as practicable. Unnecessary crossings of high-ways are to be avoided.

The fourth section, entitled "Design and Construction of Lines," requires: (a) Attention to quality and workmanship to prevent failures causing interference. (b) Consideration of the configuration of power circuits, also the avoidance of excessive spacing, long two-wire branches from three-phase lines and single-wire grounded circuits. (c) Power circuits to be transposed throughout their lengths with barrels of 6 miles to 12 miles, excepting lines under 12.5 kv. with grounded neutrals and certain lines on private rights-of-way; existing power circuits are to be transposed outside parallels hereafter created when necessary for capacitance balance, with regard to discontinuities. (d) Inside parallels. An adequate transposition scheme, consisting of co-ordinated transpositions in the power and communication lines, if the latter are metallic, to be installed, as determined by co-operative study. In general, at least one barrel shall be placed in the power circuit. At highway separations from telephone lines 3-mile barrels should ordinarily be employed. For parallels with telegraph lines 6-mile barrels are ordinarily sufficient. The most economical scheme and utilization of existing transpositions are to be considered.

The fifth section, entitled "Design, Construction and Arrangement of Apparatus," provides: (a) Quality and arrangement of apparatus to minimize interference. (b) Rotating machinery should have good wave form. Grounds on generators are to be avoided unless the arrangements are such as to avoid unbalancing the circuit and introducing residuals. (c) Transformer exciting currents should be as low as is consistent with good practice (for most cases less than 10 per cent at normal voltage). Grounded single-phase, grounded three-wire two-phase and grounded open-star three-phase connections are prohibited. Star-connected auto-transformers with grounded neutrals on three-phase lines in parallels must also have low-impedance, delta-connected windings or other equivalent means of suppressing triple harmonic residuals. (d) Auxiliary devices to prevent distortion of the waves by rectifiers, etc., are to be installed where necessary. (e) One oil switch with poles mechanically interconnected for simultaneous operation is required between a parallel and the source of supply of the power line to operate automatically in case of abnormal conditions, except where an operator is on duty. Consideration is to be given to switching arrangements to minimize transients. Where air-break or single-pole oil switches cause trouble oil switches with poles interconnected are to be used. (f) Fuses are to be avoided for main lines in parallels. (g) Electrolytic lightning arresters are to be equipped to minimize their disturbing effects. (h) Indicating devices are to be provided at supply stations to give warning of abnormal conditions, and ammeters are to be installed in important neutral-ground connections. (i) Apparatus for metallic communication circuits is to be well balanced.

The sixth and last section, entitled "Operation and Maintenance," requires: (a) All reasonable care by power and communication interests to minimize interference and, in particular, (b) prevention of mechanical and electrical failures which would cause or promote transient disturbances and unbalanced loads. (c) Daily record of current in grounded neutrals of important stations. (d) Transformers are not to be operated at more than specified percentages above normal voltage. (e) Care shall be exercised to avoid switching disturbances. (f) Where lightning-arrester charging disturbs it should be done in the early morning. (g) A definite procedure shall be provided for station operators during times of abnormal unbalance on power lines involved in parallels. In general, the section of a faulty line passing a parallel should be disconnected until cleared and not energized more than once in locating the fault. To facilitate the study of such cases, accurate records are to be kept of occurrences under abnormal conditions.

The entire work of the joint committee on inductive interference constitutes a notable example of the efficiency of co-operative work of engineers representing

conflicting interests in lieu of methods of litigation based upon meager information concerning the underlying principles and facts of a complex problem. As perhaps the chief result of this effort on the part of the joint committee, there has been created in the State of California a realization of the seriousness of inductive interference, an understanding of practical preventive and remedial measures, and, most important of all, a disposition on the part of the power and communication companies to co-operate in the solution of the problems which arise from the construction of the two classes of lines in proximity.

That the work of the joint committee is fully appreciated by the California Railroad Commission is evident from a letter written by the commission to the members of the committee, in which it says:

"In receiving this final report and in accepting the resignations of the members of the joint committee, we desire to express to each member of the committee our very sincere appreciation of the splendid work which the joint committee has done during the last five years. The work in its complete form is a monument to this committee of which each member must be justly proud."

CHANGES SUGGESTED AT POWER TEST CODE HEARING

Recommendation for Appointment of Sub-committees to Revise Each Section in Co-operation with Those Who Would Be Most Affected by Change

Numerous suggestions and recommendations were made at the public hearing held recently by the power test code committee of the American Society of Mechanical Engineers in New York. Taken as a whole these would mean the complete rewriting or revision of the existing power test code.

As a result, a motion was passed recommending to the council that sub-committees be appointed to revise each section of the code, reporting to the present power test code committee, which will then co-ordinate the work of the individual sub-committees. It was also recommended that the members of the sub-committees be representative of purchasers, manufacturers and impartial persons, and that they co-operate with the national societies or associations most vitally interested in the section of the code represented. It is intended that the new power test code shall cover all mechanical power-plant apparatus.

The section of the code which seemed to be most objectionable refers to waterwheel testing. To give the sub-committees some basis to work on in revising the waterwheel section of the code it was recommended by a unanimous vote that the Machinery Builders' Society code be considered, as it represents the best waterwheel acceptance test available at present. This subject was also discussed in New York at a closed session by a joint committee representing the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the American Society of Civil Engineers, it being the purpose so to reword and revise this section that manufacturers of waterwheels would have a definite basis on which to work and that waterwheel users would have proper protection assured by standard acceptance tests.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Ordinance Too Imperfect to Be Investigated.—The Ohio Public Utilities Commission announced on Dec. 13 that the investigation of the electric light rate case originating in Ottawa and appealed by the Northwestern Ohio Light Company had been discontinued because the ordinance attempting to fix the rates contained "so many infirmities" that it was not justified in spending the State's money or putting the company and the town to the expense of employing experts when the ordinance could be set aside.

New Rates Authorized for Calistoga, Cal.—The Calistoga Electric Company has been authorized by the Railroad Commission of California to establish a new schedule of rates for electric service, with a monthly meter consumption basis of 10 cents per kilowatt-hour for the first 100 kw.-hr., 5 cents per kilowatt-hour for all over 100 kw.-hr., and a minimum monthly charge of \$1 per meter. Power rates and municipal lighting rates are also fixed by the commission. These new rates are expected to bring the company an increase of little more than 10 per cent in gross revenue and to result in a net return on the company's total investment of approximately 4½ per cent. The company distributes electric energy for light and power purposes in Calistoga and surrounding suburban territory in Napa County, serving 317 consumers. Its energy is purchased from the Napa Valley Electric Company at Bale Station.

"Reasonable" Service.—In a case affecting the Mineral Point Public Service Company the Wisconsin Railroad Commission holds on "reasonable service": "That the term 'reasonable service' as used in the statute not only refers to a sufficient supply of power at the present moment, but also to the reasonable assurance of such supply in the future, and that the service afforded by respondent is inadequate, in that insufficient provision is made for a continuous supply of current under emergency conditions; that the necessity for continuous operation of the mines served by respondent is of great importance; that an extended interruption of power service in the case of a mine results in various serious losses, but that in the case of those here involved the welfare of the community, and perhaps the public in a much larger sense, also depends upon the successful and efficient operation of the mining industry; that the determination of what provision should be made to assure continuous service under emergency conditions is properly a function of the utility, however, with which the com-

mission does not wish to interfere, but will pass upon with reference to its adequacy for compliance with the order when decided on."

Time Allowed for Reconstruction Because of Higher Costs.—Because of higher costs, the California Railroad Commission has extended the time within which certain utilities may reconstruct systems to comply with laws regulating standardization of electric pole lines, as follows: Southern Sierras Power Company to complete one-third of its reconstruction work before Dec. 31, 1917, two-thirds before Dec. 31, 1918, and the entire work before June 30, 1919; Bishop Light & Power Company to complete one-half of its reconstruction work before Dec. 31, 1917, and the entire work before June 30, 1918; Corona Gas & Electric Company to complete its entire work before Dec. 31, 1917; Rialto Light, Water & Power Company to complete its entire reconstruction work before Dec. 31, 1917; Holton Power Company to complete at least one-half of its reconstruction work before Dec. 31, 1917, and its entire work before Dec. 31, 1918.

National Crisis Calls for Ultra-Conservatism.—A decision of the Oklahoma Corporation Commission holds that the St. Louis & San Francisco Railroad Company and Kansas City, Mexico & Orient Railway are not required to make a physical connection at a certain point because war-time conditions supersede in importance all other conditions. The commission says: "The foregoing considerations appear to the commission to be conclusive as to the merit of the application herein. However, there are certain special considerations operating at this time which emphasize the necessity for and correctness of the decision indicated. Crop conditions in Oklahoma, especially in the section through which the defendant Kansas City, Mexico & Orient Railway Company's line operates, are exceedingly discouraging, and railroad earnings in this section of the State this year, compared with normal years, indicate that the roads should forgo all except the most imperative expenditures. Railroad material, like that used in any sort of construction, is higher in cost than for years, in many instances higher than ever, and sound judgment decrees that projects involving expenditure for such material should be deferred where possible. Furthermore, the national crisis, calling for ultra-conservatism in all directions, demands universal co-operation to the end that the resources of the country, both physical and financial, shall be applied as exclusively as possible to projects contributing directly to the effective prosecution of the war in which the country is involved. The commission, being fully advised in the premises and having given full and careful consideration to all the facts submitted on both sides of the case, finds that the evidence in support of the application is insufficient to sustain the case, and the case is dismissed. Should business conditions change a new case at such time may be heard."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Water Rights of Subsequent Grantee.—Where plaintiff city had secured all the title of the owner of the fee to the water of the stream which was to be used for domestic and other purposes, the impounding of water for use in developing electricity by defendant, which had secured the remaining right from the grantor, was an interference with a substantial right justifying an injunction, although the water impounded by defendant was emptied back into the stream above the city's intake pipe, the use tending to pollute the water, and being an open and adverse use which would ripen into title if acquiesced in, the Supreme Court of Washington held (167, P. 914) in *City of Raymond versus Willapa Power Company*. The court stated that it knew judicially that modern science has demonstrated that the use of water in power plants and for other purposes where human beings must of necessity be in attendance seriously endangers its purity, rendering it unfit for human consumption.

Responsibility to Employees in Municipal Plant.—Deceased was employed by defendant as first engineer of its electric light plant, which position virtually carried with it control and management of its plant. While so employed it was his duty to work at and near two tube tanks and the arc-light switchboard. These tube tanks were about 18 in. square, placed side by side. The arc-light switchboard was about 15 in. to the nearest tank and had projecting 8 in. or 10 in. from the west side of it two electrodes, carrying constantly 2300 volts of electricity, which furnished the energy for defendant's arc lights. A wire, uninsulated, and the metal clips on top of these electrodes, which were unguarded, ran underneath these electrodes. On the west side of the building was a washbasin. It was deceased's duty to remove the tubes from these tube tanks daily and carry them to the washbasin and wash them, after which, he replaced them in the tanks. It was while he was performing this duty that he came in contact with the electrodes and received a shock of 2300 volts of electricity, which a few days thereafter resulted in his death. The Supreme Court of Oklahoma in *City of Durant versus Allen* held (168 P. 205) that defendant in operating its electric plant assumed the same responsibilities to its employees therein as are assumed by private persons and private corporations operating similar plants; that, owing to the highly destructive agency in the manufacture of which defendant was engaged, it was held to a correspondingly high degree of care and foresight.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

United States Independent Telephone Association.—At a meeting of the board of directors of the United States Independent Telephone Association held at the Hotel LaSalle, Chicago, Nov. 17, it was unanimously decided to hold the annual convention at the Hotel LaSalle on June 25 to June 28, 1918.

Pittsburgh Section, I. S. E. E.—The January meeting of the Pittsburgh Section of the Association of Iron and Steel Electrical Engineers will be a joint session with the American Institute of Electrical Engineers. Papers will be presented on generation, distribution and consumption of power, as well as one dealing with power-factor correction.

Association of Iron and Steel Electrical Engineers.—The regular monthly meeting of this association was held at the Hotel Chatham (old Hotel Lincoln), Penn Avenue, Pittsburgh, Pa., on Dec. 15. A brand-new subject, "Flywheels on Steel-Mill Motors," which is of current interest to every steel-mill electrical engineer, was presented by G. E. Stoltz of the Westinghouse Electric & Manufacturing Company.

Illuminating Engineering Society.—The Pittsburgh Section of the Illuminating Engineering Society held an all-day meeting at the Electrical League rooms in the Statler Hotel, Cleveland, Dec. 14. The program follows: Remarks by G. H. Stickney, president I. E. S.; "The Illumination of Offices," by Ward Harrison and J. R. Colville; "The Foot-Candle Meter," by C. F. Sackwitz; informal discussion of the new industrial lighting code for Ohio; "Preferred Proportions in Combining General and Localized Lighting," by F. C. Caldwell and W. M. Holmes; notes on the use of the searchlight by R. B. Chillas; some aspects of light, shade and color of timely interest by M. Luckiesh of the National Lamp Works of the General Electric Company.

San Francisco Electrical Development and Jovian League.—At the Dec. 5 meeting of this organization R. H. Ballard, Southern California Edison Company, spoke of the new movement now manifesting itself in various branches of the electrical industry on the Pacific Coast toward "The Greater Organization." This is simply another name, he said, for more effective co-operation of manufacturers, central stations, jobbers and dealers and contractors. Capt. H. F. Jackson, Sierra & San Francisco Power Company, outlined the co-operative campaign now being carried to success, in which the various branches of the industry have combined for a year's educational work aimed

toward better business. Other speakers whose talks were along similar lines were Emory Wishon, San Joaquin Light & Power Company; H. C. Reid, president California Association Electrical Contractors and Dealers; K. E. Van Kuran, Los Angeles district manager Westinghouse Electric & Manufacturing Company; Harry Bostwick, Pacific Gas & Electric Company; W. W. Briggs, Great Western Power Company; Dave Harris, Pacific States Electric Company, and J. E. Woodbridge, Sierra & San Francisco Power Company.

Chicago Section, A. I. E. E., Meetings.—Some changes in the program of the Chicago Section of the American Institute of Electrical Engineers for its winter meetings have been made since the tentative program was published. The program in its final form is as follows: Major Robert A. Millikan, vice-chairman and executive officer Research Council, on "The Relation of Science and Engineering to the War," Dec. 27 (luncheon meeting at Hotel Sherman jointly with Electric Club-Jovian League); three hundred and thirty-sixth meeting of the A. I. E. E., held as a part of the activities of the committee on economics of electric service, the speakers, Lynn S. Goodman and William B. Jackson, dealing with "The Effects of War Conditions on the Cost and Quality of Electric Service," Jan. 14, 1918; Thaddeus Bailly and John A. Seede on "Resistance-Type Furnaces" and "Arc Furnaces and Their Application," on Feb. 25; Charles F. Burgess, "Electrochemical Processes," March 25; mechanical section meeting April 22, subject to be announced later, and Frank A. Vaughn, "Regulation of Street Series Lamps," May 27.

Army Day at Chicago Electric Club-Jovian League.—Army mess served in army kits with the meal superintended by a former club member—Sergeant William L. Geuder from Camp Grant—was the feature of the program of the Electric Club-Jovian League meeting, Dec. 13. Joseph Byfield, proprietor of the Hotel Sherman and one of the speakers, told how he had assisted in training 2800 civilian cooks for the army. A service flag which Mrs. L. C. Spake made for the club was presented by Frederic P. Vose. After an appeal for contributions to the Knights of Columbus recreation camp fund F. W. Harvey took a collection amounting to \$135. This was followed by another collection made in army coffeepots and amounting to \$159.65 to purchase recreation equipment for Battery D, 332d Field Artillery, of which Sergeant Geuder is a member. On account of the fact that Dec. 13 was election day for the club and because of the unusual program, the meeting was one of the largest in the club's history, more than 325 being present. The election resulted in a complete victory for the regular ticket by very narrow majorities. The new officers are: President, Fred M. Rosseland; first vice-president, E. A. Rummler; second vice-president, Harry A. Porter; secretary, W. H. Hodge; trustees, Paul W. Koch and Arthur P. Nelson.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Date for Hearing Cleveland Rate Case.—The Ohio Public Utilities Commission has fixed Jan. 3, 1918, for hearing the Cleveland rate case. Some time ago the valuation was announced and a rehearing was refused on this phase of the case.

Women in Lamp Sales Department.—The shortage of male help in Kansas City's electrical industries, both light and power and street railway, became acute with the first of December, when the enlistment of many young men in the ordnance division of the army took place. As a result the Kansas City Light & Power Company placed girls in its lamp sales department. The company selected a standard uniform of light brown slip-over apron with white collar for these saleswomen. The service has been kept up to standard with the use of one more saleswoman than there had been salesmen. Girl stenographers and bookkeepers have supplanted the younger men.

Electrical Show at Lafayette College.—The Lafayette College branch of the American Institute of Electrical Engineers, in conjunction with the electrical department of the college, held an electrical show on Dec. 13, 14 and 15 in the college buildings at Easton, Pa. During the show illustrated lectures were given on the progress of electricity, the wiring of homes, and household appliances. Moving pictures were also shown, lectures and films being loaned by the General Electric Company. The chief feature was a series of experiments with a Tesla coil which were conducted by members of the senior class. A lamp was lighted through the body, corona effects were shown, and several insulators were punctured. Of special interest to women was the complete exhibition of household electrical appliances. For the engineer there was the industrial exhibit, which contained single-phase, two-phase, three-phase, alternating-current and series, shunt and compound direct-current power motors, starters, transformers and many other commercial appliances. William L. Lipps, a member of the senior class in electrical engineering at Lafayette and also the local secretary of the Lafayette College branch of the A. I. E. E., had charge of the show. He was helped by Dr. Rood, who is in charge of the electrical department at Lafayette. In the actual laying out of the exhibits he was greatly assisted by Professor Tanzer of the electrical department and Mr. Hartung of the senior class. Others who helped were Messrs. Britton, Riegel, Williams and Hagey of the senior class and Messrs. Ross and Cook of the junior class.

P. H. Chase, who was assistant engineer with the Public Service Electric Company, Newark, N. J., has become electrical engineer of the American Railways Company, with headquarters at Philadelphia, Pa.

Gerard Swope, vice-president and general sales manager of the Western Electric Company, has just returned from an extended tour of the East, where he has been studying markets and general conditions.

L. R. Coffin, manager of the Whatcom County division of the Puget Sound Traction, Light & Power Company, Bellingham, Wash., has been ordered to report for duty at the American International Shipbuilding Company's office, Philadelphia. Mr. Coffin has been manager at Bellingham since 1910.

H. W. Asire has been appointed research assistant for the engineering experiment station of Purdue University. Mr. Asire is a graduate of Purdue University, class of 1914, School of Electrical Engineering. Since graduation he has been engaged in research development work for the Quick Action Ignition, South Bend, Ind. For the present he will devote his time to investigation and research along special lines being developed by the schools of electrical and mechanical engineering.

J. C. Martin has resigned as chief engineer of the Pacific Power & Light Company to become connected with the Lehigh Securities Corporation at Allentown, Pa. Mr. Martin joined the Pacific Power & Light Company in the early days of the organization. He is widely known on the Pacific Coast for his association work. For two years he was chairman of the technical and hydroelectric committee of the Northwest Electric Light & Power Association. His work in committees of this association along the lines of proper rules for overhead-line construction and telephone inductive interference was also particularly noticeable.

Charles H. Parker has been appointed superintendent of the generating department of the Edison Electric Illuminating Company of Boston, succeeding the late William P. Hancock. Mr. Parker entered the employ of the company late in 1895 in the generating department in charge of steam testing. In the summer of 1900 he was appointed assistant superintendent of the generating department, continuing in that work until his present promotion. He holds membership in a number of engineering and technical societies and has had a wide experience in the Massachusetts Naval Battalion. He retired from the battalion in 1904 as a lieutenant-commander. In 1908 he was appointed engineer member of the Naval Bureau at the Massachusetts State House with rank of commander, retiring four years later with the rank of captain. Since the United States' participation in the war Mr. Parker has served on the Massachusetts Public Safety Committee as a member of the naval committee and has been appointed acting chief of the department of naval militia.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

Frank L. Dame has been elected president of the Central States Electric Corporation. Prior to becoming connected with the Harrison Williams organization, which manages and directs the Central States company, Mr. Dame was vice-president of the Electric Bond & Share Company, in charge of its operating department. He is a graduate of the Massachusetts Institute of Technology. His early connections in the industry were with the General Electric Company in the Pacific Northwest. Later he became gen-



F. L. DAME

eral manager of the Union Electric Company of Dubuque, Iowa, after which he was appointed engineer for the Electrical Securities Corporation shortly after its formation in 1904. He continued in that position until his election as a vice-president of the Electric Bond & Share Company in the fall of 1909.

Leonard S. Cairns, assistant general manager of the Manila Electric Railroad & Light Company, Manila, P. I., has been appointed general manager of the Eastern Pennsylvania Railways Company, Pottsville, Pa., by the J. G. White Management Corporation, New York City, the operating manager of both companies. Mr. Cairns has arrived in the United States and has assumed the duties of his new position. He succeeds L. H. Palmer, who lately became assistant to the president of the United Railways & Electric Company, Baltimore, as lately announced in these columns. Mr. Cairns upon leaving high school entered the employ of the Twin City Rapid Transit Company, Minneapolis, and, after several promotions, was made general super-

intendent of that company. In 1912 he was appointed assistant general manager of the Manila company.

Obituary

James McElroy, connected for the last few years with the municipal power plant at Orange, N. J., in the capacity of engineer, died Dec. 8 at his home in that city.

William F. Sonn, who since the early days of the lighting industry has been in the employ of the Edison Electric Illuminating Company of Boston and its predecessors, died at his home in Boston on Dec. 4 at the age of fifty-six years. In 1883 and 1884 he was assistant to William J. Hammer, the chief engineer of the German Edison company at Berlin, later assisting Mr. Hammer, in 1886 and 1887, when he was manager and chief engineer of the lighting company at Boston. In 1889 he accompanied Mr. Hammer to Paris, where the latter represented Mr. Edison at the Paris Exposition. Mr. Sonn assisted in the installation of the first electric lighting plant not only in Berlin but also in Wilmington, Del.; Chicago, Ill., and Grand Rapids, Mich.

William Du Bois Duddell, originator of the Duddell oscillograph and well known for his contributions to electrical engineering research both in alternating-current phenomena and radio-telegraphy, died recently in England at the age of forty-five years. In 1898 he brought his oscillograph to the attention of the engineering profession in a paper prepared in conjunction with Dr. Marchant, entitled "Experiments in Alternating-Current Arcs by Aid of Oscillographs." In his research Mr. Duddell showed his mechanical ingenuity by designing and constructing special new and delicate instruments entirely of his own handiwork. Among other papers presented by him which have caused worldwide comment are "Rapid Variations of Currents Through the Direct-Current Arc" and "The Resistance and Emfs. of the Electric Arc." In radio work his activity dated from the early days of the science. He determined the law, since confirmed and extended by Dr. Austin, connecting distance and the strength of received signals. He was appointed in 1912 by the English government a member of the technical committee for the consideration of long-distance wireless telegraphy and subsequently was appointed consulting engineer to the English Post Office in connection with the imperial wireless contract. In April, 1915, he presided in Brussels over the international commission to aid radio research. Mr. Duddell, who was one of the younger men in the industry, had the distinction of being the first to hold the position of president of the British Institution of Electrical Engineers. This was in 1912-14. He occupied many other positions of honor in connection with his activities in the field of electricity. In addition, Mr. Duddell was a fellow of the Royal Society of England.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

MEANING OF TRANSPORTATION

PRIORITY ORDER NO. 5

No "House That Jack Built" Materials of Manufacture Are Permitted Under Latest Government Order

Some confusion has arisen in the trades over the exact meaning and application of Priority Order No. 5, issued by Judge R. S. Lovett's committee. This order provides for five different classes of transportation priority and went into effect on Dec. 12. The order gives preference in car supply and movement, (1) to coal for current use of railroads, (2) to food and perishable freight, (3) to military supplies and government shipbuilding material, (4) to coal for by-product coking plants, and (5) to coal for domestic and institutional purposes and to coal and raw materials for blast furnaces, foundries, iron and steel mills, smelters, manufacturers engaged in work for the government or its allies, public utilities, flour mills, sugar factories, fertilizer plants and shipbuilders, besides shipments of paper, petroleum and petroleum products.

These priorities are now automatic, and any manufacturer by satisfying the local railroad agent that his products come under one of the five heads can secure, if at all available, quick and adequate transportation of his goods. The railroads can issue no embargoes on any of the items enumerated in Order No. 5 unless the matter is first taken up with the priorities commission and approved.

To a representative of the ELECTRICAL WORLD it was stated last week in Washington that the committee on priorities believed it to be particularly important that manufacturers understand clearly the intended meaning of Section 5 of the order. The order says for "raw materials for current use but not for storage consigned direct . . . to manufacturers engaged in work for the United States government or its allies, public utilities," etc. By "raw materials" is meant any thing necessary to the manufacture of the finished product.

It was definitely stated that the order was not meant to include those products which enter into the manufacture of what the order calls "raw materials." Thus a manufacturer of gasoline-driven generator sets for field searchlights could expect priority shipments of electrical generators. On the other hand, the generator manufacturer could not, on the basis of this contract, under Priority Order No. 5, expect priority transportation of his raw materials. What the committee has tried to accomplish in this connection is to eliminate the "house that Jack built" class of priorities.

Shipments under the five classes listed take up, it is understood, about 50 per cent of available transportation. The remaining facilities are at the disposal of all other commodities in accordance with the roads' designations.

LIST OF BRANCH OFFICES

OF THE WAR TRADE BOARD

Established in Nine of the Principal Cities in Various Parts of the Country—Officials Who Are in Charge

Following is a list of the branch offices of the War Trade Board, which has jurisdiction over licensing of goods for export and also in the administration of the enemy trading act: Galveston, Tex., George W. Briggs, special agent, bureau of exports, Federal Building; Los Angeles, Cal., William Dunkerley, special agent, bureau of exports, custom house; Mobile, Ala., M. Waring Harrison, special agent,

bureau of exports, custom house; New Orleans, La., Joseph P. Henican, special agent, bureau of exports, Canal Bank Building; New York, N. Y., W. E. Peck, special agent, bureau of exports, 11 Broadway; Portland, Ore., Henry L. Corbett, special agent, bureau of exports, 748 Morgan Building; San Francisco, Cal., C. O. G. Miller, special agent, bureau of exports, custom house; Savannah, Ga., J. W. Motte, special agent, bureau of exports, Savannah Bank and Trust Company Building; Seattle, Wash., J. MacPhee, Ferguson, special agent, bureau of exports, care of Bureau of Foreign and Domestic Commerce.

The following are branch offices of the Bureau of Foreign and Domestic Commerce which co-operate with the War Trade Board: Boston, Mass., Ansel R. Clark, special agent, care of Bureau of Foreign and Domestic Commerce, custom house; Chicago, Ill., George W. Doonan, special agent, care of Bureau of Foreign and Domestic Commerce, Federal Building; St. Louis, Mo., Paul M. La Rose, special agent, care of Bureau of Foreign and Domestic Commerce, 402 Third National Bank Building.

REASONS WHY ELECTRICAL GOODS ARE NOT HIGHER

Economies in Manufacture Due to Waste Elimination, Quantity Production and Modern Apparatus Help Prevent Prices Rising

That electrical supplies have not advanced to the same extent that basic materials and labor have increased is now well known and is often wondered at. The fact is not due entirely to any one cause but to a number of causes all of which tend toward one end—economy of production.

It probably costs considerably more to sell to-day than it did formerly because of the heavy extras and special methods. Production costs per unit of output, however, have not risen so fast. For one thing, quantity production has helped to hold down unit costs; also, new methods and machinery have been devised to decrease labor costs. Utilization of what was formerly called waste is a third factor. It is doubtful whether the saving in this latter matter would formerly have been profitable or sufficiently so to warrant any great activity in that direction. Now it is different.

To illustrate, a well-known electrical manufacturing concern specializing in motors is adopting every means by which the waste involved in its factory operations may be cut down and is having results. Recently a laundry was established in one of its plants and several hundred pounds of rags are put through weekly. Under the old plan rags were purchased at 6 cents and 7 cents a pound, used until saturated with grease, and then burned. About 2000 lb. of rags and cotton waste per month were destroyed in this manner. Under the present arrangement new rags, consisting of mill ends and ends of made-up toweling, are bought for 20 cents a pound. A minimum of twelve washings brings the price per pound, as compared with the old method of buying, down to 1½ cents.

Economy in the use of lubricating oils is considered, also the extraction of oil from metal chips and shavings. Oil used for cooling the cutting tools and lubricating the work of the new machines and lathes when renewed represents a saving. The present oil bill of the company is about one-third of what it would be if the oil were permitted to waste.

A saving in the use of mica insulation, through the method of punching, is brought about by a rearrangement of the dies. A similar economy in metals has been accomplished through the use of a double die, by means of which an armature disk and the center of an alternating-current field are punched out at the same time.

Still another saving is made in connection with the department for the cleaning of belting which has been rendered ineffective through becoming coated with oil and hardened, and repair work has been extended to utilize scrap belting by cementing pieces of belting as short as one foot. It has been found worth while.

RAPIDLY GROWING MARKET FOR ELECTRIC FURNACES

**A Number of Patents Have Been Issued Recently
for New Systems, Many of Which Have
Been Placed on the Market**

Within the past year the market for electric furnaces has noticeably expanded. In that time the number of different makes has more than doubled. Three new makes have been announced as ready for the market within the past few weeks, and patents for furnaces are being issued in greatly increased numbers. While the steel mills are utilizing many more electric furnaces than formerly, the non-ferrous field is rapidly recognizing their value.

The United States Navy in October placed contracts for seven more 6-ton electric furnaces, making eleven purchased recently. This represents a total expenditure of over \$500,000. Of the seven just ordered three will be installed at the government plant at Charleston, W. Va., three at the Watertown Arsenal, and one at the Washington Navy Yard.

The Booth Hall Company announced in October three new installations, one 3-ton, one 0.75-ton and one 1.5-ton, while a couple of weeks later the Electric Furnace Construction Company announced an order for one 6-ton, one 1-ton and a special Greaves-Atchells type furnace for ferro-alloys, besides a 2-ton furnace for use in New Zealand and three other furnaces, two of the 3-ton type, which will be used for special aeroplane and motor steels. This latter type is finding a wide use in Great Britain, especially around Sheffield.

METAL MARKET SITUATION

**Prices on Copper Remain at the Official Figure—
Lead and Brass Decline—Tin Normal**

So far as the price of copper goes, while there was a governmental conference on the question last week, no change will be made for the first quarter of 1918. Producers and large consumers are now discussing the year's output, which will be fully 40,000,000 lb. above estimates, official and otherwise. Manufacturers engaged in government work are buying, in car lots and over, the required copper at the government price of 23.50 cents, while at the established jobbing price, 24.67½ cents, a fair business has been done for early shipment. Finished copper-wire products have not fluctuated and stocks are enough for requirements of the trade. Deliveries will probably grow worse rather than better.

No tin is being offered and prices are therefore nominal. Lead will not be subject to government regulation and is reduced a shade, as is brass also.

NEW YORK METAL MARKET PRICES

	Dec. 10	Dec. 17
	£ s d	£ s d
Copper:		
London, standard spot....	110 0 0	110 0 0
Prime Lake.....	Govt. price 23.50	Govt. price 23.50
Electrolytic.....	Govt. price 23.50	Govt. price 23.50
Casting.....	Govt. price 23.50	Govt. price 23.50
Wire base.....	27.00 to 29.00*	27.00 to 29.00
Lead, trust price.....	6.25	6.25
Nickel, ingot.....	50.00	50.00
Sheet zinc, f.o.b. smelter.....	19.00	19.00
Spelter, spot.....	7.67½ to 7.77½	7.67½
Tin, Straits.....	86.00	80.00†
Aluminum, 98 to 99 per cent.	34.00 to 36.00	34.00 to 36.00

OLD METALS

Heavy copper and wire.....	22.50 to 23.00	22.00 to 22.50
Brass, heavy.....	14.50 to 16.00	14.00 to 15.00
Brass, light.....	10.50 to 11.00	9.50 to 10.50
Lead, heavy.....	5.75 to 5.87½	5.75 to 5.87½
Zinc, old scrap.....	5.00 to 5.50	5.00 to 5.50

*Nominal. †None offering.

THE WEEK IN TRADE

NATURALLY with the close proximity of the holidays the sale of seasonable merchandise is not only far in advance of previous records but continues to grow. So far, outside of delays caused by erratic deliveries, stocks are in a strong position to meet demands. Electrical equipment of a miscellaneous kind is moving and is stronger in some sections, particularly where shipbuilding and similar war enterprises are rapidly developing and increasing their output. Shortages of staples are also reported, especially on motors and transformers, carbon lamps, air heaters, etc., with prices stiffening. Reflectors, projectors, fixtures, pipe fittings, insulators, portable lamps and meters are in fairly good supply and selling satisfactorily. Orders to be filled in the new year are getting more in evidence, as it seems impossible to secure prompter shipments. Shortages due to slow freight movements promise to become more acute rather than better. The labor outlook is not altogether bright, but it is improving.

Collections are reported as not needing any harsh criticism; in fact, they are excellent, so much so that jobbers are discounting their bills. Credits are subject to close inspection, which they are receiving.

NEW YORK

General conditions, barring the late deliveries, are reported as quite satisfactory to manufacturers, jobbers and dealers. On the part of the public the purchase of electric specialties, particularly in all household appliances, is attaining new high records. Staples are also moving along, with stocks in fairly good shape. While no price changes of great account have been announced, still some revisions have taken place, with others promising to materialize at the opening of the new year.

Collections continue to hold up, as might be expected under existing circumstances. Credits are carefully looked after, with trade acceptances a subject of discussion as the proper solution of book-account troubles.

FANS.—Following the exclusive announcement in last week's ELECTRICAL WORLD regarding the revised prices and outlook for motor fans in 1918, wagers are being offered that by August the shortage will again be acute. Jobbers and dealers are cautioned by the producers and primary distributors that, so far as can be figured in connection with passing events, too conservative buying is not a safe policy. The best informed jobbers are arranging for representative stocks, larger even than in 1917. Dealers as well as jobbing houses are being advised not to force the sale of fans much in advance of seasonable demands, for obvious reasons.

HOUSEHOLD APPLIANCES.—A price increase in all appliances is regarded as certain around the first of the year. No positive percentage is mentioned as yet, manufacturers contending that material and other conditions fully warrant the revision of the list on a higher level.

COLLECTIONS AND CREDITS.—The settlement of current bills is along satisfactory lines, and little complaint is heard of chronic delinquency. Credits receive close attention.

LAMP BRACKETS.—The supply of lamp brackets is short, with no immediate prospect of improvement. Various causes are responsible for this curtailment, of which the chief is the freight embargoes.

SOCKETS.—With the introduction of a new threaded catch socket, jobbers handling this line are advising dealers to carry a stronger stock of parts, that is ¼-in., ⅜-in. and ½-in. caps, as they are then in better position to take care of requirements. Standard sockets are also in fair supply.

CARBON LAMPS.—The growing general demand for carbon lamps, of which there is a shortage, is a matter of concern to both manufacturers and the distributing trade. It is the belief that a great deal of the educational work which has been done to demonstrate the great advantage in efficiency of the tungsten lamps must be done over again.

PORCELAIN.—In this territory the porcelain situation is greatly improved. The supply is more liberal, but prices are unchanged.

AIR HEATERS.—With the sharp curtailment of coal in New York and environs resulting from the recent heavy snowstorms, the demand for electrical heaters suddenly assumed large proportions. Jobbers are urging manufacturers to expand their facilities, increase the output and better the deliveries to relieve the congested condition. Several hundred are on delivery, even by one jobber, but few are to be had. As soon as received they are allotted to various buyers to satisfy urgent requirements. Prices in a few weeks have gone from \$7.50 to \$9 each.

CONDUIT.—Conduit is reported as very unsettled. Some quotations are low, to the wonder of the distributing trade in general.

CHICAGO

The volume of business in the Chicago territory continues entirely satisfactory as to totals. Repeatedly, however, there come to the surface facts which reflect the changing character of business and the changing channels of distribution as well as of consumption. Christmas shopping in retail Chicago during the so-called early buying period has not been up to expectations, but with the present snow and cold weather bringing a "feeling" of holidays it is thought that staple gifts at least will leave the shelves in goodly numbers. A tendency along this line is noted in some quarters. Industrial activity is continuing to grow as government contracts filter down through the usual course of handling to the factory which is really to do the work. There have been no material changes in price except in isolated instances wherein the change was dictated by other than the usual competitive considerations. Wire is a little weaker pending the first of January revision of copper prices.

INSULATORS.—After a lull of about two months the market for suspension type units has become active, with inquiries originating from several sections of the country. It is thought that a large part of the business is replacement work. Deliveries of both pin and suspension types are generally on a two months' to three months' basis. Indications are that if present inquiries result in orders, deliveries may go to a six months' basis on account of the fuel shortage in eastern Ohio and western Pennsylvania.

PROJECTORS.—Demand continues better than ever. Shipyards are taking from 100 to 150 units each, and in some factories with large floor area these units are being used for indoor lighting.

FIXTURES.—Indirect-lighting units seem to be the only sort enjoying any sale. One company making this type reports it has all the business it can handle.

WATT-HOUR METERS.—Business is off on account of slack conditions in building lines.

TRANSFORMERS.—Deliveries range all the way from "out of stock" to seven months, depending on whether it is possible to get the raw materials required for a particular design. In general the larger sizes operating at the higher voltages are most difficult to get. Some 75-kw. and 100-kw. units are being shipped out of stock.

MOTORS.—The general situation as regards motor deliveries remains about the same, sizes of 30 hp. and larger being hard to find. There seems, however, to be promise of better conditions.

HIGH-TENSION EQUIPMENT.—It is reported that the demand for pot-heads, cable-end bells, high-tension switches and the like is slackened somewhat, although business is still in a very healthy state.

AIR HEATERS.—On account of the increasing tendency for apartment owners to decrease coal consumption in the interests of both the government and their own pocket-books the market for heaters to be used in bathrooms, nurseries and bedrooms has been markedly increased.

HEATING DEVICES.—The retail movement of heating devices in the last three weeks has been unsatisfactory in the Chicago territory. With the arrival of a first-class blizzard, however, it is expected that Christmas shopping will

begin in a lively fashion and will make up in the last few days in the season what it lacked earlier in volume.

VACUUM CLEANERS.—On account of the fact that central station companies have been reducing stocks of appliances on hand, and especially because they have been shortening the duration of time payments, vacuum-cleaner sales have been somewhat backward in the last few weeks. The general public has not ceased to buy, however, and now that stocks are down to a minimum, a better wholesale movement is expected. This should not be taken to indicate that the vacuum-cleaner business is at all backward in this territory, as taken for the year it is about 100 per cent ahead of last year's business.

BOSTON

Business continues brisk with the advent of the Christmas trade, and while the volume of appliance sales is not expected to reach the total of a year ago, dealers report a healthy demand for all classes of electrical conveniences. A slight recession in industrial wiring contract work is noted, but increasing demands of war service are likely soon to overshadow reductions in general construction. Collections are fair, as last week, and no price changes are announced. Insulating material is getting scarcer. For the moment the labor situation is reported as satisfactory as to supply in widely separated localities occupied by electrical manufacturing plants, but this must be taken as true in individual cases and not as the prevailing condition. An increasing shortage is anticipated, even by plants at present well supplied with labor. The most serious issue in New England at this writing appears to be the coal question. Industrial customers of the New England Power Company have been notified to reduce their energy consumption by the equivalent of one twenty-four-hour working day a week on account of coal shortage, and central stations are much disturbed over the prospect of being obliged to curtail their service. Unfavorable weather has reduced the supply of water for power production compared with a year ago. Great efforts are being made to secure coal and to economize in the use of that in hand, but lack of transportation facilities and railroad embargoes are fast producing a situation of grave menace. There never was a time when the value of hydroelectric power was so apparent.

CHRISTMAS APPLIANCE TRADE.—The week started well, and a vigorous demand is being met from stock. Portables are much in vogue and domestic heating devices are popular. Considering the times business is good.

MOTORS.—Little improvement is to be seen in motor deliveries. Shipments from the Pittsburgh district to Boston average three weeks in transit in full carloads, compared with one week before the war. A few central stations are well stocked, but buying is hesitant in view of the uncertainties due to the coal shortage. No confirmation can be secured as yet regarding the price advances rumored for early 1918. A good deal of "change-over" or efficiency work is in progress, emergency installations for war service offering excellent opportunities for correction and betterment, with reflex effect to the benefit of the fuel situation.

VACUUM CLEANERS AND WASHING MACHINES.—The former are moving fairly well, and one central station is about to start a personal campaign for the sale of the latter equipment.

ELECTRIC RADIATORS.—Continued cold tends to stimulate the sale of these appliances but in some cases where central station customers used radiators recklessly the resulting bills have led to their return.

LAMPS.—The shortage is severe in the lower sizes, notably 10-watt, 15-watt standard and 25-watt tubulars. Sign lamps are beginning to accumulate as the result of the Fuel Administration's curtailment policy. The supply of 25-watt and 40-watt lamps appears adequate for present needs.

WIRE AND CABLE.—Government orders hold the center of the stage, and the "non-essential" industrial customer finds little improvement in the delivery possibilities. Contractors are generally prepared to handle light wiring jobs, but residential work is scarce at present costs.

ATLANTA

Jobbers report increasing activity in specialties to meet the Christmas demand. Dealers state that retail and over the counter sales this Christmas will be the largest ever recorded in this section. Domestic appliances are moving very fast and jobbers are experiencing more or less difficulty in keeping up their stocks of heating devices, vacuum cleaners, washing machines and irons.

The prevailing opinion of manufacturers and jobbers is that freight movements are going to be much slower, at least for some time to come, and this condition will be reflected on deliveries. A few jobbers are placing orders now for shipment during the early part of 1918. There is little doubt that price will be of secondary importance to those that want goods at that time if goods can be delivered, even though there should be a drop in price in the meantime.

The jobbers have done an excellent business this year, and while incomplete figures only are at hand, they indicate an increase of approximately 45 per cent in gross sales for a few of the larger concerns, covering eleven months of this year. All sources report collections as being good, and exceptionally so from the jobber's point of view. Jobbers are in a better shape financially than they have ever been before. This condition is borne out by the fact that the older and some of the younger contracting concerns are doing a very big business, with a corresponding substantial profit, that has permitted them to take care of outstanding obligations in a reasonable time. This, in turn, allowed the jobbers to discount their bills.

While shipments on steel products have been slow during the last few months, the trade has been suddenly informed this week that specific shipment dates cannot be made and, further, that deliveries will be much longer. Local stocks are very low, but prices remain firm.

PORTABLE LAMPS.—The sales in this line have been large and the volume continues heavy as the holidays approach. Shipments have slowed up materially and dealers who foresaw present freight conditions are doing an excellent business.

LAMP CORD.—For a time the dealers of this section secured cord under difficulties, but the cantonment demand has about ceased; the manufacturers are beginning to master the raw-material situation, and local stocks are starting to accumulate.

TRANSFORMERS.—A slight improvement is noted in shipment promises. Special voltages and off-standard ratings, however, show little change. Owing to the betterment of deliveries in standard ratings up to 25 kva., some of the manufacturers can now make shipment from district stocks.

METERS.—Deliveries are good on the residence type and promises of delivery on the polyphase types are more encouraging.

SEATTLE

Northwest jobbers and dealers, those in Seattle and contiguous territory particularly, in commenting on pre-holiday electrical sales, state that Christmas tree lighting outfits are not moving so well as expected, although sales are comparatively satisfactory. The reason given for the decrease in sales this year as compared with former years, the last two particularly, is that households which desire electric outfits are supplied. Sales of lamps for outfits in previous years were heavy. Sales of washing and sewing machines are extremely heavy and are increasing with the approach of Christmas. Other household appliances, including percolators, chafing dishes, curling heaters, electric tea kettles, disk stoves, warming pads, etc., are moving in a first-class manner, although not to the extent expected and strongly predicted. It is believed now that heavy buying of electrical presents will not fully materialize until two or three days preceding Christmas. Dealers still confidently expect large purchases as a result of the campaign for an electrical Christmas started several weeks ago. The daily increasing volume of sales justifies their optimistic statements. Reports from suburban towns and the larger Northwest cities state that holiday sales are satisfactory. Reports from Portland and Spokane especially state that the volume of sales is increasing.

There is a little stocking up on all items for which it is felt there will be a regular demand during the coming year. This activity is expected to spread to every jobbing house in the Northwest. Jobbers are becoming more and more apprehensive of shortages along certain lines, owing to a reported list of non-essentials which the government is working on, and some are intent upon stocking up on items which may fall under that head. A prevalent feeling noted is that jobbers and dealers are at last subscribing to the theory that the war will extend over a period of at least two or three years more; therefore they will make their plans accordingly as applied to stocks. A reported embargo by the railroads, working in conjunction with the government, is also causing jobbers and dealers to build up stocks.

There is an overstock of materials for building purposes, especially wiring devices and fixtures. No outward signs are noticeable of increasing activities in building. Inquiries and a few orders for electrical equipment are trickling in from mines in the Spokane and Coeur d'Alene districts. This business is expected to increase with the coming of spring. Sales to shipyards and industrial plants continue in a steady, satisfactory flow. The Portland field reports a slight increase in sales over last week owing to recent contracts for ships received. Government buying for the navy yard and cantonments is about the same as reported for the last two weeks. The labor situation is extremely acute and was accentuated recently by the heavy enlistments. Electrical men are hit hard, and many have tried or are trying to replace with women the men who have enlisted. This applies particularly to wholesalers.

Shortages along lines heretofore reported still obtain, with no prospect of betterment. A feeling prevails that the situation will get worse instead of better. Orders from several public service corporations throughout the State of Washington for wire, transformers, pole-line material, etc., for reported extensions, have not materialized. It is thought now that this work will go over into next year. No increases in prices are noted. Collections are good.

SAN FRANCISCO

Electrical merchandising interests throughout California anticipate notable business improvement from the co-operative movement for which a fund of \$12,000 has been subscribed by contractors and dealers, jobbers, central stations and manufacturers. Of course, time will be required to produce the results desired, but the topic is uppermost in the field because the campaign is now being planned and organized. It is being pointed out that if results are in fact achieved to the extent expected by improvements in display, advertising and merchandising methods generally, there will be a permanent arrangement for keeping up the high standard in these lines which will put the percentage of sales in this territory at a record height.

Reports from southern California indicate that electrical business there is affected more seriously than in the San Francisco district by war conditions. In Los Angeles the absence of extensive industries or a high percentage of tributary territory used for agricultural purposes has left the field without an active substitute for declining construction business. The contractor and dealer suffer more from this than do other branches of the industry, because shipbuilding has been steadily increasing in the Los Angeles and San Diego districts and large orders for motors and supplies are being placed direct with the jobbers. This week, for example, a recently formed shipbuilding company launched its first 5000-ton steel vessel in Los Angeles harbor, and it has announced that the contracts for more of the same type have just been extended to call for eighteen instead of eight, as first planned.

San Diego now has more people than at any time during the Exposition year, exclusive of the 30,000 soldiers quartered at the cantonment, and industrial activity is well above normal. In addition to the extensions of the cantonment which have been ordered, plans for construction involving two governmental departments at that point have been decided upon. Several large factories are contemplated or just under way, and a transmission line is being built to tie in the local power company with the system that serves the Los Angeles territory.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B.&S. Size	List per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor

No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

Less than coil.....	No. 14 Solid List to \$61.00
Coil to 1000 ft.....	5% to \$59.17
Less than coil.....	No. 12 Solid List to \$71.00
Coil to 1000 ft.....	5% to \$68.87

Twin-Conductor

Less than coil.....	No. 14 Solid List net to \$105.00
Coil to 1000 ft.....	\$70.00 to 10% \$77.00
Less than coil.....	No. 12 Solid List net to \$135.00
Coil to 1000 ft.....	10% to \$130.95

DISCOUNT—CHICAGO

Single-Conductor

Less than coil.....	No. 14 Solid List + 10% — 10%
Coil to 1000 ft.....	No. 12 Solid List + 10% — 10%

Twin-Conductor

Less than coil.....	No. 14 Solid List + 10% — 10%
Coil to 1000 ft.....	No. 12 Solid List + 10% — 10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	List to 10% 1/5 to std. pkg.....15% to 20% Std. pkg.....28% to 34%
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DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+20% to 12% 1/5 to std. pkg.....List to 20% Std. pkg.....28% to 44%
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BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.3175	.3275
Barrel lots.....	.2875	.2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List Per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp.....	\$75.00 \$69.75
3/8-in. d. stp.....	78.75 72.00
1/2-in. s. stp.....	100.00 93.00
1/2-in. d. stp.....	100.00 96.00

NET PER 1000 FT.—CHICAGO

Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip....	\$75.00 \$63.75
3/8-in. double strip....	71.25-78.25 71.25
1/2-in. single strip....	100.00 85.00
1/2-in. double strip....	105.00 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	2.....	.47
3/4.....	.15	2 1/4.....	.55
1.....	.18	2 1/2.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$25.00-\$55.00	\$20.50-\$24.75
1/4-in.—	\$28.00-\$60.00	\$22.50-\$27.00

NET PRICE 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.....	\$55.00	\$25.00-\$37.50
1/4-in.....	\$60.00	\$27.00-\$30.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List Elbows, List

Size, In.	Couplings, List	Elbows, List
1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.50
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

Less than 2500 lb.....	1/4 in. to 1/2 in. 4% to 6% 3/4 in. to 3 in. 7% to 9%
2500 to 5000 lb.....	6% to 9% 9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

Less than 2500 lb.....	1/4 in. to 1/2 in. 1.3% to 3.7% 3/4 in. to 3 in. 4.3% to 6.7%
2500-5000 lb.....	3.3% to 5.7% 6.3% to 8.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

CHICAGO

List.....	\$5.00 to \$6.00
Discount.....	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	1.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.00 to \$5.75
1/5 to std. pkg.	4.50
Standard package, 500.	List, each, \$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500.	List, each, \$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List.
Regular, clear:		Each
10 to 40-watt-B	100	\$0.27
60-watt-B	100	.36
100-watt-B	24	.65
75-watt-C	50	.65
100-watt-C	24	1.00
200-watt-C	24	2.00
300-watt-C	24	3.00
Round bulbs, 3 1/4 in., frosted:		
15-watt-G 25	50	.50
25-watt-G 25	50	.50
40-watt-G 25	50	.50
Round bulbs, 3 3/4 in., frosted:		
60-watt-G 30	24	.72
Round bulbs, 4 1/4 in., frosted:		
100-watt-G 35	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$30.00 to \$33.98
Coil to 1000 ft.	25.50 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$30.00 to \$36.56
Coil to 1000 ft.	22.30 to 27.42

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	\$20.00 to \$29.00
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CHICAGO

Net per 100	\$19.25 to \$24.00
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OUTLET BOXES

Nos.	List.
101—A, A1 1/2, 4 S.C., 6200, 320	per 100 \$30.00
102—B.A., 6200 S.E., 300, A.X., 1 1/2,	30.00
4 S.	25.00
103—C.A., 9, 4R, B 1 1/2	20.00
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list	25%	20%
\$10.00 to \$50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list	40%	35%
\$10.00 to \$50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$20.00 to \$38.00
1/5 to std. pkg.	19.00 to 26.00
Standard package, 2200.	List per 1000, \$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80
1/5 to std. pkg.	14.80
Standard package, 2200.	List per 1000, \$20.

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net	Std. Pkg.	3500 Std. Pkg.	4000
		5 1/2 N. C.—Solid Nail-it—N. C.		

	Less than	1/5 std.	1/5 to std.
	pkg.	\$27.50 to \$29.00	\$30.75
	pkg.	15.60 to 20.75	24.20

CHICAGO

	Per 1000 Net	Std. Pkg.	3500 Std. Pkg.	4000
		5 1/2 N. C.—Solid Nail-it—N. C.		
	Less than	1/5 std.	1/5 to std.	
	pkg.	\$11.85	\$30.75	
	pkg.	11.10 to 11.40	24.20	

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/2-in. cap key and push sockets	500	\$0.33
1/2-in. cap keyless socket	500	.30
1/2-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net to 14%
1/5 to std. pkg.	Net to 30%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	\$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than \$10 list	List net to + 5%
\$10 to \$25 list	11%
\$25 to \$50 list	14% to 15%
	Low Grade
Less than \$10 list	5% to 10%
\$10 to \$25 list	16%
\$25 to \$50 list	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than \$10 list	+5%
\$10 to \$25 list	11%
\$25 to \$50 list	14%
	Low Grade
Less than \$10 list	5%
\$10 to \$25 list	16%
\$25 to \$50 list	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to —15%
Std. pkg.	List to —30%

SWITCH BOXES, SECTIONAL CONDUIT

	List
Union and Similar—	Each
No. 155	\$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00	List	List to 10%
\$2.00 to \$10.00	list	10% to 20%
\$10.00 to \$50.00	list	20% to 30%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list	25%	15% to 20%
\$2.00 to \$10.00	list	20%
\$10.00 to \$50.00	list	25% to 35%

TOASTERS, UPRIGHT

NEW YORK

List price	\$5.00 to \$7.50
Discount	25% to 30%

CHICAGO

List price	\$5.00 to \$6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools.	\$0.44 1/4 to \$0.49
No. 18, full spools.	0.43 1/4 to 0.55

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	\$0.57 1/4 to \$0.65
No. 18, full spools.	0.50 1/4 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net					
	Less than 500 Ft.		500 to 1000 Ft.		1000 to 5000 Ft.	
No.						
11.	\$15.00	\$18.00	\$13.00	\$14.00	\$11.25	\$12.00
12.	23.25	27.09	21.31	23.22	19.35	20.85
10.	32.40	37.80	29.70	32.40	27.00	29.25
8.	45.70	53.34	41.90	45.72	38.00	41.38
6.	72.40	84.42	66.35	72.36	60.30	65.50

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14....	\$18.00	\$13.50	\$12.00
12....	26.95-27.79	23.41-26.95	19.85-23.10
10....	33.24-38.25	30.47-32.72	27.70-30.60
8....	47.04-54.29	43.12-45.47	39.20-43.42
6....	68.25-92.61	62.05-79.23	55.85-74.09

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$35.25 to \$40.00
25 to 50 lb.	36.25 to 39.00
50 to 100 lb.	34.25 to 38.00

CHICAGO

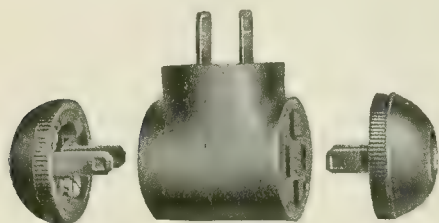
	Per 100 Lb. Net
Less than 25 lb.	\$40.00 to \$40.35
25 to 50 lb.	39.00 to \$39.35
50 to 100 lb.	38.00 to 38.35

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Double Service Receptacle

A "duplex adapter" which transforms a single outlet receptacle into a double service receptacle from which two portable lamps or devices can be simultaneously fed has been added by the Bryant Electric Company of



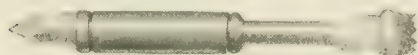
CONSISTS OF A DOUBLE RECEPTACLE AND PLUG COMBINED

Bridgeport, Conn., to its "Spartan" line of interchangeable receptacles and plugs.

The new device, which is known as the "EH Spartan duplex adapter," consists virtually of a double "Spartan" receptacle and a "Spartan" plug combined. The plug can be inserted into any of the standard "Spartan" receptacles and two outlets are then provided which will take a "Spartan" plug cap of either the "parallel" blade or the "polarity" type. It can also be used in conjunction with the "Spartan screw-base adapter" to transform an Edison screw-base socket or receptacle to a duplex "Spartan." The adapter is National Electrical Code standard.

Electric Soldering Iron for Garages

The Dover Manufacturing Company, Dover, Ohio, is now offering the trade an electric soldering iron designed especially for use in garages and other places where intricate work is necessary. The iron contains a Veal heating element which is standard with the Dover company. A flanged copper core runs the full length of the heating element. The resistance coils are wound around a thin tube of vitrified clay. The



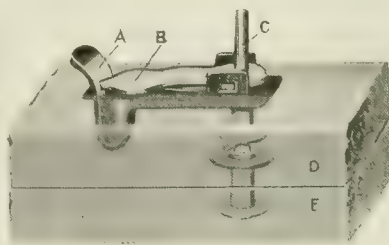
MADE EXPRESSLY FOR INTRICATE WORK

insulating material is forced between the vitrified tube and the copper core and between the coils and the steel casing. This construction is designed to prevent trouble. The heating element is sealed in the steel casing to prevent jampering.

The copper soldering tips are made from drawn copper bars and are subjected to special heat treatment. The soldering tips screw into the copper core, and hence can be removed easily. Inside of the wooden handle is a fiber terminal point. The wooden handle unscrews so that the connection can be adjusted or renewed if necessary. The iron weighs 31 oz. (877 g.) and is 15 in. (38.1 cm.) long. It operates on a potential of 110 volts, and the heating element is rated at 225 watts.

Simple Holder for Filing Drawings

The National Company, Boston, Mass., is putting out a new device called the "Presto holder" for filing blueprints, drawings, etc. The holder consists of two wood strips, designated as *D* and *E* in the accompanying illustration, between which the prints are clamped. It carries three locking de-



HOLDING CLAMPING DEVICE

vices, the middle one being located off center for convenience in clamping narrow prints. The locking mechanism has two parts, *A* and *B*, which are pressed as desired either to lock or to release *B* from the stud *C*, which is securely fastened in the lower strip.

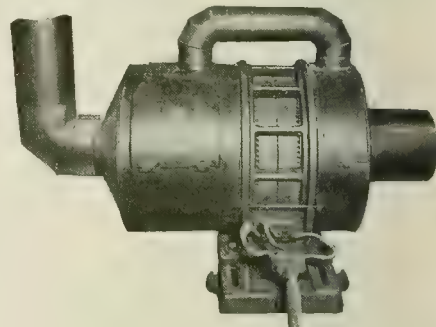
The holders are made in 30-in., 36-in. and 42-in. (76.2-cm., 91.4-cm. and 106.7-cm.) lengths, each holder having a capacity of sixty prints. An index card holder is attached for filing purposes, and hooks are provided for hanging on the wall or in rows on a suitable rack.

Motor Protection System

A motor protective device which, it is claimed, does away with the trouble and expense of cleaning motors, reduces the temperature and increases the efficiency, allows the carrying of a large overload without shortening the life of the motor, and eliminates fire hazards and loss of money due to breakdowns, is shown in the accompanying illustration. The usual type of installa-

tion consists of casings which inclose each end of the motor and make it dust-proof, a fan attached to the end of the motor shaft, a dust separator, and an air-intake pipe running to a clean air supply, preferably out of doors.

When the motor is started the fan

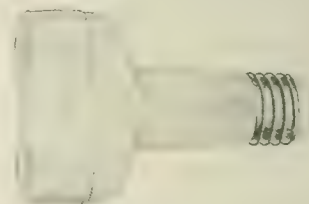


METHOD OF PROTECTING MOTOR

draws in air through the dust separator and forces it against the rear end of the motor, through the windings and out through the laminations. Part of the air is forced through a by-pass to the front hood so that the same action takes place on both sides of the motor. The motor casings are provided with large doors to permit of a ready inspection of brushes, resistance, air-gap, bearings, etc. The dust separator is also provided with doors so that the screens can be easily removed. The equipment can be applied to motors without moving them and requires a very short time to install. This apparatus is made by the Motor Protection Company of Pawtucket, R. I.

Separable Device

A recent addition to the line of the General Electric Company's separable devices is a porcelain twin-outlet separable attaching plug. By the use of



TWIN OUTLET SEPARABLE ATTACHING PLUGS

this device two portables equipped with "Standard" caps can be used in the same outlet. A feature of this improved plug is length of the stem, which is of sufficient length to enable the device to be secured into a socket or receptacle having a shade attached.

Improved Safety-First Inclosed-Lever Switch

The General Electric Company has recently introduced an improved inclosed-lever switch that, it is said, may be classed as "safety first" in every respect. The device has been examined by the National Board of Fire Underwriters and approved as "safety first" from the standpoint of both fire and casualty hazards. The switch is especially adapted to the control of motor drive on machine tools or for lighting and power circuits. It uses N. E. C. S. fuses and is limited in capacity only by the rating of approved fuses of this class.

The phantom view here reproduced shows a triple-pole safety-first switch of this type. The unit consists essentially of an externally operated standard lever switch inclosed in an iron case and so arranged that all current-carrying parts are inaccessible while alive. This feature is secured by means of a simple interlock so arranged that the cover to the fuse compartment cannot be opened while the switch is closed nor can the switch be closed while the fuse compartment is open. The screws holding the main cover of the box are covered by the fuse cover so that they cannot be removed while the fuse cover is closed.

The operating mechanism is very simple. The handle on the standard lever switch is replaced by a hook-shaped casting which engages with a curved shaft operated by the externally mounted handle as shown.

Provision is made for locking the switch in the "off" position with from one to three individual padlocks. Means are also provided for padlocking the fuse cover to prevent unauthorized persons from tampering with the fuses. The switch box is provided with knockouts for conduit wiring, two knockouts being placed at each end and two at each side of the box. Split porcelain bushings to

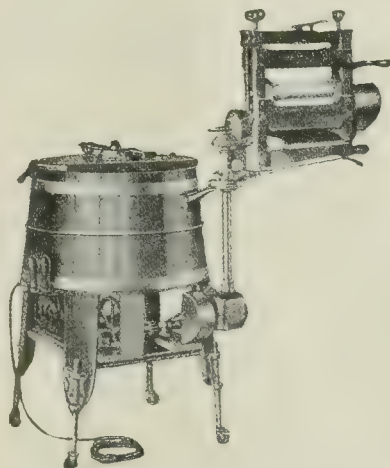
provided with a bus compartment for inclosing all incoming wires and connections.

Another accessory is the safety catch. When this catch is used the operator cannot close the switch without using both hands, one to hold the catch in the released position and the other to operate the switch handle, thus removing the possibility of accidental closure

Dolly-Type Washer

The Automatic Electric Washer Company of Newton, Iowa, has just added to its line of dolly-type wooden-tub machines two models known as models 9 and 10. The former is a belt-power type for operation with gasoline engine or power stand such as is furnished with some of the farm lighting plants, while model 10 is equipped with an electric motor for operation from any source of electric power, including farm lighting plants.

The wringer swings into four different positions and is reversible, and the machine will wash and wring at the same time. With these models it is possible to be washing one batch of



CAN BE OPERATED BY ENERGY FROM FARM LIGHTING SETS

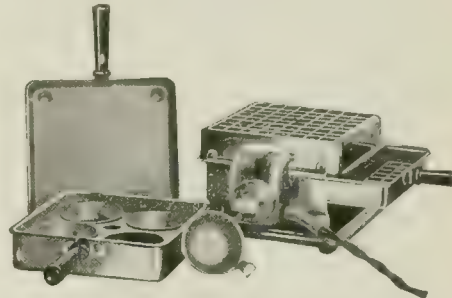
clothes while wringing another from the rinse or bluing water. Both models are gear-and-chain-driven, no belts being used. The model 10 has adjustable casters so that the height can be altered at will. The electric machines are equipped with Emerson motors.

Table Stoves

A table stove which has a three-heat switch directly attached to it and made a part of the stove, so that the user can obtain any degree of heat desired, has been brought out by the Rutember Electric Company of Marion, Ind. This stove is also supplied with custard cups which can be used for several different operations, such as poaching eggs, making cup custards, etc., and by using the deep pans on top of the stove, one turned over the other, this part of the stove can be made into a bake oven, baking such articles as biscuits, muffins, drop cakes, cookies, etc. The

makers point out that it can be used for baking potatoes and other food.

A uniform degree of heat can be maintained, and the maximum temperature obtained is 660 deg. Fahr. (349 deg. C.). The minimum temperature is 275 deg. Fahr. (135 deg. C), which gives an ample range for any

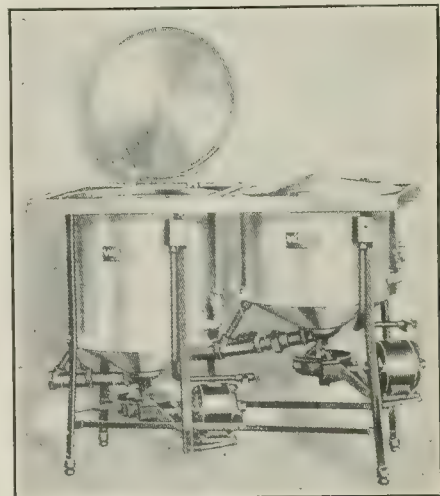


THREE-HEAT SWITCH IS PART OF STOVE

baking operation desired. It is also pointed out that by using the pans underneath the heating element excellent results can be obtained by broiling steaks, pork chops, toasting bread, etc.

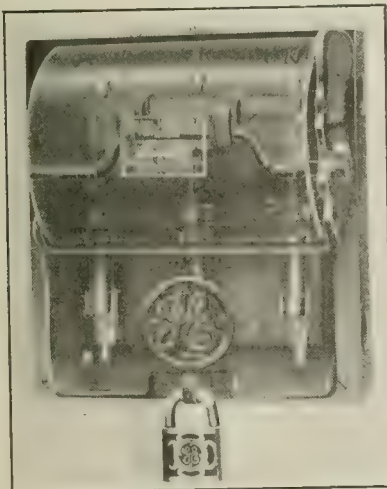
Heavy Service Electric Dishwasher

The Walker Brothers Company of Syracuse, N. Y., announces an electric dishwashing machine designed for heavy duty. The machine carries two tanks, a shallow one which is intended for rinsing only and a deep container in which the washing operation is performed. Water from the rinsing tank drains into the second and larger division from which soiled water is drained out. This arrangement, the manufacturer points out, facilitates the washing of dishes in large quantity. Two trays may be handled at one time and the washing and rinsing operations require only from one to two minutes'



DESIGNED FOR HEAVY DUTY

time. Each of the trays has a capacity of thirty-five to seventy-five pieces. Individual motors are directly connected with each tank. The entire machine occupies a space of only 2 ft. by 4½ ft. (6 m. by 1.4 m.).



TRIPLE-POLE SAFETY-FIRST SWITCH

protect the wires in open wiring work are supplied, two at each end for two-pole, three for triple-pole and four for four-pole switches. The switch is adapted to single or group mounting, and when mounted in groups it may be

Trade Notes

G. A. PETERSON, Baltimore, Md., has been appointed manager of the Philadelphia office of the A. B. See Electric Elevator Company.

THE DEPARTMENT OF COMMERCE of Washington has published and has ready for distribution "Foreign Tariff Notes" No. 25, with cumulative index for Nos. 22 to 25.

SAMUEL D. WESTLER has opened an office as manufacturers' agent, specializing in electrical merchandise, at the Postal Telegraph Building, 253 Broadway, New York City.

HAL C. WYATT now represents the Northwestern Electric Equipment Company, St. Paul, Minn., in the western Montana territory. Mr. Wyatt succeeds W. H. Plume, who resigned.

THE ARTHUR JONES ELECTRIC COMPANY announces the removal of its general offices and salesroom to 2837 South State Street and of its salesroom to 8 East Twenty-ninth Street, Chicago.

THE FRANTZ-PREMIER DISTRIBUTING COMPANY has removed its salesroom and offices from 119 West Forty-second Street to 2010 Broadway, New York City, where more suitable quarters have been taken.

THE SQUARE D COMPANY of Detroit, Mich., is the new name of the Detroit Fuse & Manufacturing Company, which has sold its fuse business to the Economy Fuse & Manufacturing Company. The company will continue to make Square D switches and meter protective trim.

THE JEFFERSON ELECTRIC MANUFACTURING COMPANY of Chicago warns the trade against R. A. Spencer, who is purporting to be its representative. The company states he is imposing on different dealers in New England. About a year ago Spencer was reported as active in Ohio, parts of West Virginia and Pennsylvania.

THE JEFFERY-DE WITT COMPANY, Detroit, manufacturer of high-tension insulators and other porcelain specialties, is erecting a new factory at Huntington, W. Va., for the exclusive manufacture of high-tension insulators. This factory will have a capacity of 500,000 units per annum and will be capable of further expansion. According to present plans, the factory will be started about April 15, 1918.

THE W. F. IRISH COMPANY is a new jobbing firm at 130 West Thirty-second Street, New York City. The company is owned and controlled by W. F. Irish, who is a well-known metropolitan jobber, having been connected with various firms during his career, and F. S. Gardiner, who was sales manager for Sibley & Pitman for twenty-five years. Both of the partners will take an active part in the conduct of the business.

THE HOME LIGHT & POWER COMPANY of Charlotte, N. C., recently held a four-day convention of its salesmen and dealers at Dayton, Ohio, where the plant of the Dayton Engineering Laboratories Company, which makes the "Delco light," distributed by the Home company, is situated. The meetings were held Dec. 4, 5, 6 and 7 at the Miami Hotel, and an inspection of the new Delco factory was an interesting feature of the gathering.

THE ANACONDA COPPER MINING COMPANY, Great Falls, Mont., is erecting a rod and wire manufacturing plant, which is expected to be in operation in the spring. Its annual capacity on an eight-hour working-day basis will be 32,400,000 lb. of rods and 27,520,000 lb. of wire, and it will consume one-fifth of the output of the Anaconda company. The plant will cost more than \$500,000 and will mark the entry of the Anaconda into the manufacturing field. A brass manufactory is expected to be erected after the rod and wire mill is completed.

THE BRIDGEPORT BRASS COMPANY of Bridgeport, Conn., in addition to supplying group life insurance for its workers, has inaugurated a plan which also includes benefits for accidents and sickness along the lines of the compensation laws of some states. Under the Bridgeport company's plan any employee may receive one-half of his wages, up to a certain maximum, for a period not to exceed twenty-six weeks, for disability or sickness and a maximum life insurance policy of \$1,000. A publication is issued by the sick benefit association of the Bridgeport Brass Company entitled "A Co-operative Plan of Benefits Covering Accidents, Sickness and Death."

THE ECONOMY FUSE & MANUFACTURING COMPANY of Chicago announces that it has purchased the entire fuse business of the Detroit Fuse & Manufacturing Company, maker of the "Arkless" inclosed fuses. The transaction includes the conveyance of all merchandise materials, machinery, tools, designs, patents, good will and unfilled orders. The physical assets of the Detroit Fuse & Manufacturing Company in so far as they pertain to the making of fuses have been shipped to the Chicago plant of the Economy company, where the manufacture of "Arkless" fuses will be continued, production being, as heretofore, under the label service of the Underwriters' Laboratories, Inc. The "Square D" line of inclosed safety switches remains the property of the Detroit Fuse & Manufacturing Company.

Trade Publications

AUTOMOBILE SWITCHES.—Hubbell automobile switches are listed in bulletin No. 16-1, issued by Harvey Hubbell, Inc., of Bridgeport, Conn.

CABLE-WAY CARRIAGES.—The Blaw-Knox Company of Pittsburgh, Pa., has issued a leaflet descriptive of its "Blaw" locking cableway carriages.

GAS-OVEN FURNACES.—Tate-Jones & Company, Inc., of Pittsburgh, Pa., has issued bulletin No. 160, descriptive of its recuperative gas-oven furnaces.

CIRCUIT BREAKERS.—Type FK-25 oil circuit breakers made by the General Electric Company of Schenectady, N. Y., are illustrated and described in bulletin No. 47471.

BLUE-PRINT HOLDER.—The Presto blue-print record, chart, drawing and newspaper holder is described in a folder prepared by the National Company, 273 Congress Street, Boston, Mass.

FLOOR MACHINE.—The "Utility" floor machine for polishing, scrubbing and sandpapering all kinds of floors is described in a booklet prepared by the Kent Vacuum Cleaner Company, Inc., of Rome, N. Y.

COIL TESTERS.—A booklet descriptive of Jefferson combination lamp, plug, horn and Ford coil unit testers has been prepared by the Jefferson Electric Manufacturing Company, 426 South Green Street, Chicago.

ELECTRICAL SERVICE.—A booklet is being distributed by the Denton Engineering & Construction Company of Kansas City, Mo., outlining this firm's electrical service and its facilities for handling repair and construction work.

HYDRAULIC TURBINES.—The I. P. Morris Company of Philadelphia, Pa., has prepared bulletin No. 4, descriptive of its hydraulic turbines. This complete and well-illustrated bulletin includes a general history of the firm, shop views, a list of wheels built by this company, efficiency curves of turbines, an article on "The Efficient Use of Water Power," and a number of plant illustrations giving views of I. P. Morris turbines.

ELECTRICITY IN RUBBER FACTORIES.—"Electrical Equipment for Rubber Factories" is the title of an elaborately illustrated publication (circular No. 7352), with an attractive art cover, which has just been issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The advantages of motor drive, particularly for the calender, are explained in some detail, and a number of views of different motors and control are shown. A large number of illustrations of application of motors to the rubber industry, taken in different parts of the country, are used. The equipment of the Howe Rubber Company, New Brunswick, N. J., is featured and a number of illustrations of this up-to-date plant are shown.

ELECTRICAL EQUIPMENT FOR TEXTILE INDUSTRY.—The application of electricity to the textile industry is thoroughly described and illustrated in circular No. 7153, entitled "Electricity in the Textile Industry," just issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. It was distributed at the Southern Textile Exposition at Greenville, S. C., Dec. 10-19. The publication is profusely illustrated with applications of electric motors to the industry, a number of views being shown illustrating the different methods of drive employed in textile mills. Considerable space is devoted to lighting, which is an important feature in all industrial establishments, especially textile ones. This book will be sent free on application to any one interested.

New Incorporations

THE DAYTON (OHIO) ELECTRICAL MANUFACTURING COMPANY has been incorporated with a capital stock of \$125,000 by H. G. Catrow and others.

THE GREEN LIGHT & POWER COMPANY of Pleasant Hill, Mo., has been incorporated with a capital stock of \$150,000 by L. K. Green, L. R. Green and others.

THE FINLEY LIGHT COMPANY of Ozark, Mo., has been incorporated with a capital stock of \$10,000 by George T. Braezale, F. W. Barrett and D. W. Bingham.

THE STANDISH ELECTRIC COMPANY of Cincinnati, Ohio, has been chartered with a capital stock of \$10,000 by P. H. Standish, John E. Devere, G. B. Jolly, H. B. Street and H. F. Gravenkemper.

THE ELECTRIC MANUFACTURERS' AGENCY of Seattle, Wash., has filed articles of incorporation with a capital stock of \$20,000. The incorporators are: Joseph Schoemer, George Buckman and W. Funsinn.

THE ERWALDSON MANUFACTURING COMPANY of St. Paul, N. C., has been chartered by W. D. Johnson, A. R. McEachern and G. T. Fisher. The company is capitalized at \$25,000 and proposes to manufacture electrical supplies.

THE AIRCRAFT SPECIALTIES COMPANY of Garwood, N. J., has been incorporated with a capital stock of \$25,000 to manufacture electric motors. The incorporators are: William B. Elliott, William Siebenmorgan and George A. Elliott.

THE EXCELLO GAS COMPANY of Baltimore, Md., has been incorporated with a capital stock of \$10,000 by Louis M. Rubin, 312 North Eutaw Street, Baltimore; Harry Rubin and S. Want. The company proposes to deal in gas and electrical appliances.

THE E. R. KIBLER COMPANY of Wilmington, Del., has been incorporated by C. L. Rimlinger, C. M. Egner and M. M. Clancy of Wilmington, Del. The company is capitalized at \$200,000 and proposes to do a general electrical and mechanical engineering business.

THE ELECTRO PRODUCTS CORPORATION of Wilmington, Del., has been incorporated by M. L. Harty, L. A. Irwin and Harry W. Davis of Wilmington. The company is capitalized at \$500,000 and proposes to manufacture machines under electrolyte, chemical and other processes.

THE MOTORLESS SIGN FLASHER COMPANY of Dover, Del., has been incorporated with a capital stock of \$300,000 to manufacture electric machines, storage batteries and accessories. The incorporators are: A. M. Halloran, S. A. Williams and Ferries Giles of Wilmington, Del.

THE BREENER GAS & BY-PRODUCTS CORPORATION of New York, N. Y., has been incorporated with a capital stock of \$100,000 by Samuel B. Howard, George V. Reilly and Arthur W. Britton, 65 Cedar Street, New York City. The company proposes to do a general electrical and mechanical engineering business.

THE BEECH BOTTOM POWER CORPORATION of Wheeling, W. Va., has filed articles of incorporation with a capital stock of \$40,000 to operate in Brooke County. The incorporators are: Allen E. Moore, George F. Jebbett of New York, N. Y.; Alfred F. McCabe, F. H. Butchorn and S. C. T. Dodd of Brooklyn, N. Y.

THE WEST TEXAS UTILITIES COMPANY of Abilene has been incorporated with a capital stock of \$400,000 by George W. Williamson, 72 West Adams Street, Chicago, Ill.; J. M. Dickie, J. F. Meadows and F. A. Matthes, all of Abilene; A. Hargrave and Sidney G. Vigo of Dallas. The company has taken over the properties of the Abilene Gas & Electric Company, the Baird (Tex.) Gas & Electric Company, and the Hamlin (Tex.) Gas & Electric Company.

THE EAST TEXAS UTILITIES COMPANY of Marshall has been chartered with a capital stock of \$300,000 and has acquired the holdings of the Marshall Electric Company, the Marshall Traction Company and the Marshall Ice Company; the Jefferson (Tex.) Ice & Light Company and the Longview (Tex.) Ice & Light Company. The incorporators are George W. Williamson, 72 West Adams Street, Chicago, Ill.; J. M. Dickie, J. F. Meadows and F. A. Matthes, all of Abilene; A. Hargrave and Sidney G. Vigo of Dallas.

New England States

SPRINGFIELD, VT.—To provide for better service on its Claremont-Cavendish transmission line, the Colonial Power & Light Company has begun work on an extension of its line from Claremont to Windsor. This line has heretofore been tied in with the Claremont-Cavendish line about 5 miles from Claremont, and the company is planning to extend the line and bring it directly into the Claremont substation.

BROCKTON, MASS.—The Sewerage Commissioners have awarded the contract for the new electrical equipment for the Campello sewerage pumping station to the Power Equipment Company of Boston, at \$12,750. The contract calls for DeLaval centrifugal pumps and Westinghouse motors and switchboards.

EASTHAMPTON, MASS.—The Turners Falls (Mass.) electric company has petitioned the Selectmen for permission to erect transmission lines in East and Hendricks Streets. The company is making an effort to get into Westfield by way of Southampton.

FALL RIVER, MASS.—The Fall River Electric Company has petitioned the Council for permission to install underground conduits on School Street, between Maple and Prospects Streets.

LENEX, MASS.—Work has begun on the erection of a new high-tension transmission line from the central distributing station of the Lenox Electric Light Company on Walker Street to Lenoxdale, where it will connect with the high-tension line of the Pittsfield Electric Company, running from Lee. For part of the distance the wires will be placed underground. The new line will provide auxiliary service for Lenox.

NEW BEDFORD, MASS.—Plans have been filed by the J. S. Rhodes Company, 128 Front Street, for the construction of a new one-story addition, 25 ft. by 40 ft., to its power plant, to cost about \$10,000.

WORCESTER, MASS.—The new substation on Grafton Street of the Worcester Electric Light Company, it is expected, will be completed by the first of the year. The station will be equipped with four 200-kva. and three 300-kva. transformers. This is the largest substation of the company and will cost more than \$100,000.

Middle Atlantic States

BUFFALO, N. Y.—The Hydro-electric Association has made recommendations to the City Council for the immediate erection of a municipally owned power plant at Niagara Falls. The association has also negotiations under way with the Council for assistance in making revisions in the treaty with Canada for the purpose of providing more power at that point.

GREENPORT, N. Y.—The Public Service Commission has granted the Albany Southern Railroad Company of Albany permission to erect and operate electric transmission lines in the town of Greenport, which was opposed by the Red Hook (N. Y.) Light, Heat & Power Company, which also has a franchise granted by the town, but was not exercised within the time limit.

GREEN ISLAND, N. Y.—The Standard Oil Company has applied to the Village Council for street lamps to be erected along Front Street, which extends from Albany Avenue south to the village line at the end of the state basin. Green Island has not a post office.

NEW YORK, N. Y.—The capital stock of the Artificial Daylighting Company, 461 Eighth Avenue, New York, has been increased from \$50,000 to \$500,000, the proceeds to be used for expansion.

NEW YORK, N. Y.—Contract has been awarded by Joseph Stern & Son, 618 West Fortieth Street, New York City, for the construction of a new two-story power plant addition, 25 ft. by 45 ft., to E. W. Broderick, 110 West Fortieth Street.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 7, 1918, for furnishing and installing one 40-ton and two 10-ton overhead electric traveling bridge cranes and runway trolley wires on the runways in the extension to the machine shop building 128, at the navy yard, New York, N. Y. Drawings and specifications (No. 2720) may be obtained on application to the above bureau or to the commandant of the navy yard named.

NIAGARA FALLS, N. Y.—The Lower River Power Company is contemplating the construction of a hydroelectric power plant to develop 350,000 hp. on the Lower Niagara River, if permission is granted by Con-

Construction

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gress. James S. Simmons, former Congressman, is interested in the company.

OGDENSBURG, N. Y.—The Ogdensburg Power & Light Company has submitted a proposal to the City Council offering to replace the arc lamps now in use with incandescent lamps, varying in candlepower from 100 to 400 units.

OTISCO, N. Y.—An electric plant is being installed to supply electricity for lighting Otisco. E. T. Harter is interested.

POUGHKEEPSIE, N. Y.—Arrangements have been completed for illuminating the Catskill Aqueduct with electric lamps from Ashokan Dam to Hill River Reservoir, in Yonkers. Energy for the lamps in Orange and Ulster counties will be furnished by the Hudson Gas & Electric Company of Poughkeepsie; in Putnam and Dutchess counties power will be supplied by the Cold Spring (N. Y.) Power Company, and by the Westchester Lighting Company in Westchester County.

RICHMONDVILLE, N. Y.—The Schoharie Valley Light & Power Company of Esperance has applied to the Village Board of Trustees for a franchise to supply electricity in Richmondville. Owing to being unable to obtain coal the Great Bear Light & Power Company of East Worcester, which has furnished electrical service here for nine years, has been obliged to close down its plant.

ROCHESTER, N. Y.—Contract has been awarded by George Keith, 155 Exchange Street, to A. Friederich & Sons Company, 710 Lake Avenue, Rochester, for the construction of a new one-story power house, 25 ft. by 50 ft., at his plant to cost about \$10,000.

SOUTHAMPTON, N. Y.—At a special meeting to be held Dec. 19 the stockholders of the Suffolk Light, Heat & Power Company will vote on the resolution to transfer its franchise and property to the Long Island Lighting Company of Northport.

SYRACUSE, N. Y.—The Board of Contract and Supply has awarded the contract for electrical fixtures at the Delaware School to the Southwick Electrical Company of Cortland, N. Y., at \$3,000.

BLOOMFIELD, N. J.—Plans have been filed by the Power Specialty Company, 111 Broadway, New York City, for the construction of a new plant on Locust Avenue, to cost about \$31,000. The company manufactures super-heaters, etc.

ELIZABETH, N. J.—Bids will be received by the Board of Public Works, City Hall, Elizabeth, until Dec. 27 for the following work: (1) For furnishing two 75-hp. horizontal electric motors, complete with hand control equipment and appurtenances; (2) for furnishing the necessary wiring, conduit, insulators, connectors and all material and appurtenances, together with the necessary labor for delivering the motors, control equipment, etc., covered by item No. 1, to the sewage pumping station on Clarkson Avenue, near Summer Street. Specifications may be seen at the office of the city engineer, City Hall. Thomas E. Collins is city engineer.

HOPEWELL, N. J.—Improvements to the street-lighting system are under consideration by the Borough Council. It is proposed to replace the lamps now in use with larger candlepower units.

JERSEY CITY, N. J.—Plans have been prepared for the erection of an addition, about 50 ft. by 50 ft., to the local power house of Swift & Company, at 154 Ninth Street.

JERSEY CITY, N. J.—Bids will be received by the trustees of the free public library, Jersey Avenue and Montgomery Street, Jersey City, until Dec. 27 for the installation of new lighting fixtures in the new library building now being erected on Zabriskie Street. E. W. Miller is secretary.

MORRISTOWN, N. J.—The Board of Aldermen has awarded the contract for lighting the streets of the city for a period of five years to the Morris & Somerset Electric Company of Morristown.

NEWARK, N. J.—Plans have been filed by the Alcohol Products Company, Blanchard Street, for the erection of a new one-story power house at its works, for which contract has been awarded to Frederick Kilgus, 13 South Sixth Street, Newark.

ORANGE, N. J.—A permit has been granted to the Radium Luminous Material

Corporation, 166 Alden Street, for the construction of an addition to its plant.

PERTH AMBOY, N. J.—Extensions and improvements to the street-lighting system are under consideration by the Board of Aldermen. An appropriation of \$25,000 for street lighting during 1918 has been approved.

BIRDSBORO, PA.—The Borough Council has awarded the Birdsboro Electric Company a contract for lighting the streets of the borough for a period of five years.

BRADFORD, PA.—Charters have been granted to the Bradford Township, Foster Township, Keating Township, Lafayette Township, Port Allegany and Smethport Power companies. Each company is capitalized at \$5,000. Milwood Oliver is treasurer.

COALDALE, PA.—Plans are being prepared by Lewis Stockton, 35 West Thirtieth Street, New York, N. Y., for the construction of a power house at the Panther Creek Valley Hospital, to cost about \$8,000.

HARRISBURG, PA.—Plans are being prepared by Clark E. Diehl, city electrician, for extensions and improvements to the underground system for the police and fire-alarm departments.

HARWOOD, PA.—The new 15,000-hp. turbo-generator at the local plant of the Harwood Electric Company has been put in operation. A third unit of 15,000 hp. is to be installed in the near future.

LANCASTER, PA.—The Conestoga Transmission Company has filed notice of an issue of \$70,000 in capital stock to provide for extensions, improvements, etc.

LANCASTER, PA.—Preparations are being made by the Atlas Powder Company for the installation of electric motors to operate the new powder plant now being erected at Reynolds.

LANCASTER, PA.—The Edison Electric Company has filed notice with the Public Service Commission of an issue of \$50,000 in capital stock, the proceeds to be used for extensions, improvements, etc.

LANCASTER, PA.—The Lancaster County Railway & Light Company has filed notice with the Public Service Commission of an increase in its capital stock from \$2,500,000 to \$3,750,000 for expansion.

LANCASTER, PA.—Charters have been granted to the Farmers' Electric Companies of Conestoga, Pequea and Marti. Each company is capitalized at \$5,000 and the incorporators are: John H. Ware, Jr., C. M. Ware and W. E. Edwards.

MARCUS HOOK, PA.—Plans have been filed by the Headley Good Roads Company, 301 South Thirtieth Street, for the erection of a new power house and shop building, to cost about \$75,000. Contract for building has been awarded.

MASONTOWN, PA.—The Youngstown Sheet & Tube Company is contemplating the construction of a new power house at its coal properties near Masontown.

PHILADELPHIA, PA.—The United States Emergency Fleet Corporation, Finance Building, has awarded contract to F. T. Ley & Company of Philadelphia for the construction of a new power house at North Bristol, to cost about \$25,000.

PHILADELPHIA, PA.—Wallace & Company have awarded contract to Henry E. Baton, 1713 Sansom Street, Philadelphia, for the construction of a new power house, about 30 ft. by 95 ft., at Eighty-first Street and Island Road, to cost about \$10,000.

PHILADELPHIA, PA.—Plans have been filed by the Philadelphia & Reading Railway Company for the construction of a new power house, 155 ft. by 215 ft., at its Erie Avenue yards. Contract has been awarded to William Steel & Sons Company of Philadelphia.

PITTSBURGH, PA.—Notice has been filed with the Public Service Commission by the Beaver County Light Company of an issue of \$600,000 in capital stock and bonds to the amount of \$565,000, the proceeds to be used for improvements, etc.

SCHUYLKILL HAVEN, PA.—Bids will be received by C. A. Faust, superintendent of the Schuylkill Haven electric light department, until Dec. 27 for the erection of a boiler house at the municipal electric-light plant. Plans and specifications may be obtained at the office of the Electric-Light Department.

SOMERSET, PA.—The Johnstown-Somerset Traction Company, which is building an electric railway from Johnstown to Jerome, a distance of 10 miles, is contemplating an extension to Boswell, 6 miles long.

DOVER, DEL.—The Rural Service Company, recently incorporated with a capital stock of \$500,000, to supply electricity for lamps and motors in Kent and Sussex and part of the eastern shore of Maryland, it is

reported, will soon begin active work in Delaware and Maryland. William G. Taylor of Wilmington and Joseph P. Bryan are among the incorporators.

BALTIMORE, MD.—The Penn Seaboard Steel Corporation, it is reported, has decided to build an addition to its works on the Delaware River, near Wilmington, Del., which will include a power house to cost about \$300,000. The cost of the entire work is estimated at about \$2,000,000.

HIGHLANDTOWN, MD.—Contract has been awarded by the Crown Cork & Seal Company, Guilford Avenue, Baltimore, to the West Construction Company, American Building, Baltimore, for the construction of a new power house in Highlandtown. The building will be about 55 ft. by 115 ft., and will cost about \$15,000.

INDIANHEAD, MD.—The Dawson Construction Company, May Building, Pittsburgh, Pa., submitted the lowest bid (\$39,000) for the construction of an addition to the power house at the naval proving ground at Indianhead.

MOUNT SAVAGE, MD.—Plans are being considered by the United Bid Vein Coal Company for equipping its plant throughout for electrical operation.

ANSTED, W. VA.—The Mill Creek Colliery Company, it is reported, will rebuild its power plant, recently destroyed by fire, causing a loss of about \$40,000.

DUNBAR, W. VA.—The Dunbar Traction Company, it is reported, will rebuild its electric power plant and car barns, recently destroyed by fire, causing a loss of about \$75,000.

NEWPORT NEWS, VA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., has awarded contract for the construction of an electrical school and general school at the naval operating base at Hampton Roads to Harwood & Moss, of Newport News, at \$297,750.

NORFOLK, VA.—Surveys, it is reported, are being made by the Virginia Railway & Power Company for an extension to Pig Point.

NORFOLK, VA.—Steps have been taken to install an ornamental lighting system on Freemason Street, from Church to Boush Street.

PETERSBURG, VA.—The Petersburg & Appomattox Railway Company is contemplating the construction of a central heating plant at Lakemont, near Petersburg. F. A. Bishop of Petersburg is architect.

ROSSLYN, VA.—Plans have been prepared by the Chesapeake & Potomac Telephone Company of Baltimore, Md., for the construction of a new telephone exchange in Rosslyn. McKenzie, Voorhees & Gmelin, 1123 Broadway, New York, N. Y., are architects.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Puget Sound, Wash., Schedule 1638—1000 ft. rubber-insulated, interior communication cable, 1000 ft. lighting and power wire, 10,000 ft. single-conductor lighting and power wire, 5000 ft. two-conductor lighting and power wire. Various, Schedule 1637—70,000 sq. ft. insulating, high-pressure blocks; Schedule 1635—miscellaneous flexible voice tubing. Applications for proposals should designate the schedule desired by number.

North Central States

EATON RAPIDS, MICH.—At an election held recently the proposal to issue \$30,000 in bonds to purchase the Smithville water power was carried.

MENOMINEE, MICH.—The Menominee Electric Manufacturing Company, manufacturer of electric fans and other appliances, has accepted the proposal of the business men at Cairo, Ill., to remove its business to that city about Feb. 1. The plans provide for the erection of a fireproof plant, including a foundry, on a three-acre site. The company will be reorganized with a capital stock of \$250,000. The plant in Menominee will continue in operation at least eight months longer.

THREE RIVERS, MICH.—The City Council has decided to purchase a transformer and other equipment necessary to change the city lighting system from two to three phase. The cost of the improvements is estimated at \$700.

CLEVELAND, OHIO.—The American Steel & Wire Company, which is erecting a coke plant on Harvard Avenue, to cost about \$400,000, will use all kinds of unloading machinery and will install from five to seven boilers. Several hoisting and magneto cranes, it is understood, will be re-

quired. The engineering department of the company is located in the Western Reserve Building, Cleveland.

CLEVELAND, OHIO.—The Board of Education is considering the erection of two new types of school buildings during the coming year, one a 30-room, one-story building, the other a three-story building without corridors and to adjoin a separate building for gymnasium, auditorium and swimming pool and perhaps a separate structure for a power house.

CLEVELAND, OHIO.—Owing to a disagreement between the city officials and the Cleveland Railway Company no lighting system has been installed on the lower level of the new high-level viaduct which connects the east and west sides of the city. At a meeting held recently it was decided that the city would have full charge of installing the system, which will consist of 60 electric street lamps and equipment, to cost from \$15,000 to \$18,000.

COLUMBUS, OHIO.—The Columbus Railway, Power & Light Company has petitioned the Public Utilities Commission for permission to issue \$276,000 in capital stock and \$1,000,000 in bonds, the proceeds to be used to pay for extensions and improvements in connection with its new plant.

DELLROY, OHIO.—The Village Council is negotiating with the Van Kirk Coal Company for the installation of an electric-light system here. The coal company is building a large tippie near Dellroy and will install an electric generating plant.

LIMA, OHIO.—A petition has been presented to the City Council by business men on Main Street and the public square asking that the ornamental lighting system be extended to those thoroughfares.

MANSFIELD, OHIO.—Work, it is reported, has begun on the erection of a new plant, 50 ft. by 100 ft., for the Phoenix Electric Company.

OVERLIN, OHIO.—Owing to the lack of coal and gas the Oberlin Gas & Electric Company will secure energy from the Lorain County Electric Company of Elyria. The County Commissioners have granted the Oberlin company permission to erect a transmission line from South Amherst to Oberlin, over which energy will be transmitted.

SALINEVILLE, OHIO.—At an election held recently the proposal to issue \$25,000 in bonds for the construction of a municipal electric-lighting plant was carried.

SIDNEY, OHIO.—The Sidney Electric Company, which has purchased the municipal electric plant at De Graff, is planning to erect an electric transmission line from Sidney through Pemberton, Quincy and into De Graff to supply these towns with electricity. A 24-hour service will be established.

TOLEDO, OHIO.—Application has been made by the Kelly Island Lime & Transport Company for a 60-kw. load to be taken from the Marblehead station of the Northwestern Ohio Railway & Power Company, the former to furnish all transformers and to erect approximately 100 ft. of line.

URBANA, OHIO.—The capital stock of the Urbana Light, Heat & Power Company has increased its capital stock from \$150,000 to \$200,000.

MAYFIELD, KY.—In a decision handed down by Judge C. D. Newell of Maysville, as a special judge, in the suit of the city of Mayfield against the Mayfield Water & Light Company for possession of the water and light plant, rendered a judgment fixing the price of the plant at \$272,000, this being the only point in contest. The company asked not less than \$325,000 for the plant and the city did not want to pay more than \$200,000.

ALBION, IND.—The Hawks Electric Company of Goshen, it is reported, has submitted a proposal to the Town Board to furnish electricity for lamps and motors. The town of Albion operates a municipal water and light plant.

CLINTON, IND.—The Wabash Valley Electric Company has increased its capital stock by \$150,000.

CORYDON, IND.—The Town Board has entered into a contract with the Interstate Public Service Company for lighting the streets of the town. Under the terms of the contract the company agrees to make improvements to the system, to cost between \$15,000 and \$20,000. Frank Wright is local agent of the company.

FORT WAYNE, IND.—The Board of Public Works is considering plans for extensions to the municipal electric light plant, involving an expenditure of about \$25,000. If plans are approved, it is understood that bids will be asked for the new building at once.

GARY, IND.—The Gary Street Railway Company has been granted a permit for the

erection of a brick substation on Jackson Street near Eleventh Avenue, to cost about \$8,000. The building, which is practically completed, will be used as a transformer station for all the city lines of the company.

GOSHEN, IND.—The Indiana & Michigan Electric Company is erecting an electric transmission line from Elkhart to Ligonier for the purpose of transmitting electricity generated at Hen Island.

JEFFERSONVILLE, IND.—The United Gas & Electric Company is erecting heavy wires to Jeffersonville to supply energy to the government depot, where all surroundings are to be illuminated by electric lamps.

MARION, IND.—The United States government has awarded a contract to the Delta Electric Company for 20,000 electric lanterns of a special type for the navy.

CICERO, ILL.—The Western Electric Company of Chicago is planning to build a manufacturing building, 37 ft. by 249 ft., adjacent to a building, six stories, recently completed at its local plant.

DECATUR, ILL.—The capital stock of the Decatur Railway & Light Company has been increased from \$1,375,000 to \$1,600,000.

EDWARDSVILLE, ILL.—The capital stock of the Madison County Light & Power Company has been increased from \$335,000 to \$500,000, the proceeds to be used for extensions to its system.

MATTOON, ILL.—The Central Illinois Public Service Company of Mattoon and the Canton (Ill.) Gas & Electric Company have filed a joint petition with the Illinois Public Service Commission asking permission for the latter company to erect high-tension transmission lines from Ipava to Lewistown, and for the former company to build a transmission line from the West Havana substation, across the Illinois River from Havana, to the southern terminus of the Canton Gas & Electric Company's present line; also for the Canton Gas & Electric Company to construct a transmission line to serve the Liverpool Drainage and Levee District, and also for the approval of the commission of an incorporate working agreement between the two companies.

BEAVER DAM, WIS.—Preparations are being made by the Wisconsin Power, Light & Heat Company to use electricity from the power plants on the Wisconsin River for the local system as soon as the transmission line is completed as far as this city.

DE PERE, WIS.—The Western Steel & Manufacturing Company is considering extensions to its plant and power house, to cost approximately \$25,000.

THORP, WIS.—The council is considering purchasing the local plant of the Wisconsin-Minnesota Light & Power Company of Eau Claire.

WAUSAU, WIS.—The Wisconsin Valley Electric Company is contemplating improvements to its local plant, involving an expenditure of about \$100,000. M. C. Ewing is general manager.

DODGE CENTER, MINN.—Bids will be received at the office of the county auditor of Dodge County, Court House, Mantorville, until Jan. 8, 1918, for construction of county home buildings on a site approximately 1½ miles east of the city of Dodge Center, including general contract work, plumbing, heating and electrical work. Copies of plans and specifications may be obtained at the office of Alden & Harris, architects, Exchange Bank Building, St. Paul, Minn., upon deposit of \$10.

HIBBING, MINN.—The Water and Light Commission is considering erecting another transmission line to supply more power to operate the pumps or the building of a steam plant at the wells south of the village.

NASHWAUK, MINN.—The municipal electric-light plant was recently destroyed by fire, causing a loss of about \$2,000. An emergency steam plant is now furnishing the service. Electricity for operating the municipal system is secured from the Virginia station of the Great Northern Power Company.

WABASH, MINN.—R. E. Jones & Company, who own and operate the local electric-lighting system, are contemplating placing its wires in underground conduits in the downtown district.

ALBURNETT, IOWA.—The local telephone exchange building was recently destroyed by fire.

ELDORA, IOWA.—The local electric-light plant, it is reported, was recently destroyed by fire.

MARSHALLTOWN, IOWA.—Preliminary plans and estimates are being prepared for the installation of new machinery in the municipal electric-light plant. The City

Council is considering the purchase of the property of the Iowa Railway & Light Company.

VAIL, IOWA.—The contract for installation of electric-lighting system has been awarded to the Electric Appliance Company of Chicago, Ill., at \$8,000. An electric transmission line will be erected from the municipal plant at Denison to supply energy to operate the system.

APPLETON CITY, MO.—Preliminary plans are being prepared for extensions and improvements to the municipal electric light plant, which will involve an expenditure of about \$15,000. The plans provide for the installation of new steam and electric machinery. W. B. Rollins & Company, 209 Railway Exchange, Kansas City, are engineers.

WARRENTON, MO.—The local electric-light plant has been purchased by August F. Sievert, who took possession Dec. 1.

ESMOND, S. D.—The installation of an electric-lighting system in Esmond is reported to be under consideration.

FAITH, S. D.—The installation of a municipal electric-light plant in Faith is reported to be under consideration.

BROKEN BOW, NEB.—The installation of a new engine at the municipal electric-light plant is under consideration.

WESTERN, NEB.—Contract, it is reported, has been awarded to I. E. Watenpugh of Lincoln for construction of brick addition to power plant.

BAXTER SPRINGS, KAN.—The Empire District Electric Company is contemplating extensive improvements to its local system, including remodeling the present building and enlarging the plant.

BURNS, KAN.—At an election to be held Dec. 27 the proposal to issue \$10,000 in bonds for the construction of an electric-light plant in Burns will be submitted to the voters. C. A. Beebe is city clerk.

CONWAY SPRINGS, KAN.—DeLos De Tar, owner of the local electric-light plant and ice factory, having been called in the selective draft, is planning to sell the property.

McFARLAND, KAN.—The Alma (Kan.) Light & Ice Company is now supplying electrical service in McFarland.

OAKLEY, KAN.—W. M. Prather, it is reported, is contemplating building an ice factory in Oakley.

RANDOLPH, KAN.—The erection of an electric transmission line from the plant of the Rocky Ford (Kan.) Electric Company to Randolph is under consideration.

ROCKY FORD, KAN.—The Rocky Ford Electric Company is considering erecting an electric transmission line to Rossville to furnish electrical service there.

Southern States

FREMONT, N. C.—Bids will be received by the Mayor and Board of Commissioners, Town Hall, Fremont, until Jan. 3, 1918, for improvements to the municipal electric-light plant, consisting of 22,000-volt steel wire transmission line, about 10 miles in length, substation, arc-lamp and electric distribution systems. Plans and specifications are on file at the office of the town clerk, Fremont, and at the office of B. O. Austin, consulting engineer, Raleigh, N. C.

MARION, N. C.—The Cross Cotton Mills Company is planning to build an addition to its power plant, including the installation of an additional boiler.

ATLANTA, GA.—The City Council is considering the installation of an electric generating plant at the garbage crematory (using refuse for fuel), to cost from \$60,000 to \$70,000. E. R. Turner is city electrician.

BRUNSWICK, GA.—The City & Suburban Railway Company contemplates extending its car line to the shipbuilding plant of the United States Maritime Corporation.

NASHVILLE, GA.—The City Council is considering the installation of electric lamps on the public square.

WEST PALM BEACH, FLA.—The Associated Realty Investors, which is developing a residential section, 125 acres, 1 mile south of West Palm Beach, is planning to install an electric-light system in connection with the proposed project. Alfred H. Wagg is president.

MOBILE, ALA.—The Mobile Builders' Equipment Company, recently incorporated, has acquired building and machinery for the manufacture of doors, sash, blinds and frames, etc. The company contemplates equipping the plant for electrical operation, replacing steam power. James K. Glennon, 51 North Royal Street, is president.

MONTGOMERY, ALA.—The Montgom-

ery Light & Water Power Company is planning to erect an electric transmission line from its plant in North Montgomery to the aviation field.

FORT SMITH, ARK.—The City Council is considering a proposal submitted by the Fort Smith Light & Traction Company for a contract for lighting the streets of the city.

STUTTGART, ARK.—The City Council has granted S. R. Morgan & Company of Little Rock a franchise to construct and operate an electric-light plant in Stuttgart for a period of 50 years. Under the terms of the franchise the company must begin work within 60 days and the plant must be completed within 10 months. The company owns and operates electric-light and power plants in Beebe, Ashdown, Des Arc, El Dorado, Fordyce and Warren. It is also financing an electric transmission line from Fort Smith to Russellville, a distance of 65 miles. Energy for the line, which will supply electricity to Alma, Mulberry, Ozark, Altus, Cole Hill, Paris, Clarksville and the coal mines at Hartman and Spadra, will be purchased from the Fort Smith (Ark.) Light & Power Company. The line will be completed by the first of January.

KENNER, LA.—The Council is considering an issue of \$10,000 in bonds for the installation of an electric-lighting system.

BARTLESVILLE, OKLA.—Mid-Co Gasoline Company, it is reported, is erecting a large power plant south of Bartlesville, which when completed will furnish electricity for the oil fields of Oklahoma. The cost of the plant is estimated at \$2,000,000.

COMMERCE, OKLA.—The Triangle Mines Company is planning to install an electric-light and power plant in connection with its proposed 150-ton stamp mill. N. C. Barry is president.

LAWRENCE, OKLA.—Bonds to the amount of \$13,000 have been voted to purchase the electric-lighting system.

NACOGDOCHES, TEX.—The City Council is considering installing additional equipment and machinery in the municipal electric-light plant. It is proposed to double the output of the plant.

RUSK, TEX.—The Texas Steel Company of Beaumont has purchased the Rusk foundry property, which includes iron furnace, pipe foundry, electric-light plant, dwellings, etc., at \$112,500. The new owner it is understood, contemplates general improvements and the rehabilitation of the blast furnace.

WACO, TEX.—The City Commission has decided to install an ornamental lighting system in Waco.

Pacific and Mountain States

AUBURN, WASH.—The Valley Gas Company, which was recently granted a franchise in Auburn, it is understood, will begin work on the installation of the system as soon as materials can be secured.

CLE ELUM, WASH.—The City Council is negotiating with the Northwestern Improvement Company to furnish electricity for lamps and motors in the South Cle Elum Addition, lying on the south side of the Yakima River. It is proposed to make an extension from the South Cle Elum system.

SEATTLE, WASH.—The Board of Public Works has awarded the Baker-Joslyn Company the contract for supplying the city with 85,500 ft. of copper for the lighting department, at \$23,927.

SPOKANE, WASH.—The Doerr-Mitchell Electric Company has been awarded the contract for the installation of the lighting system in the new Crescent store. The plans provide for about 375 fixtures to cost about \$4,000. The company recently secured the contract for equipping the new Grant County court house at Ephrata with electrical fixtures, at \$1,200.

TACOMA, WASH.—The City Council has decided to submit the proposal to issue additional bonds to buy and develop a power site to the voters next spring.

WASHOUGAL, WASH.—The County Commissioners have granted the Northwestern Electric Company a franchise to extend its transmission lines in Washougal and also in Oak Park.

WHITE SALMON, WASH.—The Pacific Power & Light Company has purchased two lots in White Salmon on which it proposes to erect a large station.

BEND, ORE.—Plans have been prepared by the White Pine Lumber Company of Bend for the construction of a lumber mill at Pringle Falls. The proposed plant will have a daily capacity of 80,000 ft. and will cost about \$140,000. The plans also provide for building a hydroelectric power plant of 2250 hp.

HALFWAY, ORE.—An electric-lighting system, it is expected, will be installed in Halfway as soon as the transmission line reaches the edge of the valley.

ALPAUGH, CAL.—The San Joaquin Light & Power Company has begun work on the erection of a new substation, to be located 4 miles south of Alpaugh. A high-tension transmission line will be extended from Corcoran.

FAIROAKS, CAL.—Application has been made to the State Railroad Commission by R. A. Rose, owner of the local electric plant, to execute a promissory note for \$5,500, the proceeds to be used to take up former notes and to pay for additions and improvements to the plant.

FORT BRAGG, CAL.—The Fort Bragg Electric Light Company has decided to install meters throughout its entire system. Additional street lamps will be erected where necessary.

FRESNO, CAL.—The Fresno Interurban Railway Company is contemplating the construction of an extension from Sunmaid to Centerville, a distance of 7 miles, through a new orange district.

LOS ANGELES, CAL.—The Southern California Edison Company has been awarded a contract by the Board of Supervisors to furnish electricity for lighting the El Modena, Garden Grove and Tustin lighting districts with electricity.

LOS ANGELES, CAL.—The United Power Company of Los Angeles, which has acquired the properties of the Electric Power Company in San Gabriel Canyon, it is reported, contemplates the construction of a new power plant at Iron Fork.

MODESTO, CAL.—Improvements are being made to the Modesto plant of the Sierra & San Francisco Power Company, which will cost about \$30,000.

SAN BERNARDINO, CAL.—Improvements and extensions are under way by the Southern California Edison Company, which will involve an expenditure of about \$200,000 and will include the construction of a joint pole line with the Southern Sierras Power Company out of E Street, rebuilding of many lines within the city, erection of a new "tie-in" line from the Fontana Company's power plant north of Rialto, and a new line along Base Line into this city, in addition to a new line to connect with the Mentone line and a connection with the 60,000-volt line from the Long Beach plant, and the construction of a warehouse and service headquarters at 240 E Street.

SAN FRANCISCO, CAL.—Plans are being prepared for the construction of a new shipbuilding plant for the Pacific Coast Shipbuilding Company, which will include slips, docks, power plant, foundry and a number of machine shops, to cost about \$500,000, in the upper bay near Port Costa. Frederick H. Meyer is architect. Henry T. Scott, telephone executive and former owner of the Union Iron Works, is interested in the company.

MISSOULA, MONT.—The Northern Pacific Railway Company is installing a telephone system between the headquarters of the Rocky Mountain division in Missoula and Livingston, and points east, as well as Spokane and coast points. The company, it is stated, plans ultimately to institute communication between St. Paul and Tacoma. The present project calls for connection of 42 stations by telephone.

Canada

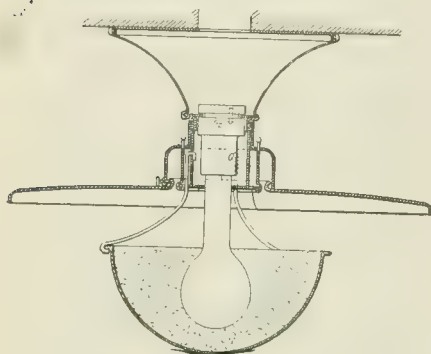
VICTORIA, B. C.—Plans have been filed with the registrar of joint stock companies by the British Columbia Telephone Company for laying another submarine telephone cable across False Creek. The work, it is understood, will begin within the next few weeks.

BRIDGEBURG, ONT.—The Board of Aldermen has authorized Mayor Atwood to enter into a contract with the Canadian Niagara Power Company of Niagara Falls for energy to operate the new duplex pumps in the municipal pumping station.

ST. CATHARINES, ONT.—Work is progressing on the construction of the Chippewa Hydroelectric Power Canal which will carry water from the Niagara River at Chippewa through the Chippewa River to Queenstown. When completed this canal will supply 900,000 hp.

TORONTO, ONT.—Extensions to the power plant of the Ontario Power Company, involving an expenditure of over \$1,000,000, and which will make available 25,000 additional hp. by July next and another 20,000 hp. within the next three or four months has been decided upon by the Hydro-Electric Power Commission of Ontario. All contracts will be made through the Ontario Power Company for the Hydro-Electric Power Commission.

- 1,248,444. **REGULATING DEVICE**; Porter H. Brace, Pittsburgh, Pa. App. filed March 8, 1917. For controlling mechanisms or apparatus in accordance with predetermined conditions.
- 1,248,457. **MECHANISM FOR OPERATING RAILWAY SIGNALS**; James W. Coffman, Springfield, Ill. App. filed May 3, 1915. Improvement.
- 1,248,459. **IGNITION MECHANISM**; Frank Conrad, Pittsburgh, Pa. App. filed April 8, 1914. Improvement.



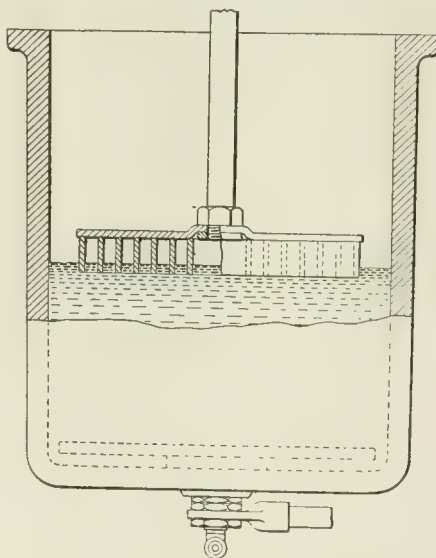
1,248,187—Lighting Fixture

- 1,248,461. **ELECTROMAGNETIC DEVICE**; Gustavus C. Crawford, East Orange, N. J. App. filed Nov. 17, 1916. Pole changers.
- 1,248,466. **TELEPHONE-EXCHANGE SYSTEM**; Bert G. Dunham, Hawthorne, N. J. App. filed July 20, 1915. To provide a simple circuit arrangement for selector switches and to insure the proper selecting operation of such switches.
- 1,248,469. **SIGNAL**; William F. Egelhofer, New York, N. Y. App. filed Aug. 10, 1916. For automobiles.
- 1,248,474. **ALTERNATING-CURRENT MOTOR**; Valere A. Flynn, St. Louis, Mo. App. filed Dec. 15, 1916. Simple means for adjusting the speed of such motors.
- 1,248,479. **AUTOMATIC TELEPHONE-EXCHANGE SYSTEM**; Charles L. Goodrum, New York, N. Y. App. filed Sept. 7, 1915. Means for inserting in an automatic telephone exchange system an overflow finder which acts as a substitute for or duplicate of the finder with which it may be associated.
- 1,248,484. **SYSTEM OF DISTRIBUTION**; Arthur J. Hall, Wilkinsburg, Pa. App. filed Feb. 17, 1915. Direct-current railway systems.
- 1,248,495. **ELECTRODE FOR SLIP REGULATORS**; George W. Huey, Wilkinsburg, Pa. App. filed June 18, 1913. Provides an electrode having a structure upon which bubbles have practically no tendency to adhere, while the dispersal of the bubbles is uniform and at a rate corresponding to their formation.
- 1,248,497. **VAPOR-ELECTRIC APPARATUS**; Ray P. Jackson, Edgewood Park, Pa. App. filed April 6, 1914. Applies to the structure of the wall of such apparatus in the neighborhood of the electrodes.
- 1,248,498. **SUSPENSION DEVICE FOR INSULATORS**; Ray P. Jackson, Edgewood Park, Pa. App. filed Dec. 4, 1915. Readily separable.
- 1,248,508. **ELECTRIC SWITCH**; Pierre L. Leisse, Billancourt, France. App. filed Dec. 1, 1913. For use in combination with variable-speed dynamo-electric machines to maintain the voltage of the dynamo substantially constant.
- 1,248,511. **AMMETER**; Paul M. Lincoln, Pittsburgh, Pa. App. filed May 16, 1914. May serve as a maximum-demand meter also.
- 1,248,512. **BRAKE APPARATUS**; David L. Lindquist, Yonkers, N. Y. App. filed July 7, 1914. Electric elevator.
- 1,248,515. **TELEPHONE-EXCHANGE SYSTEM**; Alben E. Lundell, New York, N. Y. App. filed Oct. 2, 1916. Adapted to service in multi-office districts.
- 1,248,519. **STARTING SWITCH**; Joseph N. Mahoney, Wilkinsburg, Pa. App. filed Feb. 21, 1914. Means for stopping the movable-contact member in each of its correct successive positions.
- 1,248,527. **ELECTRICAL MEASURING INSTRUMENT**; Walter G. Mylius, Wilkinsburg, Pa. App. filed Aug. 9, 1916. Light-load adjusting devices for such instruments

Record of Electrical Patents

Notes on United States Patents
issued on December 4, 1917

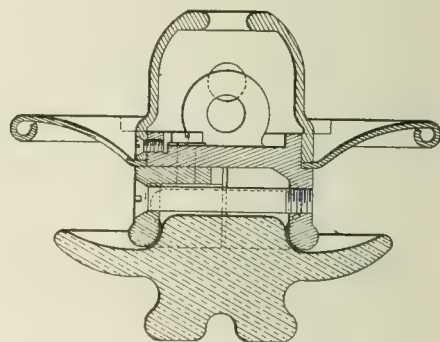
- 1,248,528. **CLAMP-TYPE TERMINAL**; Harry C. Nagel, Wilkinsburg, Pa. App. filed Feb. 7, 1916. Large current-carrying capacity which requires a few bolts only.
- 1,248,531. **BALANCING MEANS FOR PHASE-CONVERTING SYSTEMS**; Stanley G. Nottage, Wilkinsburg, Pa. Application filed Dec. 9, 1916. Improvement.
- 1,248,544. **METHOD OF MAKING ELECTRIC-SWITCH JAWS AND THE LIKE**; Karl C. Randall, Edgewood Park, Pa. App. filed April 12, 1915. Improvement.
- 1,248,559. **HIGH-TENSION SUSPENSION INSULATOR**; Edson O. Sessions, Chicago, Ill. App. filed July 10, 1916. For high-tension wireless work.
- 1,248,566. **ELECTRICAL DEVICE**; Frank M. Slough, Elyria, Ohio. App. filed May 13, 1915. In connection with telephone signaling systems.
- 1,248,568. **SINGLE-PHASE POWER-FACTOR-MEASURING DEVICE**; Benjamin M. Smith, Turtle Creek, Pa. App. filed July 3, 1914. Adapts a polyphase power-factor meter for operation on a single-phase circuit.



1,248,495—Electrode for Slip Regulators

- 1,248,569. **ELECTRICAL APPLIANCE FOR CONDUIT OUTLET BOXES**; Floyd D. Smith, Syracuse, N. Y. App. filed May 6, 1911. Improvement.
- 1,248,572. **SWITCH LOCK**; Arvid P. Sunnergren, Pittsburgh, Pa. App. filed Nov. 18, 1915. Improvements.
- 1,248,574. **BRUSH-HOLDING DEVICE**; Egbert M. Tingley, East Orange, N. J. App. filed Feb. 7, 1917. Formed substantially of punched parts.
- 1,248,575. **SNAP SWITCH FOR SADIRONS AND THE LIKE**; Samuel Trood, Edgewood Park, Pa. App. filed Jan. 28, 1913. Improvement.
- 1,248,603. **PANELBOARD CONSTRUCTION**; Frederick L. Benzon, Plainville, Conn. App. filed May 12, 1916. Facilitates the assembling of the panel units or sections.
- 1,248,612. **DISTRIBUTOR ARM**; John F. Cavanagh, Meriden, Conn. App. filed June 11, 1912. Ignition apparatus.
- 1,248,624. **ELECTRIC REGULATION**; John L. Creveling, New York, N. Y. App. filed Jan. 15, 1910. Automatic.
- 1,248,632. **POLYPHASE ELECTRIC FURNACE**; Joseph L. Dixon, Detroit, Mich. App. filed Jan. 20, 1917. Control.

- 1,248,637. **ELECTRIC LOG**; Lloyd C. Eddy, Buffalo, N. Y. App. filed Dec. 4, 1916. Improvements.
- 1,248,638. **FLAME-PROOF INSULATING COMPOSITION**; Carleton Ellis, Montclair, N. J. App. filed Aug. 5, 1915. Improvements.
- 1,248,663. **SPEED-CONTROLLING MECHANISM FOR BLOCK-SIGNAL SYSTEMS**; Marsena R. Julian, Birmingham, Ala. App. filed April 22, 1915. Improvements.
- 1,248,688. **PORTABLE ELECTRIC LAMP**; Engelbert Ludescher, Chicago, Ill. App. filed May 16, 1917. Can be used as a flashlight, lantern, electric torch or candle, and the like.
- 1,248,699. **TERMINAL BOX**; Chester C. Oberly, Chicago, Ill. App. filed March 10, 1916. For train lighting.
- 1,248,719. **SIGNAL LAMP**; Gordon E. Roeding and Edward B. Roeding, Detroit, Mich. App. filed Dec. 21, 1914. For motor vehicles.
- 1,248,738. **ENGINE-RESTING DEVICE**; William E. Somerville, Coal City, Ill. App. filed Jan. 27, 1916. Combined in a single structure and arranged in a convenient position for the operator.
- 1,248,741. **SAFETY DEVICE FOR ELECTRICAL CIRCUITS**; Maximilian H. Spielman, New York, N. Y. App. filed March 23, 1916. In connection with burglar alarms on windows.
- 1,248,848. **SELF-STARTING DEVICE FOR STORAGE-BATTERY PLANTS**; Julius H. Gugler, Milwaukee, Wis. App. filed May 16, 1913. Improvement.
- 1,248,868. **SEMI-AUTOMATIC TELEPHONE-EXCHANGE SYSTEM**; Morton L. Johnson, Chicago, Ill. App. filed May 6, 1910. Provides a cord circuit of universal utility which may be used between different kinds of telephone lines and which will automatically adjust itself.
- 1,248,870. **ENGINE STARTER**; John J. Kane, Milwaukee, Wis. App. filed Feb. 9, 1914. Motor vehicles.
- 1,248,877. **SPARK-PLUG TESTER**; William D. Luce, Haverhill, Mass. App. filed Jan. 31, 1917. Adaptable to different conditions of use and also susceptible of reduction in size.
- 1,248,894. **ELECTRIC THERMOSTAT**; Charles L. Norwood, Philadelphia, Pa. App. filed May 2, 1917. Improvements.
- 1,248,927. **ELECTRIC WELDING APPARATUS**; Gustave H. Schkommodau, Cincinnati, Ohio. App. filed Oct. 2, 1916. For welding metal in sheet form.
- 1,248,934. **POCKET FLASHLIGHT**; Edward W. Seymour, New York, N. Y. App. filed Sept. 23, 1916. Suitable casing.
- 1,248,942. **ELECTRIC DETECTOR CIRCUIT**; Frank J. Sprague, Sharon, Conn. App. filed Dec. 31, 1914. Improvements.
- 1,248,968. **AUTOMOBILE-LIGHTING APPARATUS**; Frank E. Wilson, London, England. App. filed Nov. 28, 1914. Combined switch and meter box.



1,248,559—High-Tension Suspension Insulator

- 1,248,978. **ATTACHMENT PLUG FOR CONNECTING DRY CELLS TO INCANDESCENT-LAMP HOLDERS**; Charles E. Youmans, Yonkers, N. Y. App. filed Nov. 23, 1915. Improvements.
- 1,248,979. **TELEPHONE-EXCHANGE SYSTEM**; Frederick V. Young, Newark, N. J. App. filed Feb. 17, 1917. Signaling means.
- 1,248,998. **MICROPHONIC ATTACHMENT FOR TELEPHONE TRANSMITTERS**; Walter C. Bellows, Chicago, Ill. App. filed July 12, 1916. Means by which whispered speech will be rendered clearly audible.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN

Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70

NEW YORK, SATURDAY, DECEMBER 29, 1917

No. 26

Honor to Whom Honor Is Due

OF THE 650,000,000 tons of coal which will be mined this year only 4 per cent represents the entire electric central station requirements of the country, the greater part of the electrical energy now used being generated in hydroelectric stations. By utilizing water power the central station industry conserves nature's resources, releases millions of tons of coal, the cars necessary to transport it and the labor required to mine it, while the coal it consumes, as the Fuel Administrator himself has graciously allowed, is burned most economically. In view of the wide publicity given to the sign-lighting orders which indirectly involve the electric lighting industry, it is well that these facts be constantly borne in mind. Fuel saving, however slight, is vitally necessary in the present world crisis, but we suggest that as a matter of self-interest any striving for psychological effect be definitely labeled as such. From the usual tone of press reports the general public is led to believe that the central station industry is most profligate in the use of coal, whereas just the opposite is true. There is nothing in the entire engineering history of the industry which, even in the present emergency, warrants anything but praise.

Daylight Saving

IN VIEW of the general efforts at economy the present session of Congress is likely to see another move toward the passage of a daylight-saving bill, which, in view of the agitation last year and the general results attained abroad, is quite likely to be made law. As we have intimated in discussing the matter previously, the actual decrease in the use of electric light resulting from daylight saving is not likely to be large; indeed, it is more than probable that it will be quite wiped out by increase in night work and the collateral uses of electricity. To sum up the discussion during 1917, most bodies which considered the matter at all were inclined to favor it. The only really adverse comment came from somewhat academic sources, and the objections raised were not such as have proved of material importance on the other side of the Atlantic.

With these companies, as with other industries, the situation is one which demands, not business as usual, but an adaptation of business to meet changed conditions. No man has a right in the face of the great war to expect to go on his way undisturbed by the tremendous struggle. He has a right to expect a chance to make himself profitably useful, whatever his original business, but his activities must change with the requirements of the situation. Similarly, supply com-

panies must not anticipate their wonted distribution of business, although there is every reason to believe that there will be plenty of it in the aggregate. The soundest general policy to pursue would seem to be the intensive one of seeking out and taking over all the load which has been overlooked in the diversified efforts of the past. The amount of this, both in lighting and power, is large, and a very considerable increase can be and will be made in load taken squarely over on to the existing networks without considerable extensions, thereby increasing the load density and making better use of the costly distribution systems.

Particular attention ought to be directed toward those classes of load which actually mean increased efficiency of industry or obvious saving of fuel. As everybody knows, the balance of economy between central station supply and the isolated plant turns chiefly on the cost of fuel. The former has a great advantage in its general efficiency of utilization, and when coal supply is costly or difficult it is time for the owners of isolated plants to revise their balance sheets and see whether their expenditure has not become rather a foolish one. There is already considerable activity in taking over these isolated plants, and there is going to be far more in the future, since, however vigorous the efforts made by the Fuel Administration may be, it is a sure thing that coal prices are up to stay at least for the period of the war. Here is the place where the central station may reasonably expect to win out, despite the minor losses which may come from various small economies, among which is daylight saving.

Heaven for Housebreakers

FAR be it from us to doubt the wisdom of the Olympians, but if we were of burglarious disposition the recent call for two "lightless" nights per week would rouse in us a sentiment of profoundest gratitude. It used to be said that an electric light was as good as a policeman, and with what joy should we hail the suppression of any or all of these inconveniences to the profession of Raffles! We should judge it particularly thoughtful, too, to specify the lightless nights to be expected and to impress on the public the necessity of universally observing the same two evenings of darkness. Frankly, we have never been quite able to see why all men should abstain from pork on the same day of the week or fill up on fish on two other specified days. Indeed, the distribution of provender would be rather simplified by distribution of demand. But in this matter of the lightless nights universal agreement on the dates is really, from the standpoint of public safety,

a rather serious matter if any substantial attention is to be paid to this particular economy. We do not wish to register any kick in behalf of the electric light companies against a request to diminish the market for their product. They have shown no lack of patriotism and can be depended upon to stand by loyally, bearing their share of the public burden even though they cannot recoup themselves, as some others do, by raising prices at will. But, with all seriousness, effecting economy in fuel by the reduction of lighting may turn out to be a rather bad business.

Of course, we are not yet in the situation of London or Paris and have no need for protective darkening. The question here relates to the probable effect of systematic decrease of lighting on accidents and on crime. It certainly will not take any large experience to show positive results in these particulars, and we hope that the information thus gained will lead to general rather than specific recommendations for economizing light. This is only one of the many ways in which the individual can reduce expenditures to meet the war conditions which confront us, and it is to be judged strictly on its merits. As a measure for fuel saving we do not anticipate any startling degree of success for the new regulations. A few weeks' investigation of the load curve will tell the story. Certainly there are many more efficient ways of reducing waste of fuel much less open to serious objection. The 20 per cent or so of perfectly good fuel to be found in the ordinary ash can suggest immediate possibility of results, and the amount of coal wasted in heating practically unused rooms is another item that looms large in the total of domestic fuel expenditure.

Hope for Water-Power Conservation

WITH Congress likely to be in continuous session for many months, the coal supply short, and industries calling loudly for motive power, there must be a reasonable chance that the national legislature will at last permit the utilization of water powers on the public domain under terms that will be economically possible. Even Gifford Pinchot seems in some measure to have seen the light. In a recent letter to the press he lays down as a fundamental principle that "the thing to do with water power is to develop it. Whatever retards or restricts the development of public water powers on terms fair to the public is against public policy and hostile to the general welfare." One would suppose that this declaration might impose the duty of silence upon Mr. Pinchot, but instead he goes on to lay down half a dozen more propositions which together pretty effectively nullify his paving contract of good intentions. Briefly they are as follows: Hydraulic privileges belong to the people and should be retained as such in public hands. Where development by the public is not desired the rights should be leased for periods never exceeding fifty years, at which time the whole property would, of course, revert from the lessee to the lessor. Rates in service should be regulated by federal authority "when state or local authori-

ties fail to do so." Prompt development should be demanded since, according to Mr. Pinchot's view, "millions of water horsepower are held out of use to further the monopoly of private corporations." Finally, those who make money out of rights granted by the people should share their profits with the public, which has a right to complete information about every such business.

Now, this pronouncement is a curious complex of honest intentions and the brand of socialism affected by Trotsky. Mr. Pinchot explains that the people of the United States own about 50,000,000 undeveloped water horsepower, pretty nearly enough to meet our complete industrial requirements. What he does not state is that a very large amount of this power is at the present time so impossible to market that its usefulness must be deferred pending the growth of population and industry. Much there is, however, that could be developed and would be developed if the Bolsheviki element among so-called publicists in and out of Congress would permit it. Where water powers exist on the public domain in regions which are within the scope of prompt commercial development all are agreed that the work should be begun at once and pushed to the swiftest possible conclusion, in order to relieve the difficulties of fuel supply and to furnish power for the industries necessary to all. It will be readily granted by everybody, too, that public property should not be given away to private interests or transferred to their custody without reasonable payment therefor. So far as the consumer is concerned, it is a matter of indifference whether he pays the government or somebody else for his power, provided that it is obtained at a reasonable price for the service rendered. It is emphatically not true that it is necessary for the hydraulic privileges to remain in public hands, provided that the product obtained from them is under such control as will insure its development and distribution in such way and at such prices as shall be to the public benefit.

We do not think that "millions of horsepower" are held out of use to further monopoly. More effective monopoly could be insured by putting them into use and building up power-distribution enterprises on a gigantic scale, thereby increasing output and profits. The undeveloped water powers in private hands are undeveloped chiefly because there is no market for them within reasonable range at the present cost of construction, or because they are of a character requiring costs of development too high to be justified by the demand at present in sight. The natural course of events is that the privileges most easily developed should be first put into service, followed by the others as the certainty of market for their full utilization makes it profitable to bring them to use. As regards the powers on the public domain, those of them which are capable of development on an economically sound basis will be put to work as quickly as possible when Congress permits it on terms that will not be disastrous to those undertaking the enterprise. Right here is where Mr. Pinchot departs from the straight line of sound economics. Every public service corporation, from whatever source it derives its power, realizes its

public obligations and grants that it must be accountable for what it has received from general or local authorities by recognition of control by those authorities. What it asks is merely security against the virtual confiscation of the property which it has built up about such public privileges as have been granted to it.

Under existing statutes the right of public control of rates exists practically everywhere to the extent of regulation of prices to the consumer, and every corporation is compelled to make returns of its business in as complete a form as may be from time to time prescribed by statute. Under these rights the people of any state have power to protect themselves amply against the possible danger of extortion, and in virtue of price regulation they can and do compel public utilities to share profits with them by this means. The main issue in the premises seems to be the terms on which development of public powers should be permitted and the nature of the regulation which should be applied to them. We do not believe that the government itself will undertake the development of water powers on its own responsibility. Public ownership on a much lesser scale than this would imply has often been tried and generally found wanting. If the work is to be undertaken, on the other hand, by private capital, this cannot be secured, particularly under present conditions, unless it is reasonably assured that the investment will be a sound one and that it will be for a time long enough, and on terms reasonable enough, to give security to the investor not only for the capital put into the actual hydraulic development, but for the much greater amount necessary to secure adequate service to the consumer.

Electric Power in Rolling Mills

THOSE of our readers who are in close touch with the steel industry know to what extent electricity has been used for driving rolling mills; but very few outside the inner circle of the industry realize to what an extent the work has now been carried. Considerably more than 200 electrically driven rolling-mill plants are in operation, using, moreover, very large amounts of power even by the 1913 figures available. Since that time the business has increased considerably. The average kilowatt-hours generated per plant were little short of 10,000,000 annually, double the average output of the electric railway companies

operating in the United States. In the largest plant then in operation the annual output rose to 330,000,000 kw.-hr., an amount which is comparable with the output of the largest class of central stations. Broadly, the advantages of electric power in rolling mills are similar to those found in other industrial works. The simplicity of the drive, the regularity of the speed which can be attained, the flexibility of the whole equipment, appeal as strongly to the engineer of a rolling-mill plant as to others. Besides these advantages, there is in many mills a considerable economy of power due to working the motors in reversal, which has a very perceptible effect on the power cost of operation.

As most engineers know, the general problem of electric drive in rolling mills is now purely an economic one, the fundamental question being whether such a drive is or is not cheaper than a steam-engine drive, and, granted that it is, whether it is cheaper to generate or to purchase power. Large electrical supply companies are able to deliver energy on the scale demanded by rolling mills at a figure which permits competing with power locally generated. The great public supply plant can work on so big a basis and derive so much benefit from the diversity factor that it is in a particularly good position to sell power cheaply in large blocks. The average rate offered by twenty central stations furnishing power to steel works is, as stated by a recent report on the subject, between 8 mills and 9 mills per kilowatt-hour. The methods of charging adopted are usually based on certain requirements for maximum demand plus a flat rate. Only in rare instances is the latter system of charging used alone. As is well known to our readers, the arrangements adopted for equalizing the enormously irregular loads in rolling mills are highly ingenious and on the whole very successful. We have from time to time published articles giving details of this work. For the present purposes it is sufficient to point out that the difficult problems presented have been very successfully solved, so that there is no sound reason for central stations in general being timorous about taking on rolling-mill load, assuming that its quantity is not so great as quite to swamp the station capacity. Generally, special provisions in the feeding system are necessary, and some extra care must be taken in the matter of regulation. But, by and large, the rolling mill offers to the large producer of electricity an excellent market for his product, and in turn the rolling mill is able to utilize it with a high degree of efficiency.

AS IS customary, the ELECTRICAL WORLD will devote the first issue of

The Coming Issues

the new year to a review of the performance of the industry during the past year. Especial attention, however, will be given in the coming issue to the part that has been played by the electrical interests in helping the country successfully to wage the war. To few other industries has such an opportunity been given to serve the nation. No other industry has responded more promptly than the electrical industry in man power, resources and facilities. As a conserver of fuel and a supplier of

energy for the manufacture of munitions of war and ships to transport them, as a producer of equipment that alone makes possible increased output of supplies and the spreading of intelligence quickly on the field, as the university from which the best of trained engineers enter the nation's service, the electrical industry stands apart as a war aid to the government. How this has been accomplished and how the industry has continued to maintain in almost full measure its great service to the public will be the theme running through the Jan. 5 number.

Factors Affecting Selection of Insulators

The Advantages and the Disadvantages of Ground Wire—Consideration of the Effects Exerted by Operating Surges and by Parallel-Circuit Operation—Local Conditions Always an Important Factor in This Problem

BY A. O. AUSTIN

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IN CONSIDERING the investment needed for insulators "it is advisable to remember," said the author in the Nov. 10 issue of the *ELECTRICAL WORLD*, writing under the same heading, "that the relative cost of the insulator as compared to the remainder of the system is often under 3 or 4 per cent, and that there are only a few systems which could not afford to use more insulation simply as a matter of good business investment in safeguarding their plants." He then pointed out that the liability of interruption to service is dependent on the size of the system, that steel structures impose greater strains on insulators than wood poles, and that competition and the nature of the load are important considerations in determining the margin of safety to allow in insulators.

In this article he goes on to point out the advantages and disadvantages of ground wires, the effects of switching surges on insulators, the relative merits of independent and parallel circuit operation and the effect of local conditions.

ADVANTAGES AND DISADVANTAGES OF GROUND WIRES

Heretofore ground wires have been regarded from too narrow a point of view, their advantages being often doubtful, while the troubles that they cause sometimes offset any possible theoretical advantage. When used on a steel structure the ground wire will not greatly increase the danger of shorts caused by birds and may protect the insulator slightly. However, if the investment represented thereby is applied to increasing insulation, the benefits will be still more marked.

The use of a ground wire on a wood-pole line will

the disadvantages of a ground wire will not be so noticeable, but when a wood-pole line is equipped with metal cross-arms tied into the ground wire the system has all the disadvantages of a steel-tower line in so far as the danger of flashovers and short-circuits developing is concerned, and will have the further disadvantage of requiring more insulators per mile. A bird standing on the cross-arm may cause a short-circuit, even with the largest pin insulator, unless it is mounted on an abnormally long pin. This trouble, although negligible on a short line, may seriously affect the service on a long line.

Since the flashover strength of an insulator must be more than 300 kv. practically to eliminate spillovers from lightning, the largest pin insulators cannot be expected to prevent "kick-outs" from lightning when mounted on a grounded cross-arm.

The removal of the ground wire will clear up many cases of trouble, but if needed to prevent poles from being shattered it should be so installed that its disadvantages will not outweigh its advantages. A small wire run down each pole will protect the latter from being shattered and ground resistance will prevent many "spills" from developing into "shorts." If the wire is insulated from the poles, it will be still more effective. On one large system using part metal and part wood construction serious trouble developed from short-circuits by birds or from flashovers from lightning, although in no case did an insulator fail. Insulating the ground wire in such a way that the metal arms were not grounded removed the trouble entirely.

It must be remembered that guyed structures will

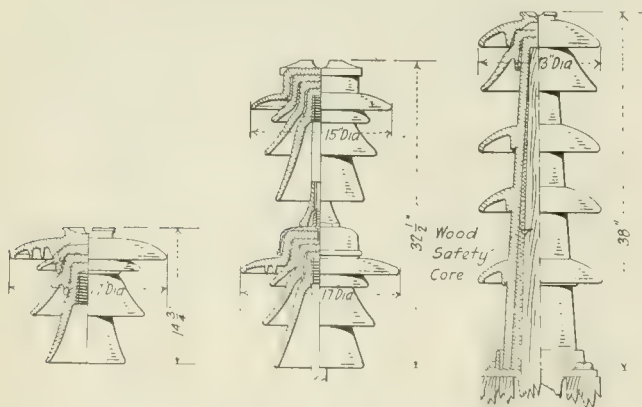


FIG. 1—FOUR-PETTICOAT, TANDEM AND POST TYPE PIN INSULATORS

The trouble from insulators flashing over is so serious that the tendency is to raise the insulation where lightning will not flash the insulators. This requires the equivalent of a seven-section insulator or a tandem insulator like that shown.

protect the poles from being shattered, but the strain on the insulators will be increased and there will be more short-circuits from birds, insulator flashovers and punctures. Where a good, effective cross-arm is used

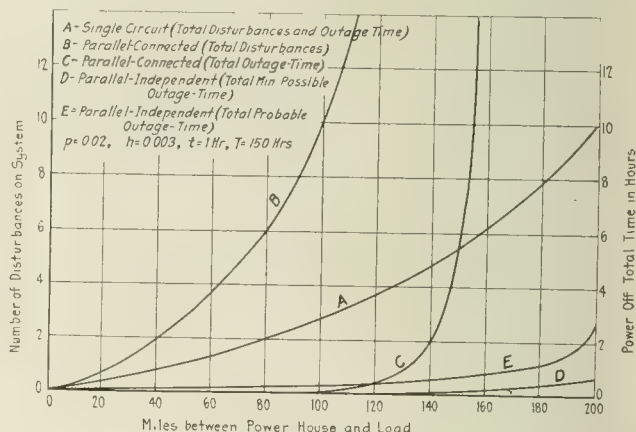


FIG. 2—POSSIBLE NUMBER OF DISTURBANCES UNDER DIFFERENT OPERATING CONDITIONS

Where W equals the number of disturbances the probability that a circuit will be out is $p = Wt/T$; the probability of two circuits p_1 and p_2 being out will be P_1P_2 , and the probable time that power will be off the line will be P_1P_2T .

have a greater electrical hazard than ungrounded wooden poles, and very much larger insulators will be required to furnish the same reliability that smaller ones will give on wooden structures. Therefore the

use of guys, unless thoroughly insulated, is of doubtful value at crossings and other points where it is desired to make the construction very safe.

The hazard caused by strain insulators is many times that obtained with suspension insulators, hence the mechanical advantages will have to be very marked to warrant their use. The depreciation rate for strain

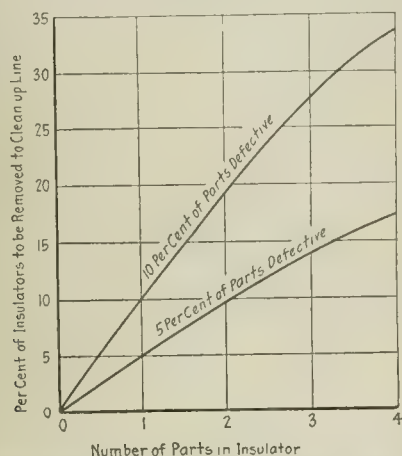


FIG. 3—PROBABLE AMOUNT OF "WEEDING OUT" NECESSARY UNDER DIFFERENT CONDITIONS

insulators is more than double that of suspension insulators, so that in the larger insulators the hazard increases from thirty to sixty times that for suspension insulators, owing to matching of defects.

Protection can be secured by the use of weather shields or short disk-spacing, so that the one part affords protection for another by the removal of defective material before it can cause trouble and by the rotation of the insulators after a period of service so as to expose new parts and relieve the stressed ones.

EFFECT OF SWITCHING SURGES ON INSULATORS

When the line insulation gets in very bad shape owing to the matching up of a number of faulty members, it sometimes happens that when service is once interrupted it is practically impossible to restore and maintain it until the voltage is built up slowly. The natural conclusion is that the switching surges must be abnormal. Investigation, however, shows that serious trouble often exists with a comparatively slight rise in voltage during switching, due to high-frequency oscillations. While these may not be destructive to porcelain as ordinarily used in insulators, they do tend to locate air pockets or internal defects with a partial vacuum. It is this latter characteristic which makes switching surges troublesome.

The current flowing in an air pocket increases with the frequency, since the pocket is really a poor conductor in series with the rest of the dielectric which forms a condenser. The increase in current causes a large IR loss, which in turn heats the air and dielectric, causing the resistance of the insulator to drop to a point where it will fail. This phenomenon is particularly dangerous in multi-part insulators which have depreciated sections, because if one part breaks down a larger stress is thrown on the remaining sections.

From the preceding remarks and the accompanying data it follows that (1) the switching surges cause large operating hazards where there is much insulator depreciation; (2) a line which does not have switching surges will give good service with considerably less

insulation than a line having switching surges; (3) switches which insert resistance or reactance prior to opening are more valuable than generally supposed and should be further developed; (4) if switching is to be general practice, larger insulators should be used or the poor material should be removed from the line more frequently; (5) when difficulty is experienced in restoring or maintaining service after interruption, time should be taken to build up the voltage gradually, splitting up the system if possible while doing so; (6) low charging current in insulators lessens the shunting of defective parts, hence insulators with small electrostatic capacity or those mounted on wooden structures have, for the same depreciation, a lower secondary hazard than those of larger electrostatic capacity or when mounted on steel structures; (7) arresters or other apparatus which induce high-frequency disturbances should have resistances in series with them for minimizing disturbance; (8) hot weather, unusual bird trouble, high winds or electrical storms may greatly increase the primary hazard, so that it is advisable to split up the system, even if only for a short time, going back to a larger connected mileage as soon as the primary hazard is reduced to normal.

Lightning, although producing a high local hazard, has a relatively small effect on the total system hazard, so that switch surges are more to be feared. For instance, a line of seven-section insulators operating so that $g = 1$ constitutes a hazard will have 0.01 dangerous strings per thousand. If a switching surge produces a hazard when $g = 3$, it may be seen that there are 0.95 dangerous strings per thousand. The hazard has been increased $0.95 \div 0.01 = 95$ times. If the line was 300 miles (482.8 km.) long and the secondary hazard was $h = 0.003$ for the switching disturbance,

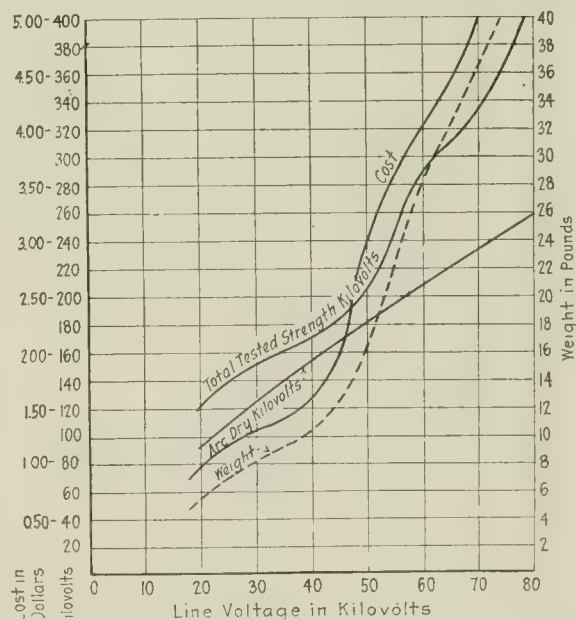


FIG. 4—TESTED STRENGTH OF INSULATORS HAS KEPT PACE WITH PRICE

there would be sixty failures in a given time. In the case taken, however, the switching disturbance would cause 0.95 cases of secondary trouble compared to 0.01 at normal voltage. If the switching surge was eliminated, then, by building up or other means, the secondary hazard h would be $0.01 \div 0.95 \times 0.003 = 0.0000316$.

By referring to Fig. 1 in the author's article of Nov. 10 it will be seen that a line having a secondary hazard $h = 0.0000316$ will have a negligible secondary hazard, hence a total of six interruptions only. It is further evident that a very long mileage could be operated where $h = 0.0000316$ and the primary hazard p is low, whereas the switching surge would probably reduce the possible mileage to under 200.

INDEPENDENT VS. PARALLEL CIRCUIT OPERATION

The use of automatic relays may maintain service practically all the time where there are two lines serving a load, although there may be a number of interruptions on either circuit. However, if the secondary hazard h is high, much better operation may be obtained by operating the lines independently.

From Fig. 2 in this article it will be noted that up to 150 miles (241.4 km.) the parallel circuit has far more disturbances (B) than the single line (A), but the time that power will be off (C) will be less. After this mileage is exceeded the single circuit not only has fewer disturbances but less time outage. Hence the single circuit would give far better service than the parallel circuits even when tied together and operated with automatic relays. The curves constitute another argument for splitting up the system, so as to have A in place of B disturbances and D or E for outage time in place of C .

EFFECT OF LOCAL CONDITIONS

The practice of paying little or no attention except to very highest altitude is undoubtedly good practice as far as insulator performance is concerned, since the clear air, lower temperature, lower stresses and greater dielectric factor of safety all go to increase the reliability or permissible operating voltage for any insulator and will usually more than offset the reduction in flashover.

Conditions around large cities are becoming more severe each year, and insulators which would formerly have given good service cause no end of trouble by burning pins or from increased surface leakage. This condition calls for refinements in the insulator rather than size. For these conditions an insulator should be made up of parts having low surface stress. Since the energy expended in the pin increases as the square of the current, the small electrostatic capacity is well worth while.

If there are some points on the system difficult to get at or which offer particular hazards, it is advisable to increase the insulation at these points either through the use of more sections in the case of the suspension insulator or by a change in the type of construction or a larger insulator. The better insulators usually have fewer number of parts, as it is believed that they form a better compromise. Few well-made parts can be made for less cost, and the depreciation is likely to be very much less. The more cement surface an insulator has the more uneven will be the temperature distribution, and this at best is likely to set up serious stresses unless relief is provided. The mechanical stresses also go up almost directly with the diameter of the cement areas.

Another important factor in a pin-type insulator is that where a large number of parts are used the rate of depreciation must be very small, otherwise the num-

ber of insulators which have to be scrapped to weed out a comparatively small percentage of defective parts is likely to be prohibitive (see Fig. 3).

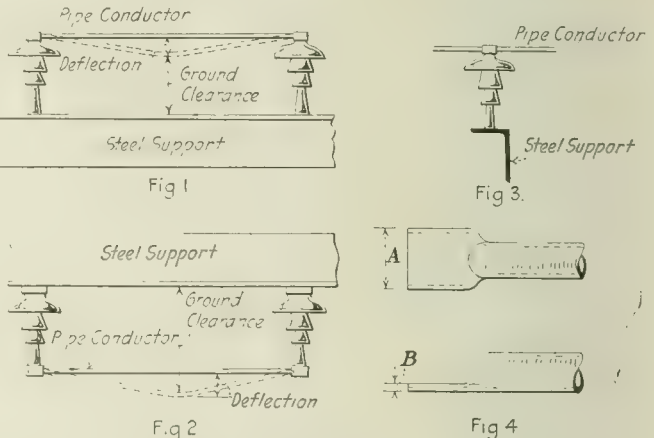
It may be noted from Fig. 4 that, although the cost of a pin-type insulator goes up very rapidly as the size increases, the total tested strength of the parts has increased almost at the same rate as the cost. This would not have been possible had it not been for the successful manufacture of the more efficient designs, the benefits to be derived from the proper use of which are by no means exhausted.

THE UTILIZATION OF PIPE FOR OUTDOOR BUS WORK

Charts Giving Deflections of Copper, Brass and Iron Pipe With and Without Ice Load Designed for High-Tension Apparatus

BY M. M. SAMUELS

Copper, brass and iron pipe is now being used extensively in high-tension parts of outdoor substations for buses and connections, the great advantage of being able to support it on rigid insulators instead of by strain insulators being generally recognized.



FIGS. 1 TO 4—GROUND CLEARANCE WITH BUSBARS STRUNG ABOVE, BELOW AND ACROSS STEEL SUPPORT—FORM OF TERMINAL

No strict rules can be made as to how far apart pipe-bus supports should be. The exact spacing of insulators must be determined in each individual case. For instance, where a conductor runs parallel to a steel

DIMENSIONS OF FLATTENED COPPER OR BRASS PIPE FOR TERMINAL

		SIZE OF PIPE IN INCHES										
		$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	1	1 $\frac{1}{4}$	1 $\frac{1}{2}$	2	2 $\frac{1}{2}$	3	
Standard iron-pipe size:												
A	.....	0.57	0.76	0.96	1.20	1.52	1.86	2.44	2.82	3.56	4.32	5.28
B	.....	0.12	0.17	0.18	0.22	0.23	0.24	0.29	0.30	0.31	0.33	0.44
Extra heavy iron-pipe size:												
A	.....	0.54	0.72	0.91	1.15	1.48	1.85	2.39	2.76	3.49	4.20	5.16
B	.....	0.20	0.25	0.25	0.30	0.31	0.35	0.39	0.41	0.44	0.56	0.61

member, as in Fig. 1, with the steel member underneath the conductor, a large sag will considerably decrease the ground clearance. Therefore insulators must

be spaced so that even with a maximum sag under ice conditions there will still be enough clearance between the conductor and the steel. But even for an individual case like this no rule can be made as to the minimum spacing of insulators, since the ground clearance at maximum sag will depend upon the insulator's height.

When the conductor is suspended underneath the insulator with the steel above the conductor, as in Fig. 2, or when the conductor runs at right angles to the insulator, as in Fig. 3, a greater sag and consequently a greater distance between supports is permissible. In this connection it may be mentioned that the majority of standard insulator pins on the market at present are too short to allow for the required ground clearance

Electrical Determination of Ore Beds

Dr. Reginald A. Fessenden of Brookline, Mass., describes in patent No. 1,240,328 a method by which he has actually been able to detect and determine the location of a body of mineral invisible to the eye at a distance of 2.5 miles (4.0 km.). In general the method consists in drilling four holes in the earth a given distance apart—for example, 5 miles (8.0 km.)—filling these holes with water so that proper receiving and sending apparatus can be let down, and noting the differences recorded on the several receiving instruments. The apparatus employed would in the above case be three photographic recording oscillographs of the Ein-

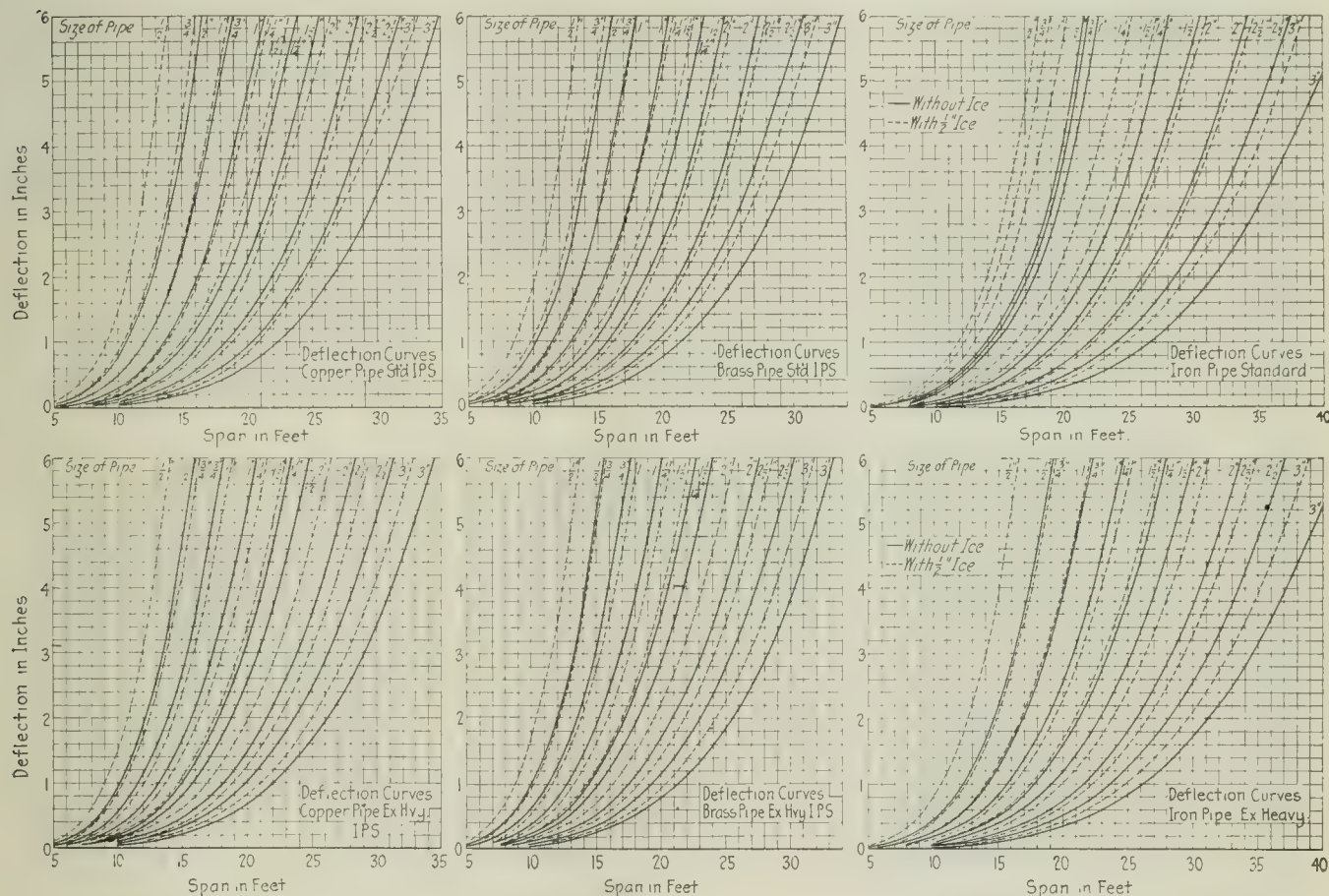


FIG. 5—DEFLECTION OF COPPER, BRASS AND IRON PIPE USED AS BUSBARS WITH AND WITHOUT ICE LOAD

when used as in Fig. 1, since most standard pins are designed for cross-arm use as in Fig. 3. Caution should be used therefore when deciding upon the type of pin for a high-tension bus support.

The accompanying curves give the deflection of the various kinds of pipe for different spacings of insulators, both without ice load and with ice load. They may be used readily for determining the required spacing of insulators after a certain kind of pipe has been decided upon or to determine the size of pipe to be used when the distance between supports is fixed through other determinations. The deflections given are for two end supports and are therefore maximum. For a continuous pipe with more than two supports the deflections will be considerably less than those given.

The simplest method of connecting a pipe connector to a terminal is to flatten the pipe, drill a hole through it, and use the pipe conductor itself as a terminal lug.

thoven type coupled to microphone receivers and a single strong underwater sound-wave oscillator of the kind developed by Dr. Fessenden for submarine signaling work. Given the distance between two points in a mine and having determined the time taken by a sound wave to travel between the two points, it is possible to draw conclusions in regard to the probable nature of the rock between the two points, or if an echo be observed or a refraction of the sound, it is possible to estimate the distance of the reflecting or refracting vein.

Since the oscillograph photographic strip moves with a regular and known velocity, the distance on the strips between the records produced through the transformers when the key is pressed down and the records made by the sounds received, whether direct, or by reflection or refraction, or by the echo, indicates the distance between the drill holes and the ore bodies.

Factors Affecting Application of Motors to Lathes

Necessity of Knowing Work for Which Lathe Will Be Used in Order to Arrive at Correct Conclusions in Providing Motor Drive—Methods of Calculating Power Required—Speed Requirements

BY C. E. CLEWELL

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SYNOPSIS.—In this, the ninth installment of a series of articles on industrial motor and control applications, the lathe is taken as one of the typical classes of machine tools with which motors are widely used, and some of the practical points related to the application of the motor to such machines are discussed in detail. A typical piece of work used as the basis for showing how the root-mean-square horsepower may be calculated for such a cycle when the graphic record of current input to the test motor is available. Reference is also made to the approximate calculation of horsepower on the basis of the cubic inches of metal removed per minute. The requirements of speed are treated at some length, and notes on the control problem are included along with simplified wiring diagrams applicable to a given type of machine-tool controller.

NEARLY every application of motors has its own peculiar characteristic, so that the analysis of the motor requirements may be simplified by the selection of some one industry or a given type of machine tool and limiting the discussion thereto. In this article it is proposed to take the lathe as an example of one class of industrial machinery and to point out some of the elements connected with the selection of a motor suitable for driving such a machine.

The average lathe, in contrast to the planer, for example, is essentially a non-reversing piece of apparatus. Even where reversal¹ becomes necessary occasionally the motor may readily be reversed by the ordinary drum machine-tool controller, and no special reversing mechanism is ordinarily required as with the planer. Furthermore, the need for an adjustable-speed rather than a constant-speed motor will depend somewhat on whether the lathe is used for one given standard operation, and consequently requires only one or at most a few speeds of small ranges, or whether it is used for special or repair work, including a wide range of diameters, and thus has a correspondingly wider range in the speed requirements.

However, even where a lathe is purchased primarily for a standard operation, natural changes in manufacture are likely to result in its use for turning sizes of

Fundamentally, the lathe is used for the removal of metal, from a shaft, for example, where the cutting tool makes a cut of a certain depth and each succeeding revolution of the shaft results in a given progression of the tool along the shaft known as the feed. The depth and width of the cut, together with the peripheral speed of the shaft, determine the power requirements

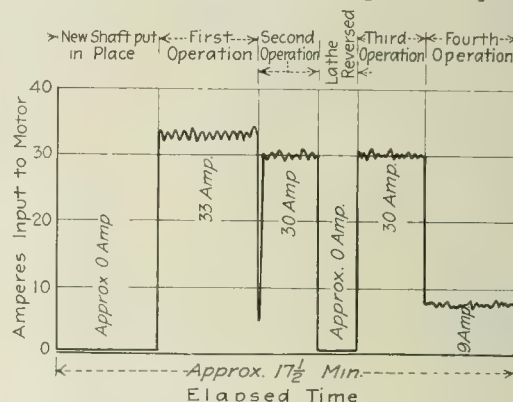


FIG. 2—GRAPHIC RECORD OF INPUT TO THE MOTOR, DRIVING THE LATHE REFERRED TO IN FIG. 1

for a given kind of metal. To this must be added the power losses in the lathe itself, these two elements constituting the power which must be supplied by the motor to the lathe. In some cases the power required by the removal of metal is so small in comparison with the mechanical losses in the lathe that the driving motor may be selected on a basis of the losses only. However, where the power required by the cut is large in comparison with the losses, the latter may be neglected and the power requirement based entirely on empirical formulas in terms of the cubic inches of a given kind of metal removed per minute.

Where the determination of the power requirement is based on the measured input to a test motor used for driving the lathe under operating conditions, obviously both the mechanical losses and the power for removing the metal are taken into account, and hence this scheme for testing out the required horsepower is to be preferred.

The present problem may therefore be divided into two parts, one of which relates to the motor and the other to the methods of control for obtaining the required operating characteristics. In discussing the motor attention will be directed, first, to the question of its horsepower rating; second, to its speed range, and, third, to the practical item of how the motor may be connected to the machine tool.

HORSEPOWER REQUIREMENTS

Three possible schemes are presented for deciding on the rating of the motor to employ for driving a lathe: (a) Tables of average ratings for a lathe of the given size as issued by the motor manufacturers may be con-

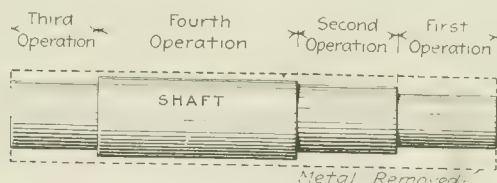


FIG. 1—SECTION THROUGH A SHAFT ON WHICH FOUR OPERATIONS ARE TO BE PERFORMED IN A LATHE (SEE FIG. 2)

work with diameters which differ from that in the first instance, so that the question of the possible ranges in diameters of the work and the necessary changes in the r.p.m. of the work often become important.

¹It becomes necessary, of course, to reverse the spindle now and then when reversing the progression of the cutting tool along a shaft, but the rotation of the work for any given operation is usually continuous and is hence in one given direction.

sulted. (b) A calculation may be made of the cubic inches of metal removed per minute, which should take into account the maximum as well as the average. Constants are available for various metals, which if

multiplied by the amount of metal removed by the cutting tool per minute indicate the horsepower required to remove the metal. As pointed out above, this scheme may not take into account the mechanical losses in the

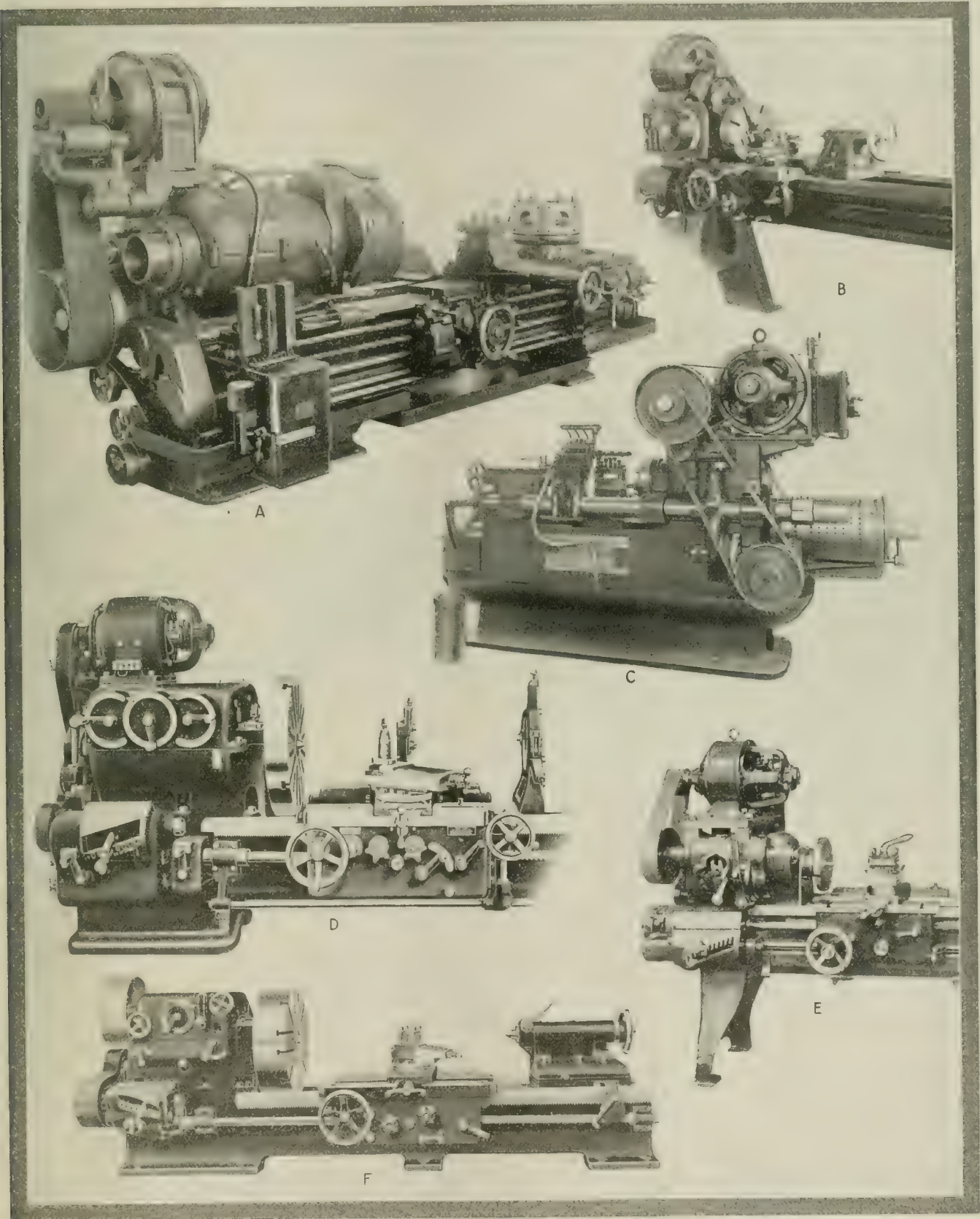


FIG. 3—DIFFERENT METHODS OF CONTROLLING LATHE MOTORS

A—Motor mounted on lathe but belted thereto. B—Snap-switch control for motor driving lathe through gears with sliding idler. C—Motor-driven lathe in which speed adjustments are obtained by change gears (quick speed changes are not necessary as machine is used for long runs). D—High-duty lathe which can use

either constant-speed or adjustable-speed motor by connecting through twelve-speed geared head (apron control is used). E—Motor arm arranged for driving geared head. F—Geared-head lathe which can be driven at fifteen different speeds by constant-speed motor.

lathe but merely give the net power required at the point where the cut is being taken. (c) A test motor may be attached to the lathe temporarily and a graphic record of the amperes input taken throughout one or more duty cycles. Such a chart may be used as the basis for calculating the r.m.s. horsepower as well as the maximum or peak requirement, as described below.

TABLE I—CALCULATION OF THE R. M. S. CURRENT INPUT TO THE MOTOR OF A MOTOR-DRIVEN LATHE

Amp.	Time, Seconds	Calculated R. M. S. (Amp.) ² ×Time
33	180	1089×180=196,020
30	140	900×140=126,000
0	112	0×112= 0
30	171	900×171=153,900
9	260	81×260= 21,060
0	190	0×190= 0
		Total.....496,980

Suppose, for example, that a shaft is to be turned as in Fig. 1, and that the sequence of operations is as indicated in the diagram. Suppose, furthermore, that Fig. 2 represents a graphic record of the amperes input to the motor during the operations involved in turning such a shaft. The complete duty cycle includes two rest periods for the motor, (1) while the new shaft is being put into place, and (2) when the lathe is reversed between the second and third operations.

Table I is a summary of the duty cycle shown in Fig. 2. Here the average current for each operation is squared and multiplied by the time (seconds) of the operation, the total of such products being 496,980². The total time of the one cycle is 1053 seconds, and hence:

r.m.s. current = $\sqrt{496,980 \div 1053} = 21.7$ amp.

The determination of the r.m.s. horsepower rating of the motor depends on the supply voltage and on the efficiency of the motor. At 220 volts and 86 per cent efficiency the r.m.s. horsepower rating of the motor required is 5.5, while the peak requirements during the first operation amount to 8.3 hp. These are sufficient data on which to base the selection of the motor rating for the class of work involved. For reasons already stated it constitutes a more accurate method than either of the other two methods mentioned.

SPEED REQUIREMENTS

The peripheral or cutting speed of a shaft in a lathe with a diameter *d* inches and revolving at *n* revolutions per minute is given by the simple relation:

Cutting speed (ft. per min.) = $\pi d n \div 12$.

This may be expressed conveniently in terms of *n* as follows:

$n = (\text{cutting speed} \times 12) \div \pi d$.

From this equation it follows that the rotational speed of the shaft (sometimes called the spindle speed of the lathe) depends directly on the cutting speed and inversely on the diameter *d* of the shaft. Moreover, it is obvious that the speeds of a directly coupled individual motor depend directly on *n*. Hence in the anal-

ysis of the speed requirements of the motor it is convenient to study the effects upon *n* produced by changes in the cutting speed and in the diameters of the work to be turned in the given lathe.

The practice in cutting speeds was materially modified by the invention of high-speed-tool steel as a substitute for the older carbon-steel cutting tools. With its use it has been possible to increase the speeds for metal cutting from say 20 ft. to 40 ft. (6.1 m. to 12.2 m.) per minute for soft steel up to 80 ft. and 160 ft. (24.4 m. and 48.8 m.) per minute, and up to 50 ft. and 75 ft. (15.2 m. and 22.9 m.) per minute for cast iron. Cutting speeds for finishing run even higher. Depending, therefore, upon the kind of metal worked upon and partly upon the nature of the operation, that is whether a roughing or a finishing cut is being taken or some intermediate condition, the cutting speed has come to be looked upon as a fairly definite factor for given operations. In other words, there is a most economical cutting speed, beyond which mechanical limitations, such as undue shortening of the life of the tool or too rapid a deterioration of its cutting edge and excessive racking of the machine itself, come into play. On the other hand, to employ a cutting speed below the most economical value means a longer time for the duty cycle and consequently a higher production cost for the work.

Conversely, if owing to limitations in the speed ranges with the use of cone pulleys and belts the work in a lathe has been performed at cutting speeds say 5 or 10 per cent below the economical value, the substitution of a motor with sufficient speed ranges and gradations so that practically any diameter of work can be accommodated with a motor speed which will

TABLE II—RESULTS OF AN ANALYSIS OF LATHE SPEEDS UNDER POOR AND IMPROVED CONDITIONS

	16 In.×48 In.		16 In.×36 In.		16 In.×36 In.	
	Poor	Im-proved	Poor	Im-proved	Poor	Im-proved
Maximum speed (r.p.m.), gear out.....	530	400	580	400	624	200
Minimum speed (r.p.m.), gear out.....	90	100	143	100	114	50
Back gear ratio.....	12	5	7.5	5	8.8	5
Maximum speed (r.p.m.), gear in.....	44	80	77	80	71	40
Minimum speed (r.p.m.), gear in.....	7.25	20	19	20	13	10
Per cent gap in speed.....	105	25	85	25	61	25
Minimum diameter of work... 1 in.	1 in.	1 in.	1 in.	1 in.	2 in.	2 in.
Maximum diameter of work... 10 in.	10 in.	10 in.	8 in.	8 in.	16 in.	16 in.
Maximum cutting speed at minimum diameter.....	139	100	152	100	326	100
Minimum cutting speed at maximum diameter.....	19	50	40	40	55	40
Cutting speeds not possible:						
On 1-in. diameter.....	12-23	21-26	25-40	21-26	20-35	11-13
On 2-in. diameter.....	25-50	42-52	40-75	42-52	40-70	21-26
On 3-in. diameter.....	35-70	62-78	60-110	62-78	60-100	33-39

result in the most economical cutting speed means in turn a material increase in production for the same labor cost or a reduced labor cost for a given amount of work performed.

It is possible with many lathes to accommodate quite a wide range of diameters, with the result that the same lathe may be used for any or possibly all of the diameters at one time or another. In Table II, for example, the first lathe can accommodate work ranging from 1 in. to 10 in. (2.54 cm. to 25.4 cm.). Suppose the maximum cutting speed desired is 100 ft. (30.5 m.)

²In the preparation of Figs. 1 and 2 and Tables I, II and III three articles by A. G. Popcke, *American Machinist*, Vol. 37, No. 3, have been consulted freely. The reader will find the extended analysis of motor drive for lathes in these articles an excellent treatment of the subject, primarily from the standpoint of factory management. The present article approaches the subject rather from the engineering viewpoint.

per minute, this immediately fixes the maximum r.p.m. of the lathe spindle which occurs when the smallest diameter (1 in.) of work is in place; namely, about 400 r.p.m. Assuming further that a four to one speed-range, adjustable-speed motor is used, the minimum sprindle speed without the aid of gear changes will be

current or alternating-current type for such work must be accompanied by mechanical speed-changing facilities if production is to be maintained at its most efficient standard. Even where the desired speed ranges are possible with mechanical means, it is apparent that many operators will prefer a lower cutting speed to

TABLE III—PORTION OF A CHART PROPOSED FOR USE IN MACHINE SHOPS SHOWING THE RELATION BETWEEN FEEDS, CUTTING SPEEDS, DIAMETERS OF WORK AND SPINDLE SPEEDS ON LATHES

Feed (in. per rev.):														
Cast iron.....	.....	0.18	0.14	0.11	0.09	0.08	0.07	0.06	0.055	0.043	0.036	.....	.....	.....
Machinery steel.....	0.17	0.12	0.09	0.075	0.06	0.055	0.045	0.04	0.035	0.03	0.025	.....	.....	.....
Tool steel.....	0.10	0.07	0.05	0.04	0.035	0.028	0.025	0.022	0.02	0.016	0.012	.....	.....	.....
Brass.....	.....	.....	.....	0.20	0.17	0.14	0.12	0.11	0.10	0.08	0.06	0.05	0.03	0.02
Cutting speed (ft. per min.)	20	30	40	50	60	70	80	90	100	125	150	200	250	300
Diameter (in.):														
2.....	160	240	320	400	480	560	640	720	800	1000	1200	1600	2000	2400
1.....	80	120	160	200	240	280	320	360	400	500	600	800	1000	1200
	14													
2.....	40	60	80	100	120	140	160	180	200	250	300	400	500	600
	6	11	14	16										
3.....	30	45	60	75	90	105	120	135	150	188	225	300	375	450
	3	7	11	13	15	16								
4.....	20	30	40	50	60	70	80	90	100	125	150	200	250	300
	16-a	3	5	9	11	12	14	15	16					
5.....	16	24	32	40	48	56	64	72	80	100	120	160	200	240
	15-a	2	5	7	9	11	12	14	15	16				
6.....	13.3	20	27	33	40	47	54	60	67	84	100	134	167	200
	13-a	1	3	5	7	9	11	12	13	14	16			
7.....	11.4	17	23	28	34	40	46	51	57	71	85	114	142	171
	10-a	14-a	1	2	4	6	8	9	10	12	14			
8.....	10	15	20	25	30	35	40	45	50	63	75	100	125	150
	9-a	13-a	16-a	1	3	5	6	7	9	11	13	16		

As an example of how such a chart may be used, consider machinery steel. For a feed of 0.07 in. (0.178 cm.) per revolution a cutting speed of 60 ft. (18.3 m.) per minute is indicated, and hence for a shaft 5 in. (12.7 cm.) in diameter a spindle speed of 48 r.p.m. is required. This is accomplished by controller notch 9

in the equipment corresponding to this table. The bold-face figures indicate the position in which the controller should be (see Fig. 4). The sub-letter *a* accompanying some of the controller notch indications means that in such instances it is necessary for the back gear to be thrown in.

400/4 = 100 r.p.m., for a maximum spindle speed of 400 r.p.m. To find whether 100 r.p.m. is low enough to accommodate the maximum diameter of work, assume that the minimum cutting speed for the maximum diameter is 50 ft. (15.2 m.) per minute. Then the spindle speed of the lathe to give this minimum cutting speed with the maximum diameter of work (10 in.) must be about 20 r.p.m. This being the lower limit of spindle speed, it follows that with a minimum of 100 r.p.m. (above) through the range of motor speed adjustment, a five to one back gear must be employed. With the back gear in, the motor may now be speeded up from its lowest to its highest speed, that is, in the ratio of one to four, increasing the spindle speed from 20 to 80 r.p.m.

To summarize, the extremes in diameters and cutting speeds of the first lathe in Table II are met with a four to one adjustable-speed motor and a back gear having a ratio of five. For direct connection of the motor to the machine such a plan means a range in speeds from 100 to 400 with the back gear out and from 20 to 80 with the back gear in, thus leaving a gap from 80 to 100 r.p.m. throughout which it is impossible to obtain spindle speeds with this lay-out of equipment. Inasmuch as it may sometimes occur that important cutting speeds for certain diameters of work require such a range of spindle speeds, it is desirable to keep a gap of this kind down to limits of 15 to 25 per cent.

The analysis tabulated in Table II shows that the ranges in speed, even where quite wide, may be met successfully by the four to one adjustable-speed motor. The use of a constant-speed motor of either the direct-

shifting belts or gears. This leads naturally to the subject of control for adjustable-speed motors which are called upon to meet the requirements.

The foregoing discussion of the speed requirement points clearly to the importance of wide ranges in speed (for many lathes) and the necessity for carefully planned gradations in speed. The latter may readily be provided by the modern controller (Fig. 3), but not

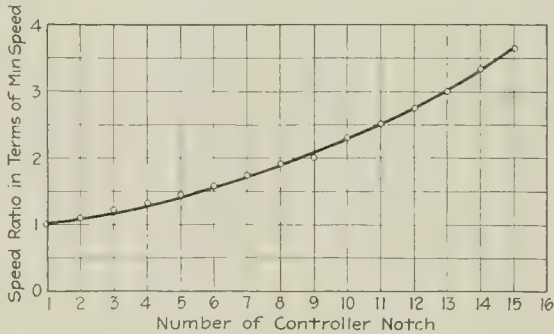


FIG. 4—SPEED RATIO OBTAINED BY CONTROLLER IN TERMS OF MINIMUM SPEED

This curve is based on geometric speed increments, each succeeding speed being about 10 per cent greater than the immediately preceding value. The futility of attempting such a gradation of speeds by cone pulleys, for example, is apparent.

so well perhaps with mechanical speed changes. Even if the mechanical speed-changing facilities give comparable increments, the controller still has the important advantage of convenience both in operation and location with respect to the machine-tool operator.

While the motors for small lathes may be operated by face-plate controllers, a more standard form is the combined drum and dial type, in which starting is ac-

complished by the drum part of the controller and speed adjustment by the dial part (Fig. 3).

While the application of motors to old belt-driven machine tools often makes it necessary to mount the motor as a separate unit, and possibly to supply the power through a counter shaft, the tendency in the manufacture of modern tools is to make the motor an integral part (see Fig. 3) of the machine. This method has many advantages.

FURNACE CHANGES BRING INCREASED BOILER ECONOMY

Furnace Interiors Designed to Reflect Heat Back to Green Coal to Hasten Ignition and Produce Increased Economy

An Iowa central station company operating several 300-hp. Heine water-tube boilers found it difficult to develop more than 70 per cent of the boiler rating with steam coal. The grate surface under each unit measured about 60 sq. ft. (5.4 sq. m.) and each boiler had about 3000 sq. ft. (276 sq. m.) of heating surface, making the ratio of grate area to heating surface one

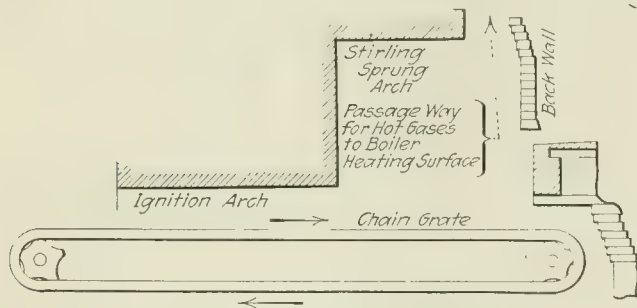


FIG. 1—FURNACE WITH SPRUNG ARCH ORIGINALLY INSTALLED UNDER 500-HP. WATER-TUBE BOILERS

to fifty. Over the grate there was a flat arch 6 ft. (1.8 m.) long. It was installed parallel to and about 14 in. (35.6 cm.) above the face of the grate. Later Stirling boilers each of 500-hp. rating were installed, with 138 sq. ft. (12.9 sq. m.) of grate area and 4920 sq. ft. (452.6 sq. m.) of heating surface. The new ratio was about one to thirty-six. For one furnace a flat arch 6 ft. (1.8 m.) long was installed parallel to and 15 in. (38.1 cm.) above the face of the grate. A Stirling sprung arch was also installed, as illustrated in Fig. 1. With this equipment it was found possible to develop about 120 per cent of the boiler rating, or 50 per cent more than with the old furnaces and boilers. The increase in rating was considerably greater than the increase in grate area, but one fault still remained. With the draft maintained at the pressure necessary for hard forcing the fire would die down at the front of the grate and allow the ignition arch to cool off. It would then be necessary to reduce the draft pressure as well as the rate of evaporation in order to heat the arch again.

After some experimentation the improvements indicated in Fig. 2 were made. The Stirling sprung arch was taken out and the flat ignition arch was inclined until the lower face of its rear end was 3.5 ft. (1.1 m.) above the grate, while its front end remained at the former level, 15 in. (38.1 cm.) above the grate. The bridge wall was also raised. These modifications were

made in order to reflect heat from the hottest part of the furnace back against the green coal and thus hasten the beginning of combustion.

Results have proved that the theory upon which the new construction was based was correct. It is not at all difficult now to procure 150 per cent of the boiler rating with Iowa steam coal, and the units can be forced to

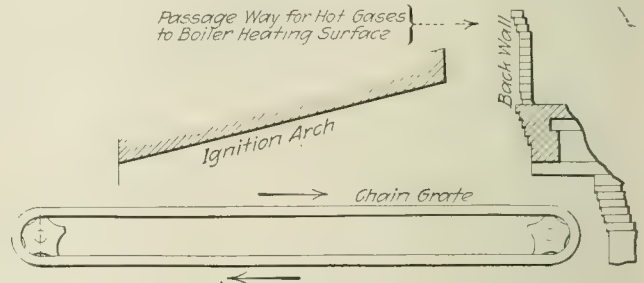


FIG. 2—MODIFIED FURNACE REPLACING ARRANGEMENT SHOWN IN FIG. 1

200 per cent of their rating with Illinois coal. During the course of these improvements the coal consumption per kilowatt-hour was reduced from 9.5 lb. (4.3 kg.) to 6 lb. (2.7 kg.).

Surprisingly better results were also obtained subsequent to changes in another Iowa plant, where a 500-hp. Edge Moor water-tube boiler, served by 110 sq. ft. (10.12 sq. m.) of grate area, was installed. As originally set up 300 hp. was the maximum rating which could be developed from this unit with Iowa steam coal. After changing the lengths and angles of the arch and the back wall, the installation was able to develop over 200 per cent of the boiler rating with the same fuel. The coal consumption per square foot of surface per hour was raised to 40 lb. (18.1 kg.) without interfering with the good quality of combustion.

In this instance, instead of leaving the back wall at the rear of the grate, standing vertically or sloping backward, the engineer rebuilt it so that it now slopes toward the front of the boiler and has its upper end about 3.5 ft. (1.1 m.) above the grate. The arch over the grate was also given an upward tilt and was made to end at about the same level as the top of the back wall and about 18 in. (45.7 cm.) from it. This arrangement forms a larger, high-center ignition chamber, with the white-hot surfaces reflecting more directly upon the burning fuel. The hot gases are led to the boiler tubes through the passageway between the back

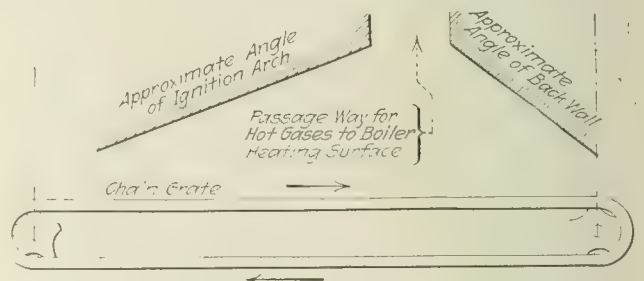


FIG. 3—BACK WALL AND IGNITION ARCH SET AT ANGLES TO REFLECT HEAT BACK ON TO GREEN COAL

wall and the arch. The engineer believes that the increased rating and efficiency gained are due to the fact that reflection of heat from the modified back wall gives better conditions for ignition at the grate. In this furnace such high temperatures can be produced that the grates, if they are allowed to become bare, will be burned.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

CONVENIENT TAG FOR SWITCHES

Consists of a Leather Envelope Containing a Card Properly Arranged to Receive Full Information

Line construction and repair work is done by linemen reporting to headquarters. These linemen, working on street-lighting circuits or other circuits which must be interrupted for them, should be adequately protected against the possibility of the switch being inadvertently closed. Because of the fact that there is no regular operator in attendance this problem is difficult, but the following solution is suggested, after a trial of a number of years in several substations:

A leather envelope is used as a tag to be hung on the switch controlling the circuit to be protected. On one side of this envelope is printed the customary warning that men are working on the circuit. Within the envelope is a card properly arranged to receive full information as to the time the tag is placed and removed from the circuit, for whom it is so placed and for what purpose. The workman wishing to be protected makes his record on the card and hangs and removes the tag himself. Two or more gangs working on the circuit at the same time have equal protection, the last one to clear from the circuit removing the tag. The cards are collected from the substations at suitable intervals and become a record.

This suggestion was made by W. C. Pearce, superintendent electrical department Syracuse Lighting Company, in a paper read at the recent meeting of the National Safety Council.

INCREASING EFFICIENCY OF THE BOILER PLANT

More Mechanical Apparatus Advocated for Even Small Boiler Rooms—Need of Interpreting Instrument Readings

Methods of insuring maximum efficiency in steam boiler plants were discussed at a meeting of the Providence (R. I.) Engineering Society on Dec. 12. George F. Weaton read a paper advocating the use of more mechanical apparatus in plants as small as 1000 hp. The author maintained that a 1000-hp. plant, if equipped with three 350-hp. boilers, can be operated economically by two men and provide for equipment lay-offs. Fuel economizers, underfeed stokers, coal and ash conveyors and overhead coal storage are desirable even in a plant of this size, enabling the load to be carried on two units when necessary. The returns on such an investment may be less than in a larger station, but they will exceed those for a smaller investment and a simpler plant.

In lately designed plants of high efficiency the excess of oxygen required for combustion has been cut as low as 20 per cent and the boiler efficiency runs around 86

per cent. The controlling fireman should receive the highest wages of all employees in the station except the chief engineer. Every plant should have an Orsat or other hand-operated apparatus for flue-gas testing. Imperfect combustion is indicated by streaks of dark color obscuring the opposite sides of the furnace from the observer. Perfect combustion occurs at a temperature producing light which penetrates blue glass. The dun-colored gases arising from the fuel bed, upon entering the zone of perfect combustion, should disappear, leaving a clear lavender-gray color. A furnace temperature of from 2800 deg. to 3000 deg. Fahr. (from about 1500 deg. to 1700 deg. C.) indicates good conditions. The most accurate check is obtained by metering the feed water, accurately weighing the fuel, and by periodic readings of steam, feed-water and flue-gas temperature, etc. Any plant not equipped with means for measuring such quantities, unless it be very small, will waste enough to pay for the outfit required in a short time. The use of elastic cements on settings and of painter's putty around door-joints is recommended.

Present boiler-room labor is widely unsatisfactory, even at 32 cents per hour, but in a plant where coal passing has been subjected to scientific analysis the following conditions and results obtain: Coal dumped alongside the boiler house on the floor level of the latter is handled to stoker hoppers 8 ft. (2.4 m.) above and from 50 ft. to 150 ft. (15.2 m. to 45.7 m.) away. Two balanced barrows are used, each of 500-lb. (226.8 kg.) rating. By skillful loading a maximum of 700 lb. (317.5 kg.) has been attained on some occasions. In one day the operator handled 679.3 lb. (308.1 kg.) per trip, the run being over 35 ft. (10.7 m.) of paving, up an elevator and along 80 ft. (24.4 m.) of steel plate to the hopper. Fifty-nine trips were made, the average time per trip being 7.17 minutes and the total coal handled 40,800 lb. (18,506.6 kg.). At present five men handle about 190,000 lb. (86,182.5 kg.) in twenty-four hours, at an average cost of 21.5 cents per gross ton. This represents maximum economy, in the author's opinion.

MANAGERS MUST BE SHOWN VALUE OF IMPROVEMENTS

Discussing this paper, H. A. Wilcox said that lack of economy in the past and to-day is in part due to the unwillingness of many managers to spend anything on economy-producing equipment. This feeling has gradually undergone a change owing to the entrance of highly trained efficiency engineers into the field and to the retaining of expert engineers by the manufacturers of boiler-plant accessories. In a boiler plant of several thousand horsepower an allowance of two men per 1000 hp. is ample, but in a plant of only 1000 hp., the speaker considered, at least three men are needed—one man to operate the stokers, tend water, etc.; one to operate and maintain the coal and ash-handling machinery, and one to clean economizers, clean and re-

pair laid-off boilers, etc. Stokers of the mechanical type are favored, even for a plant of 1000-hp. boiler rating. Large combustion spaces are desirable, with maximum cleanliness. The present tendency is to increase the distance between boiler and grates, in order to prevent cooling the gases by contact with the comparatively cold heating surfaces before combustion is complete. Exposed portions of boiler shells, feed piping, etc., should be surrounded by asbestos covering. The grate must be adapted to the fuel to insure minimum loss of combustible material. Periodic lay-offs of equipment for inspection and cleaning and a frequent ash analysis are of great importance. Frequent use of gas-analysis apparatus and simple draft readings will check air infiltration, and the condition of baffles may be determined by flue-gas temperature study. The speaker queried the efficacy of inspecting the fire through violet glasses, on account of variations in the personal equation.

Mr. Wilcox favored the use of both Orsat and carbon-dioxide recorders, and also of a sampling tank for gases capable of covering considerable periods. Recorders of flue-gas temperature, drafts, amount of feed water, weight of coal, etc., are indispensable aids to fuel economy. All such instruments, however, are without value unless their indications are intelligently interpreted.

MANHOLE CONTAINING NO SPLICED CABLES

Chance for Cable Weakness Eliminated by Pulling Cable Two Ways from Manhole Without Cutting It

In laying out an underground cable system the Iowa Railway & Light Company of Cedar Rapids found it expedient to place the first manhole of the system about 25 ft. (7.6 m.) outside the power-house wall. This manhole as it appeared before the top was built is shown in the accompanying illustration. It will be observed that the cable passing through the hole con-



2300-VOLT CABLES PASSED THROUGH MANHOLE WITHOUT SPLICING

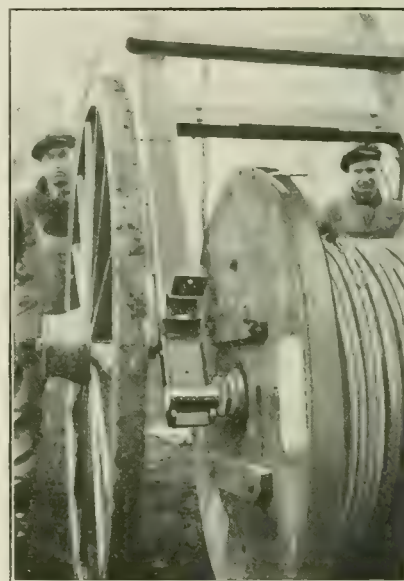
tains no splices. This unusual circumstance is the result of a desire on the part of the company's engineers to keep the cable as free from splices as possible. The work was accomplished in the following manner: The cable was first pulled from this manhole to the

next one. This left just about enough on the reels to extend into the power house. The cable was then removed from the reel, doubled back on the ground, and the end was pulled into the ducts leading to the power house. The four concentric, two-conductor, cambric-insulated, lead-covered, 600,000-circ. mil., 2300-volt cables shown here have now been in service several months, proving that no damage resulted from this sort of handling.

CABLE CART THAT LIFTS ITS OWN CABLE REELS

It May Be Used for Hauling Cable, and It Also Saves the Time Usually Required to Set Reels on Jacks

A two-wheeled cart which will serve both as a cart and as a cable reel has been constructed by the electrical department of Lincoln Park, Chicago, under the



DETAILS OF THE LEVER CONSTRUCTION BY MEANS OF WHICH THE REEL IS EASILY PICKED UP

direction of Claude H. Shepherd, electrical engineer for the park. The cart consists primarily of a pair of 72-in. (182.91-cm.) wagon wheels, in which a special pair of shafts have been fitted. The shafts have been arranged so that when the end into which the horse will be hitched is elevated the other end can be slipped under a special mandrel which has been made to fit into the center of the cable reel. When the shafts are pulled down the hook on the short end of the shafts lifts the reel of cable, which then rolls down the shafts about 6 in. (15.24 cm.) into a groove (see illustration). This places the mandrel, which runs through the center of the cable reel, just back of the center line between the two wheels in such a position that the weight of the long end of the shafts is sufficient to keep them on the ground. The reel can then be fastened securely in place by hinges which fasten down over the ends of the mandrel with hand screws. With this cart two men can very easily handle a reel of standard-size cable in much less time than it can be handled on the ordinary type of jack.

The cost of constructing this cart was by no means of a prohibitive kind. The cost of material came to

\$89.61, the cost of labor expense was \$103.06, and the overhead charge was \$14.27, making the total cost for the completed vehicle \$206.94.

COMPENSATING LONG FEEDERS THAT ARE LIGHTLY LOADED

Accomplished by Inserting a Two-to-One Current Transformer in the Compensating Leads to the Contact-Making Voltmeter

In connection with the use of automatically controlled feeder voltage regulators of the induction type, the proper compounding of lightly loaded feeders of considerable length often presents difficulties. Such feeders require approximately full boost over the peak, not because of high load but on account of excessive drop due to length.

In any substation the feeders will usually be found equipped with current transformers of similar size, and with a lightly loaded feeder it will be found impossible to get full boost out of the regulator, even when the dial switches on the contact-making voltmeter are adjusted for maximum compensation. In such a case it is inadvisable to change the current transformer on the feeder, since such a change spoils the uniformity of the equipment, and, furthermore, the smaller current transformer may seriously limit the capacity of the feeder in case it becomes necessary to tie additional load to it in an emergency.

A better solution of this difficulty is the insertion of a two-to-one current transformer in the compensating leads to the contact-making voltmeter, with the 5-amp. winding connected to the feeder current transformer and the 10-amp. winding in circuit with the contact-making voltmeter. This practically doubles the compensation per unit of primary current and gives high boosts at relatively light loads.

COMBINING STATIC BOOSTERS WITH INDUCTION REGULATORS

Case in Which a Static Booster May Be Used to Improve Regulation, and How It May Be Done

The use of static transformers as boosters is often a makeshift of great value in practice. However, it must be remembered that lines which require such boosters because of either excessive load or excessive length will be subject to poor regulation, for although a static booster raises voltage it does not improve regulation.

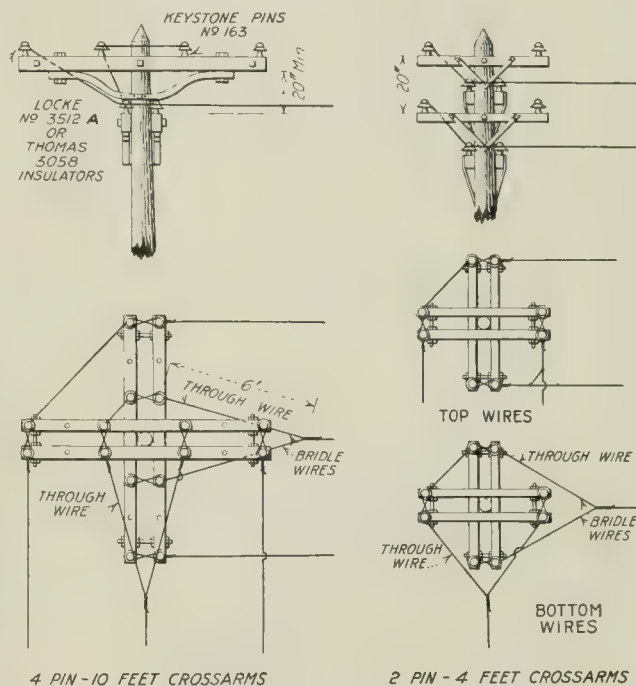
A case in which a static booster may be used to improve regulation is as follows: Where an automatic induction, feeder-voltage regulator is used on a line having a regulation in excess of 10 per cent and the bus voltage cannot be modified because of the necessities of other unregulated feeders connected to the same bus, the feeder will have insufficient pressure over the peak, even with the regulator at full boost, unless a regulator having a greater range than the standard plus or minus 10 per cent be obtained. In such a case a static booster boosting 10 per cent can be used in conjunction with the regulator to secure a range of

full 20 per cent above the bus voltage. The contact-making voltmeter should be set to give 10 per cent under voltage. This will give full buck at no load, and the automatic regulator will counteract the additive effect of the static booster. As load increases this regulator will pass from full buck to full boost, giving a range of 20 per cent above bus voltage. If the bus voltage is variable and regulation desired on the feeder does not exceed 15 per cent, it will be advisable to use a 5 per cent booster, thus giving a range with reference to bus voltage of minus 5 per cent to plus 15 per cent.

PLAN FOR EQUALIZATION OF WIRE STRAIN AT CORNERS

How an Extra Bridle Wire Has Been Employed in Buck-Arm Construction to Prevent Corner Poles Twisting

On the transmission lines of the Southern Illinois Light & Power Company of Hillsboro, Ill., a novel plan has been worked out for equalizing wire strain at buck-arm corners. The standard line construction of the company is of two types. One of these types employs



DOUBLE-ARM CONSTRUCTION TO EQUALIZE STRAIN ON CORNERS

standard four-pin 10-ft. (3-m.) cross-arms, permitting the transmission lines to be strung with all three wires in a single plane. The buck-arms are so placed that the bottom of the top arm is never less than 20 in. (50.8 cm.) above the top of the buck-arm. With this arrangement it is necessary to dead-end two line wires on one end of the arm and one wire on the other end. In order to equalize the strain on the pole and on the arm, an extra 6-ft. (1.8-m.) bridle wire is employed as shown in connection with the hitherto empty pin.

The company's other standard type of construction employs two arms of the two-pin 4-ft. (1.2-m.) type, placing two wires on the top arm and a third on one pin of the bottom arm. The method of working out the same scheme on the bottom arm with this type of construction is shown in the accompanying illustration.

CENTRAL STATION SERVICE

*A Department Devoted to Commercial Policy and Management Topics,
Including Applications of Electric Light, Power and Heat*

METHOD FOR FIGURING THE MAXIMUM DEMAND

Chattanooga Company Using Wright Demand System Changes from Taking Lamp Census to Socket-Census Method

For the purpose of checking the actual connected load on the consumer's premises the Chattanooga (Tenn.) Railway & Light Company periodically takes a census of all lamps on its lines. The company uses the Wright demand system of charging for residential service, and therefore the demand has been based on the actual connected load as evidenced by the total wattage of the lamps installed. Owing, however, to the expense involved in keeping a complete record of consumers' lighting equipment, the company is changing this method to a socket rating. An average rating per socket of 50 watts is assumed. This figure multiplied by the total number of sockets gives the assumed maximum demand. The company takes 66 2/3 per cent of this latter quantity as representing the maximum demand for rate purposes.

MAKING PUBLIC-RELATIONS CAPITAL FROM TAXES PAID

How the Milwaukee Company Secured Valuable Unpaid Publicity Through Its Local Newspaper's Interest in Its Internal Affairs

When the Milwaukee Electric Railway & Light Company sent the State Treasurer a check for a part of the tax which it must pay to the various governing bodies a fac-simile of the check was given to one of the local newspapers, together with an article setting forth the company's position as regards taxation. The check was reproduced in the newspaper, with the following story:

On Nov. 30 the Electric Company handed to State Treasurer Johnson a check for \$546,872.53 in payment of the State taxes of the company for the last year. This sum represents only what is paid the State as direct taxes and does not include any of the real estate, special or income taxes paid the federal government. It is an increase over those paid last of \$36,433.94.

Of this sum \$425,729.88 is paid on the property of the Milwaukee Electric Railway & Light Company, and \$121,142.65 represent the taxes of the Milwaukee Light, Heat & Traction Company.

Of the taxes paid by the companies the city will finally receive 65 per cent, or \$276,724.42; the county 20 per cent, or \$85,145.98, and the State 15 per cent, or \$63,859.48, this division being in accordance with the new State law. The total cash taxes of all kinds will amount to \$612,290.47, State and federal.

This means that of the total operating revenue of both companies, commonly known together as the Electric Company, of \$9,892,492.04 there is paid in taxes 6.18 per cent, and for every dollar of the net income of \$1,463,077.96 there is paid in cash taxes 41.86 cents, or nearly one-half. Last year the ratio of such taxes to the net income was 21.1

per cent, but the greatly increased cost of operation and taxes with no increase in rates or fares this year raised the proportion to the high figure of 41.85 per cent. Few net incomes even with war profits are taxed so highly.

In addition to the amount paid the State the company will pay \$65,517.94 for real estate and federal income tax. These figures include nothing for indirect taxes, such as paving, electricity to operate city bridges, street sprinkling and snow removal, or free passage of city policemen and firemen and other public employees.

This total paid in taxes means that every day the company must pay the State and nation \$1,705.18 and that the fares of 57,300 passengers, at the average for original and transfer passengers of 2.98 cents each, must be taken for this purpose each day. This must be taken from the income before anything can be taken for its employees or other costs of operation, or for maintenance or interest on the investment.

During the year ended Oct. 31 the company carried a total of 177,515,482 passengers of all kinds, revenue, transfer and free, the latter composed of its own and various public employees, there being an increase for the year of 4.12 per cent. There was also a total of 57,880 electric service customers of all classes, commercial, power and residence, an increase of 12.95 per cent. The passenger revenue of the company increased 6.5 per cent; the railway operating expense including taxes increased 11.4 per cent. The electric service revenue increased 21.9 per cent, while the expenses are due to the higher cost of everything needed in operation.

PLAN FOR STIMULATING ELECTRIC VEHICLE INTEREST

Southern Central Station Stages in Its Show Window a Special Demonstration of Pleasure-Car Battery Charging

The commercial department of the New Orleans Railway & Light Company has been giving considerable attention during the last few months to the stimulation of electric vehicle business, in the effort not only to arouse more public interest but to secure a greater activity on the part of the local vehicle dealers. Several industrious distributors have taken on agencies for the best electric trucks and pleasure vehicles, and have found the market so responsive that they are enthusiastic over their experience so far.

In order to make it convenient for the public to get acquainted with the advantages of electric pleasure vehicles an arrangement was made with one of the local distributors to place an electric car on exhibition in the lighting company's showroom. This was a late model of particularly appealing design. At the same time, a complete line of storage batteries of different types and a special demonstration of "How to Charge Your Electric" were featured. Invitations were sent out by this local agent to a list of New Orleans people financially able to purchase an electric car, and the showroom was crowded daily with interested visitors inspecting the cars and discussing the advantages of electric vehicles.

ANOTHER CLASS GRADUATES AT DOMESTIC TRAINING SCHOOL

Union Electric's Courses Now Number 933 Women Fully Convinced of Economy of Electric Range Operation

Another course of ten weeks has just been completed at the domestic science training school of the Union Electric Light & Power Company, St. Louis, Mo. Out of 323 women enrolled 250 received diplomas. The fourth term opened Dec. 3.

The lessons in these classes have been chosen with special reference to the question of food conservation with the electric range as the cooker. Since last April 933 women have graduated from the courses, with a full conviction of the economical operation of the electric range.

The work carried on by the St. Louis company, if supplemented by similar work by other central stations in all sections, will have a direct bearing on the momentous question of coping with the food shortage that is a necessary accompaniment of the nation's participation in the war. The electric range properly mustered in and efficiently supported will acquit itself as a steadfast and dependable auxiliary of the electrical service brigade that is doing so much to help make the world safe for democracy.

CHICAGO ELECTRIC TRUCK SERVICE GARAGE FINISHED

A Contract, Including Transportation, Tires, Repairs, and All Garage Service, Is Entered Into Under a Single Monthly Flat Rate

The complete electric truck service for Chicago is now a reality. The Commonwealth Edison Company has erected a commercial electric service garage in the West Side wholesale and industrial district on the corner of Jackson Boulevard and Morgan Street. This new building has capacity for 100 vehicles. The new portion measures 125 ft. by 200 ft. (38.1 m. by 60.9 m.), and is built adjacent to an older garage used for some



FIG. 1—THESE SHOW WINDOWS FRONTING ON JACKSON BOULEVARD WILL BE USED TO DISPLAY NEW TRUCKS

of the company's cars. There are seventy-two additional charging positions in the old part of the building.

By the plan worked out a customer by paying a flat charge per month gets everything his transportation service requires except liability insurance and the services of a driver. Ordinary repairs, tires, battery re-

newal and charging, washing, garaging and painting are all covered by the contract. The only stipulation is that the contracting party must start with new electric trucks. The building was started in July and is now practically completed.

The one-story building is divided into two rooms,



FIG. 2—WHEN A DRIVER BRINGS HIS OWNER'S TRUCK INTO THIS GARAGE HIS DUTIES CEASE; THE VEHICLE GETS COMPLETE CARE FROM A TRAINED FORCE

each of which is served electrically by a standard Schafer switchboard. One of the rooms is used for the company's own trucks at present. Energy taken from the company's direct-current substations is distributed through these boards to fifty-eight charging positions in the two rooms. Each circuit, in addition to carrying the usual switching equipment, also has an individual rheostat and meter. The rating of most of the circuits is 100 amp., but some circuits to carry 200 amp. are installed for boosting. As will be observed from the illustrations herewith, the junction boxes are all overhead and A. & J. M. Anderson plugs are used throughout. The general lighting is of the steel-reflector in-

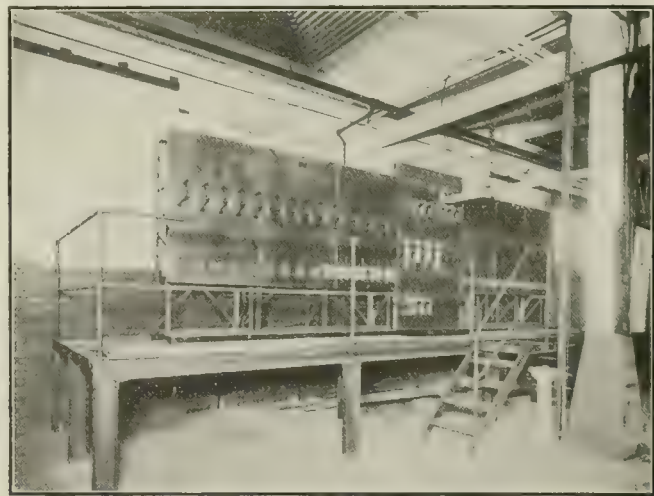


FIG. 3—ONE OF THE BLACK SLATE DISTRIBUTING BOARDS; THE OPERATORS' GALLERY HAS A SLATE FLOOR

dustrial type with special receptacles for the washing racks and with liberal window lighting at one side where manufacturers' truck displays will face the adjacent boulevard.

In selling the service which the company will offer through this garage it has been observed that many

vehicle owners do not know their exact costs. It is pretty generally conceded, however, that a 1-ton truck with Edison batteries doing an average amount of work day by day costs an individual \$125 a month to operate from his own garage without counting driver's wages or insurance. When owners do know their costs they are often ready to concede that this truck service plan will save money for them. The sale of the service, of course, involves the sale of trucks, and four truck manufacturers are now co-operating with the Edison company's commercial vehicle men. They are the Walker, the Ward, the General Vehicle and the Couple-Gear companies. Since the Chicago campaign started Sept. 1, sixteen new trucks have been sold, of which ten are already delivered. The men in charge of the commercial-vehicle work stated that the prospects for more business appear particularly bright.

The total investment represented in this truck service station, including real estate, is \$185,000.

RENDERING MONTHLY BILLS TO CONSUMERS

Ohio Association Receives Information from Members on Their Plans for the Exercise of Economy in This Direction

A little while ago the Ohio Electric Light Association made a request of its membership for information as to what companies were doing or proposed to do in relation to the increase of 1 cent upon each postal card that has been caused by the government war tax. A few responses have been received in answer to this request.

The Dayton Power & Light Company reports that it has for several years had its meter readers deliver about 90 per cent of its bills to its customers and would not return to the mailing system for this 90 per cent, as it finds the delivery system much more satisfactory.

An interesting suggestion is found in a paper presented by F. H. Patterson at the thirteenth annual convention of the Empire State Gas & Electric Association, held on Oct 5, 1917, as follows:

"The bill deliverers are paid at a flat salary of \$14 per week. For this they are expected to deliver an average of 450 bills per day. For all bills delivered in excess of this they receive $\frac{1}{2}$ cent per bill. As in the case of the meter readers, a penalty of 10 cents is imposed for each error discovered against the bill deliverers. Under this arrangement the average amount of compensation paid each bill deliverer is about \$76.50 per month, and per bill delivered, exclusive of supervision, 0.659 cent."

The Pomeroy & Middleport Electric Company says that it will continue to mail out its light bills on postal cards, notwithstanding the increased cost. It feels that even at the advanced price the cost of service is lower and better than it would be if it had to furnish paper for printing the bills and make personal delivery in addition.

The Columbus Railway, Power & Light Company reports that it has used the postal-card form of bill for all light and power customers since 1913 and the arrangement has been extremely satisfactory. With the present change in postal laws the cost of mailing the

postal-card bills will be doubled, and it is at this time making a study of the situation and endeavoring to find a means by which it will be enabled to eliminate the extra expense. One plan receiving its earnest consideration is that of leaving the bill on the premises when reading the customer's meter, by which the company believes it can eliminate the postage charge, together with a large portion of the cost of delivery.

The Greenville Electric Light & Power Company so far has taken the stand that it will continue the postal-card system at the increased rates, not only because of the efficiency and excellence of the postal delivery system, but also on the ground that this war has to be paid for and it might as well do its bit in that direction as in some other.

WIRING IMPROVEMENTS ARE REQUIRED OF CONTRACTORS

Worcester Central Station Has Posted a Bulletin Outlining Outcome of the Experience of the Company's Illuminating Department

To insure wiring installations in accordance with its convictions as to the best practice, the Worcester (Mass.) Electric Light Company recently posted a bulletin for local contractors covering the following requirements in all cases where central station service is provided. The points insisted upon are the outcome of the experience of the company's illuminating engineering department, and their inclusion makes each installation better from the standpoint of both the company and the customer: (1) Indicating switches are required on all interior lighting circuits. (2) Holes made at the building entrance must be carefully closed up to keep out cold, if too large for the conduit. This means fuel saving as well as increased comfort for the customer. (3) Ceiling pans are required to be fastened by means of crowfeet or insulating joints and not by screws through the edge of the pans. (4) Insulators are required by the company on pull-chains in all kitchens and baths and also in pantries having sinks, thus doing away in large measure and at trifling cost with claims for damages for shocks received in such situations. (5) Shades about 6 in. in diameter are required in kitchens where only one lamp is installed, in order to give a satisfactory general distribution. (6) In the past an insufficient number of pipe straps have often been used in outside attachment of conduit above the head of the wireman. Enough to insure rigidity are now required. (7) Brass pans of the two-light type are required to be at least 12 in. in diameter, using at least 14-in. diameter on three-light to five-light units, inclusive. The insistence upon these sizes improves the distribution and avoids the poorer service resulting from the use of smaller and less expensive units. (8) Contractors are required to furnish meter boards of good quality instead of using scrap boards from the cellars of buildings being wired. In one case before this ruling the contractor employed pieces of an egg crate, which failed to hold satisfactorily. In these regulations, issued from its counter where requests for wiring bids are displayed, the company did not intend to criticize the work of the local contractors as a class, but to catch up a few loose ends in wiring practice and point the way to betterments easily obtained.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Parallel Coupling of Three-Phase Transformers.—JACQUES DAMIEN.—After some theoretical considerations upon the relative advantages and disadvantages of three-phase transformers as influenced by the method of connection, the author concludes that star connections and delta connections are of nearly equal advantage from the points of view of construction, of insulation and of performance, and that from the point of view of coupling in parallel the advantage rests incontestably with the star-connected transformers. He lays down definitively the rules that should be observed in the construction of this kind of apparatus.—*Revue Gén. de l'Elec.*, Nov. 17, 1917.

On the Effect of Armature Resistance and Reactance on the Terminal Pressures of a Rotary Converter.—S. NEVILLE.—Continuation of an article which is concluded in this issue. Among the subjects discussed are resistance drop, pressure between direct-current brushes, pressure between adjacent polygon tapings, pressure between diametral tapings, reactance drop, inverted rotary and double-current generator.—*London Electrician*, Nov. 30, 1917.

Lamps and Lighting

An Integrating Hemisphere.—F. A. BENFORD, JR.—During the work of developing the compensating screen described in a previous paper the calibration of the instrument required the use of only one of the hemispherical halves of the integrating sphere. This suggested the permanent use of a hemisphere such as described in this paper. The sphere is well established as a photometric instrument, and the theories of the two instruments are compared to show that the hemisphere has certain theoretical advantages. The tests that have been completed confirm the calculated data. It was found necessary to correct for the lack of pure diffusion by the sphere paint, and the means of making this correction is described along with the absorption effects of the test unit in both sphere and hemisphere.—*Illuminating Engineering Society*.

Street Lighting with Modern Electric Illuminants.—S. L. E. ROSE and H. E. BUTLER.—This article on street illumination covers both incandescent and arc lamps from the illumination standpoint and gives charts facilitating the comparison of different units on the basis of illumination. It discusses the various factors entering into street-lighting contracts which should be thoroughly understood by all concerned in order to avoid controversies.—*Gen. Elec. Review*, December, 1917.

Generation, Transmission and Distribution

Practical Calculation of Electrical Transmission Lines.—B. GUERSCHINOVITCH.—Second part of a study on this subject, of which the first part was printed in the *Revue Générale de l'Electricité* for April 7; in the second installment the economic point of view is cov-

ered, with an elaborate compilation of formulas, largely based on the results already obtained.—*Revue Gén. de l'Elec.*, Nov. 10, 1917.

Relay Operation Under Heavy Short Circuits.—L. M. CRICHTON.—An analysis of tests by the Alabama Power Company to determine the reliability of the relays used under the following conditions: (1) low voltage due to a short circuit close to the substation; (2) poor power factor; (3) distorted phase relations due to unbalanced short circuit; (4) phase-angle error of the low-ratio ring-type current transformers which were installed in the circuit breaker bushing and which energized the relays; (5) energizing the relay potential coils from the low-tension side of the main power transformers, which were connected delta-star and consequently shifted the phase angles 30 deg.—*Elec. Journal*, November, 1917.

Traction

Utah Electrification Embodies Latest Developments.—Automatic substations with 1500-volt motor-generator sets and all-steel cars with equipment for automatic acceleration and constant-potential motor-generator sets for supplying energy to the control and lighting circuits are features of the Salt Lake, Garfield & Western electrification and extension.—*Elec. Railway Journal*, Dec. 15, 1917.

Catenary Overhead Construction.—W. C. LANCASTER.—Study of the design of the overhead system for the Montreal tunnel and terminal of the Canadian Northern Railroad.—*Elec. Railway Journal*, Dec. 8, 1917.

Notes on Steam and Electric Locomotive Performance.—F. WYNNE.—The author brings out several important comparisons of the performance of these two types of locomotives. He points out that the steam locomotive is a variable-speed machine, capable of developing practically uniform torque over a wide range of speed. The performances of several typical steam locomotives are given in curves. An excellent feature of the steam locomotive is its ability to develop any tractive effort within its capacity at a number of speeds below the maximum speed for that tractive effort. On the other hand, the electric locomotive is a variable-output machine, the developed horsepower varying with tractive effort demanded of it. The continuous capacity is limited by the temperatures which are safe for the continuous operation of the various parts of electrical equipment. Curves are presented giving the performance characteristics of direct-current locomotives with series motors, with commutating-pole series motors, with series alternating-current motors and with polyphase induction motors. Comparison of the curves indicates that an increased demand for tractive efforts in ascending grades or hauling greater tonnage will reduce the speed of an electric train with any type of locomotive less than that of a steam train. In addition, the reduction in fuel consumed with electric service is

enormous. The concentration of very much greater power in a single locomotive unit, the ability to operate two or more units with a single engine crew, and a resulting increased size of train, all tend to reduce the number of enginemen and trainmen required to produce a given amount of service electrically. A similar reduction in maintenance and inspection forces also leads to the elimination of secondary engine terminals, reduction in classes of repair men required and a smaller amount of repair work to be done.—*Elec. Journal*, October, 1917.

Installations, Systems and Appliances

A Swedish Hydroelectric Development.—This descriptive article, one of a series dealing with the state hydroelectric power houses of Sweden, takes up the installation at Porjus, of which the capacity is much superior to that at Trollhättan. Built upon the Lule River, it has a possible eventual rating of 700,000 hp. At the present time it comprises two single-phase generators of 12,500 hp. each, one three-phase unit of 14,000 hp. and one auxiliary set made up of a turbine coupled directly to two alternators, single-phase and three-phase. The project provides in the near future for five single-phase and five three-phase sets, each set operated by two turbines. The energy produced is transmitted at 77,000 volts and 8000 volts for the needs of a railway line and a mining company.—*Revue Gén. de l'Elec.*, Oct. 27, 1917.

Performance and Design of Surface Feed-Water Heaters.—M. C. STUART.—The writer develops his theory of heat transmission from the fundamental law that heat transmission is proportional to temperature difference. From this the writer proceeds to the determination of, first, the mean temperature difference between water and steam and then of heat transformation from steam to water. The validity of the theoretical relations between temperatures and tube lengths are demonstrated on multi-pass feed-water heaters by comparison with actual test data.—*Journal American Society of Naval Engineers*, August, 1917.

Turbo-Blowers and Turbo-Compressors.—V. OSWALD DAVIS.—The author points out the advantages of turbo-blowers and turbo-compressors over reciprocating steam and gas-engine-driven sets. Blast furnace turbo-blowers, turbo-compressors, efficiency of turbo-blowers and turbo-compressors and small turbo-blowers and exhausters are the topics discussed.—*Beama Journal*, October, 1917.

Electrophysics and Magnetism

Experimental Method of Solving Electrostatic Problems.—CHESTER W. RICE.—The electrodynamic method for solving electrostatic and allied problems has been developed to a high degree of accuracy and applied to the study of high-voltage bushings. An experimental high-air-efficiency bushing was built and tested with the result that the arc-over was very materially lower than had been anticipated. From a study made to ascertain the reason for this large discrepancy, it was found that an unexpectedly large surface effect, which varied greatly with different materials, existed. After obtaining the numerical value for the surface effect a reasonably accurate predetermination of the arc-over of structures in which the stress distribution is known can be made. In order to determine the desirability of using arti-

ficial equipotential surfaces to increase the efficiency of the use of the supporting dielectric, diagrams were taken and a small bushing of this type was constructed and tested. A study was then made to find out whether the reduction in diameter of condenser bushings is principally due to equalization of potential or to the greater strength of insulation when barriers are used. As a result of this work it is believed that the barrier effect greatly predominates. A short discussion shows the difficulties of obtaining a sufficiently exact theory of bushing design to make it possible to predetermine the most efficient shape for a practical bushing. A series of small bushings were tested with a view to determining the general shape and characteristics which go to make up a practical all-around bushing. An appendix gives an uncondensed solution of the following two-flow problems: (1) The distribution of the electrostatic field when any two confocal hyperboloids of revolution of one sheet and of the same family are maintained at given potentials; (2) the distribution of the electrostatic field when any two confocal hyperboloids of revolution of two sheets and of the same family are maintained at given potentials.—*Proceedings A. I. E. E.*, November, 1917.

Telegraphy, Telephony and Signals

Time Service in Switzerland by Telephone.—In Switzerland the complete suspension of private wireless installations at the outbreak of war caused considerable inconvenience to the watch and clock industry, which was accustomed to take its time from the wireless time signals issued from the Eiffel Tower. The difficulty appears to have been overcome by an automatic apparatus installed at Berne, which receives the wireless time signal and conveys it by telephone to those who so desire. It is said that the telephone transmission has proved quite successful, accidental errors in transmission being rarely more than one-tenth of a second.—*London Electrician*, Nov. 30, 1917.

Miscellaneous

Electrical Situation in Germany.—DR. NIEFIND.—A number of interesting sidelights were thrown on the electrical situation in Germany during 1917 by the annual convention of the Association of Electrotechnical Companies of Germany at Frankfort on the Main. The central stations of Germany use only 4 per cent of the total German coal consumption, so the association protests against the government orders curtailing the use of electric lights in homes and public buildings. Of the amount stated only 0.3 per cent is turned into electric light. Another part of the report dealt with the continued introduction of substitutes for materials considered "indispensable" in electrical work. It covered practically the whole insulating and conducting field from switchboards in central stations and high-voltage transmission lines to incandescent-lamp sockets and bulb bases with the ordinary insulated house wires. Good progress is reported in the use of aluminum, iron and zinc wires, as well as compressed and impregnated paper for insulating boards. An alloy of zinc has been discovered which combines ductility and toughness with fair electrical conductivity. In some cases it has been found feasible to use iron wires covered with a double coating of good varnish instead of the ordinary form of insulated wire.—*Elektrot u. Maschin.*, Nov. 11, 1917.

Limiting Alternator Short-Circuit Currents

To the Editor of ELECTRICAL WORLD:

Sir: I was much interested in the article entitled "Limiting Alternator Short-Circuit Currents" which appeared in the issue of the ELECTRICAL WORLD for Sept. 8 last, and I should like to call attention to some of the points taken up.

The author states clearly that the subject is so complex "that anything like a simple explanation is difficult." This is true enough, but it is hardly an excuse for failing to give a "qualitative theory" within about the space taken up by the writer. It is stated "that the transient current is of much the same nature as that which flows when an induction motor is connected to the line. . . . In the present case the rotating field is the armature reaction, which is fixed in space, but rotates synchronously. . . . That the likeness exists only for a very short time, however, will soon be evident." There is little that is evident in regard to the above, and in fact the last statement is not quite correct. The likeness exists, not "for a very short time," but only so far as component *II* is concerned, as will be explained presently.

Following up the author's explanation and excellent scheme of "treating separately" the different causes and by superposition determining the "resultant effects," this is what happens: For the sake of convenience consider a two-phase revolving armature alternator, such as that described in the article. The armature reaction under sudden short-circuit conditions can be separated into the following: *I*. The armature field produced by the sustained short-circuit current and which is fixed in space, constant in intensity with respect to time and demagnetizing in regard to the field flux. *II*. A transient oscillatory decaying component similar to the one shown in curve *a*, Fig. 1. This was taken on a standard three-

Readers' Views and Comments

exploring coil wound around the pole. Curve *b* gives the emf. impressed across one of the armature lines. The oscillating component of armature reaction is fixed in space and dies down according to the armature attenuation factor and is a function of the time angle Θ_1 with respect to the phase voltage at which the short-circuiting switch happens to close. *III*. The third component of armature reaction is a non-oscillating transient fixed in space (in case of the revolving armature machine considered). The rate of decay of this component depends upon the field attenuation factor α_f , and is independent of Θ_1 . For the sake of further clearness these three components of the armature reaction, with respect to the field and time, are shown in Fig. 2.

The field flux now, in turn, has three components, as illustrated in Fig. 3 by *a*, *b*, and *c*. Component *a* is that due to the direct-current excitation. The oscillatory transient component *b* dies down according to the armature attenuation factor α_a , while the non-oscillatory component decays according to the field-damping factor α_f , and both *b* and *c* are independent of the time angle Θ_1 at which the short-circuit happens to occur.

Now the components *I* and *a* combine to give the small sustained short-circuit flux, which in turn is responsible

sultant flux or emf. and no current produced by $II + b$; in the most favorable case of symmetrical sudden short-circuit armature current this is exactly what happens. Otherwise $II + b$ gives rise to a unidirectional current in the armature which dies away according to the attenuation factor α_f . Finally *III* and *c* combine to produce a non-oscillating decaying flux, which produces an oscillatory current, decaying according to the field attenuation factor α_f .

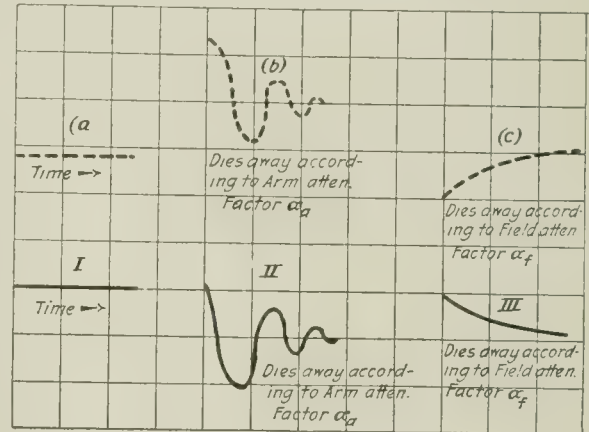


FIG. 2—COMPONENTS OF ARMATURE REACTION WITH RESPECT TO FIELD

The above represent the main reactions only and are approximate in that secondary effects are neglected and certain simplifying assumptions are made. The actual complexity of the reactions may be appreciated by referring to curve *c*, Fig. 2, which represents the voltage induced in a full-pitch exploring coil at the top of an armature slot. Curve *a* represents the field current while *b* gives the armature current. In this test an external resistance of 2500 per cent of the field resistance was suddenly inserted into the field just before short-circuit. A few such tests were made by the writer nearly two years ago, but as the results did not

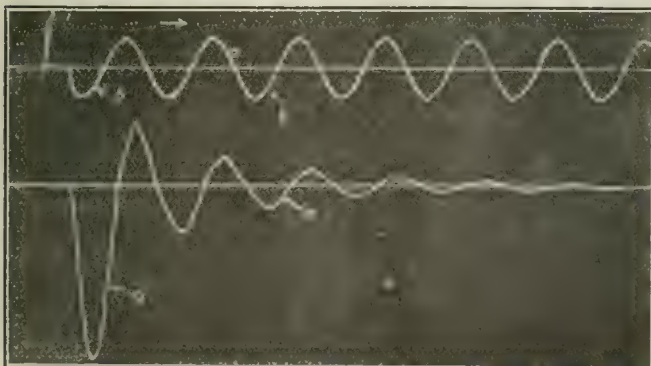


FIG. 1—EFFECT OF SUDDENLY CONNECTING UNEXCITED MACHINE AT SYNCHRONOUS SPEED

(a) First curve (from bottom)—voltage induced in full-pitch exploring coil around pole when three-phase alternator was suddenly connected across three-phase supply while running at synchronous speed and without excitation. (b) Voltage impressed across machine

phase alternator, running at synchronous speed with the field unexcited and the armature suddenly connected to a three-phase supply. Curve *a*, Fig. 1, gives the emf. induced in a full-pitch

for the sustained short-circuit component of armature current. As mentioned before, *II* is a function of Θ_1 , and thus it may happen that it may neutralize *b*, in which case, of course, there is no re-

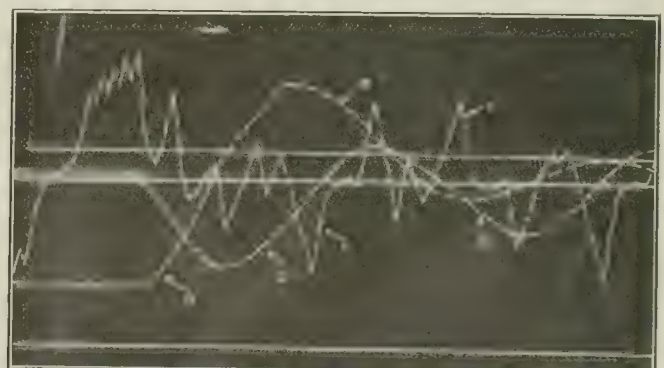


FIG. 3—CONDITIONS EXISTING IN MACHINE CIRCUITS BEFORE SHORT CIRCUIT

(a) First curve (from bottom)—field current. (b) Armature current. (c) Voltage induced in exploring coil at top of slot. From oscillographic record made just before sudden short-circuit. Before making this record external resistance had been inserted into the field circuit

prove consistent enough, owing to the difficulty of controlling and duplicating the time of the closing of the short-circuiting switch, they were given up, and thus the writer feels that he is in

plane, lagging currents being drawn to the right of the *OY* plane and leading currents to left.

D. D. EWING,
Associate Professor Electric Railway
Engineering, Purdue University.

"Saving Derived from Covering Steam Pipes"

To the Editor of ELECTRICAL WORLD:

Sir: In the Oct. 6 issue of the ELECTRICAL WORLD, under the above title, is an article containing this statement: "This firm has covered all of its power piping, carrying 150 lb. pressure and 120 deg. superheat, with two layers of asbestos millboard $\frac{1}{2}$ in. thick . . . designed to withstand the high temperature to which it is subjected. The purpose of using two layers is to completely fill the air space which would otherwise exist under the outer molded insulation."

Surely this practice represents a lot of needless trouble. In the first place, if 85 per cent magnesia coverings are properly made and specified to fit a standard pipe, there should be no "air space," or at least so small a space that it would be negligible because of the outer layer of 85 per cent magnesia, which would effectively retain any heat that had radiated into the space.

Whoever recommended "asbestos millboard" for such a purpose was evidently not aware of the fact that such a covering has not enough insulation value to warrant so expensive and so laborious a procedure. It is a common fallacy among engineers and steamfitters to refer to pipe covering as "asbestos," when all the while they mean something else. Asbestos *per se* has little or no insulation value, although it is a valuable fireproofing material. In loose, fibrous form it acts as a dead-air holder and so has some value as a heat insulator, but used as millboard it would allow the heat to pass almost as readily as if it were not there.

In the manufacture of 85 per cent magnesia coverings a small proportion of fibrous asbestos is used but merely as a binder, in the same way that hair is used in lime plaster for walls. It serves only to give structural strength and is not considered as contributing to the well-known insulating qualities of this covering.

In the second paragraph of the article "asbestos magnesia cement" is mentioned. I do not find this listed in any manufacturer's catalog. Is it a new material or merely another misuse of the much misused term "asbestos"?

Evidently it has been impressed on some one that 85 per cent magnesia coverings need protection from high temperatures? No practical engineer would countenance such an absurd proposition. Steam at 150 lb. pressure and 120 deg. superheat has an initial temperature of 478.5 deg. Fahr., while 85 per cent magnesia coverings are today and have been for years giving efficient service at temperatures up to around 600 deg. Tests made by independent authorities show no loss of insulation efficiency at temperatures far

in excess of these figures. Furthermore, this efficiency is permanent, 85 per cent magnesia coverings tested after more than twenty years' service having shown no apparent deterioration in efficiency nor alteration of structure due to heat action.

Without questioning the figures quoted to show the (theoretical) efficiency of this installation, I believe that far better results would have been obtained, judging by the actual tests of coal economy, had these superheat pipes been covered by a double-standard thickness of 85 per cent magnesia, as advised in the official specification of the Magnesia Association of America, an association of the leading manufacturers of 85 per cent magnesia coverings formed for the especial purpose of supplying accurate data on pipe and boiler coverings. AUSTEN BOLAM.

Prince's Bay, S. I., N. Y.

Difficulties Encountered in Utilizing Screenings

To the Editor of ELECTRICAL WORLD:

Sir: Screenings at one time were very low in price because apparatus was lacking to burn them, there was little demand, and they were considered as a useless fuel. To-day screenings have risen so in price that still lower grades of coal are being used and apparatus is being developed for them.

For some time now the uniformity of size of screenings has been getting worse, becoming less uniform, until today in many places the specified size of screenings may constitute only a minor percentage of the shipment, the remainder being of smaller sizes down to the dust. The reason for this may be the haste with which coal is being taken out of the ground. But the result is certain—lower combustion efficiencies, greater difficulties of firing, increased loss due to carbon content in the ash, and less coal delivered owing to loss in transit and handling.

The size of coal and the percentage of different sizes plays a large part in furnace, stoker and boiler performance. Variation over wide limits in the same shipment and different shipments from the same place makes performance variable and firing difficult. Dust and small sizes are very useful for banking purposes and may be used to good purpose on grates designed for them, but when used in conjunction with larger coal—1-in. (2.54-cm.) and 2-in. (5.1-cm.) screenings—result in waste of heat and coal.

The remedy seems to be to insist upon more uniform deliveries or modify the price. Dust and small screenings are acceptable—any coal is acceptable at this time—but surely screenings are too expensive already without paying for a large portion of dust at the same price. Many large users and many smaller ones now purchase coal on specification, although this practice has been held in abeyance lately on account of the fact that any sort of coal obtained anywhere is the object sought. However, when conditions revert to normal, but with

the use of low grade fuels seriously and definitely established, it would seem worth while to adopt specifications that shall deal not alone with volatile matter—moisture, ash, sulphur, etc.—but shall also specify the percentage of dust and of sizes other than the nominal permitted. Screenings have now become sufficiently expensive without paying for dust at the same price, particularly since the same quality of dust when purchased alone may be considered a low-grade fuel, for the consumer could with advantage mix the two grades himself instead of paying for them at the higher price.

There is another phase of this matter. Coaldust absorbs a greater quantity of moisture and more rapidly than lump coal. It is not uncommon for Illinois coals to absorb in wet weather 10 to 20 per cent and give up during windy and dry weather 2 to 3 per cent of their weight during fifteen days in travel. Where mine weights govern the coal and freight bills the additional weight due to moisture matters little, but where either freight or fuel bill is dependent upon delivery weights the consumer may have to pay for moisture picked up in transit. Freight rates and fuel are costly enough without paying for water, and it would seem that as low-grade fuels and coaldust come more and more into use methods should be employed to protect them from the elements during the rainy months. It must also be remembered that lump coal can be shipped with fair efficiency in box cars or any type of car, whereas the finer coal and dust must be transported only in gondolas that are in good condition, otherwise there will be appreciable loss due to spilling and wind.

The absorption of moisture by coal of small sizes is not only objectionable because of the high price paid for water in such cases, but if this coal is to be stored the presence of moisture tends to encourage spontaneous combustion. Perhaps the greatest objection to absorbed moisture is that it must be evaporated by the furnace heat and raised to the temperature of the furnace gases.

GILBERT RUTHERFORD.

Evanston, Ill.

Burning Coal While Water Power Runs to Waste

To the Editor of ELECTRICAL WORLD:

Sir: In your issue of Nov. 10 I was much interested in the letter from Mr. Nichols. It does seem strange that we should continue year after year to burn up our coal and let water run to waste. I have thought for a long time that every drop of water that went over Niagara Falls should be used for development of electrical power. I am sure the Falls "dry" would be as much of a curiosity as they are "wet," and the use of the water would not necessarily mar the present attractions of the whirlpool and rapids. I hope I shall live to see the day when this power is utilized.

A. D. T. LIBBY,
Consulting Engineer Splitdorf Electrical Company, Newark, N. J.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

TO REDISTRIBUTE THE NIAGARA FALLS POWER

Conferences Between American and Canadian Authorities Lead to Agreement Which Will Allot Energy to Specific War Industries

Formal orders have been issued at Washington that no new war contracts shall be placed in Buffalo before the War Industries Board certifies that there is sufficient power for their manufacture. This is the outcome of conferences to consider the acute power situation at Niagara Falls, reported in last week's issue of the ELECTRICAL WORLD.

Assurances have been given to the Canadian government that approximately 100,000 electric horsepower imported from Canada will be used only for the manufacture of war products.

The War Industries Board is developing plans, which are now partly in effect in Buffalo, for a redistribution of electric power supply. It is proposed that industries of lesser importance in the war program shall receive power when it is not needed by war order consumers. To some extent the power received by industries of less importance, totaling about 110, will be curtailed.

Canadian authorities were unwilling that Canadian power should be sold to American non-war factories when factories on their side of the river are not receiving all the energy they need.

It is part of the plan that industries in Rochester, Syracuse and other cities shall also be restricted in their use of Niagara power so that Buffalo industries shall have more for their requirements.

FOLLOWING THE ORDER FOR "LIGHTLESS" NIGHTS

Widespread Co-operation Indicated by Reports Received at Washington—Sweeping Authority Is Given to State Administrators

Directly after the first practical experience with the so-called "lightless night," reports received at the United States Fuel Administration in Washington indicated widespread co-operation.

In a ruling telegraphed to Texas officials the Fuel Administration held that the electric sign order covers all light operated by any fuel, including oil and natural gas.

The United States Fuel Administrator, replying to an inquiry from Administrator Prudden of Michigan, said:

"If you decide it to be necessary in order to meet domestic consumers' needs, issue order closing some or all industrial plants, theaters, halls and places of amusement during the holidays."

This action of the United States Fuel Administrator follows the general policy of giving local fuel adminis-

trators ample authority to handle local fuel emergencies as they may develop.

Similar authority has been given to the New York State Fuel Administrator.

GOVERNMENT IN CONTROL OF RAILROAD OPERATION

Proclamation of the President Leads to Hope of Improvement in Coal Situation—Attitude on Electric Facilities

Complete federal control of the railroads, under the President's proclamation of Dec. 26, is of immediate importance because of its promise of improvement in transportation. Individual operation did not produce the measure of co-ordination which will be possible under sweeping governmental authority. It is evident that the federal Fuel Administration is looking to government control of railroad operation to improve the facilities for coal transportation. That result would be of immeasurable relief to electric central stations as well as to all other coal consumers.

The proclamation brings within government control the electric power facilities of electrically operated trunk line railroads and terminals. Evidently it also includes the contractual relations under which privately owned central stations furnish energy to such railroads. It embraces "every system of transportation and the appurtenances thereof * * * whether operated by steam or electric power."

After naming William G. McAdoo (who continues also as Secretary of the Treasury) to be Director General of Railroads, the proclamation adds:

Nothing herein shall be construed as now affecting the possession, operation and control of street electric passenger railways, including railways commonly called interurban, whether such railways be or be not owned or controlled by such railroad companies or systems. By subsequent order and proclamation, if and when it shall be found necessary or desirable, possession, control or operation may be taken of all or any part of such street railway systems, including subways and tunnels, and by subsequent order and proclamation possession, control and operation in whole or in part may also be relinquished to the owners thereof of any part of the railroad systems or rail and water systems possession and control of which are hereby assumed.

The Director shall, as soon as may be after having assumed such possession and control, enter upon negotiations with the several companies looking to agreements for just and reasonable compensation for the possession, use and control of the respective properties on the basis of an annual guaranteed compensation above accruing depreciation and the maintenance of their properties, equivalent, as nearly as may be, to the average of the net operating income thereof for the three-year period ending June 30, 1917, the results of such negotiations to be reported to me for such action as may be appropriate and lawful.

But nothing herein contained, expressed or implied, or hereafter done or suffered hereunder, shall be deemed in any way to impair the rights of the stockholders, bondholders,

creditors and other persons having interests in said systems of transportation or in the profits thereof to receive just and adequate compensation for the use and control and operation of their property hereby assumed.

Regular dividends hitherto declared and maturing interest upon bonds, debentures and other obligations may be paid in due course; and such regular dividends and interest may continue to be paid until and unless the said Director shall from time to time otherwise by general or special orders determine. And, subject to the approval of the Director, the various carriers may agree upon and arrange for the renewal and extension of maturing obligations.

The order of the President became effective on Dec. 28, 1917.

Aside from his public career, Mr. McAdoo is widely known as the father of the Hudson River tunnel system operated by the Hudson & Manhattan Railroad Company and connecting New York City with New Jersey.

NO ADVANCE NOW IN THE NEW YORK EDISON RATE

Difficulty of Determining Effect of Conditions in War, Fuel and Labor Stated Before Public Service Commission by Mr. Lieb

No advance will be made in electric rates by the New York Edison Company for several months, probably for at least another six months. This was announced by J. W. Lieb, vice-president, before the New York Public Service Commission on Dec. 24.

If the company, however, experiences in the next few months a decided falling off in business and a reduction in income as a result of orders of the Fuel Administration or from other business conditions, it may find it necessary to appear before the commission and ask for a restoration of its former maximum rates, either 7½ or 8 cents per kilowatt-hour. The maximum rate is now 7 cents per kilowatt-hour. That rate was put in effect on July 1 last, following extensive hearings before the commission on the application of the company to maintain for another six months its 7½-cent rate, put in effect on Jan. 1, 1917, when a reduction was made from 8 cents. Under the present schedules by general understanding a rate is maintained for about six months, the formal proceeding in reference to the rates of the New York Edison Company and the affiliated United Electric & Power Company being kept alive by the commission for this purpose.

Mr. Lieb said that statements which had been made on behalf of the company last June as to the condition of business and prospects in the next six months had been described as unduly pessimistic, but that it was now known in general that the worst feared had developed and in increased measure. He said in part:

The situation is most difficult and uncertain, but as the year has not ended we are unable to furnish figures which will tell what happened in 1917 and will permit conclusions as to 1918.

We know that the company has had no considerable acceleration of business due to the reduction in rates six months ago, nor has it yet felt the full depressing effects of the general business situation. Nor has it yet developed to what extent conservation of fuel will be directed by the Fuel Administration and how far and how deeply this will affect business and income.

One of the things that we looked for last summer as possibly having a serious effect is not yet in effect, namely, the daylight-saving plan, but it now looks as if this would be put through Congress as one of the early measures at

the President's request. The situation as to coal and labor is most disconcerting. It is impossible to make any coal contracts. Big producers will not consider them. The labor situation is disquieting. I have found it necessary to make notable advances recently in our payroll.

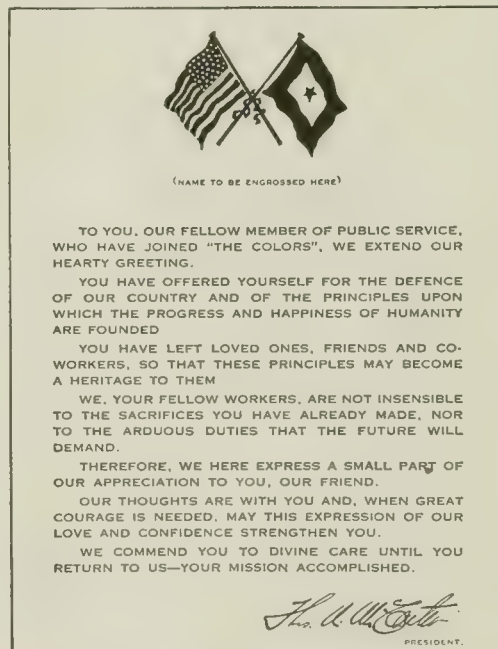
The situation is uncertain and we do not know how badly off we are going to be. We would rather not guess when we present our situation here. We desire to do so with facts and definite statements, and as we cannot produce facts and make definite statements at this time, it is the company's suggestion that the case should be postponed for six months with a privilege of making advances if it should be necessary.

Chairman Oscar S. Straus and Commissioner Travis H. Whitney, by questions to Mr. Lieb, obtained the statement that the company would not make increases without giving notice of at least thirty days. The hearing was adjourned to June 3, 1918, with the understanding that the rate will remain at 7 cents, unless the company finds its income so reduced by high costs of manufacture or by Fuel Administration orders, or both, that application for leave to restore the old rates would necessarily be made earlier.

GOOD-WILL MESSAGES TO MEN AT THE FRONT

Public Service Corporation Employees in Military Service to Receive Evidences of Regard from Fellow-Workers

Employees of the Public Service Corporation, Newark, N. J., are sending messages of appreciation and goodwill to all fellow employees in military service. The



A MESSAGE FROM THE HOME COMPANY

plan is to send a copy 7½ in. by 10½ in. (19 cm. by 26.6 cm.) in size to the home of the employee, and another, measuring 4½ in. by 5½ in. (11.4 cm. by 13.9 cm.), to the man at the front.

At the top of the message are the national flag and the service flag, printed in colors. Under the emblems the name of the man will be engrossed. Then will follow the engraved messages, signed by Thomas N. McCarter, the president. The Public Service emblem at the bottom will be in red, blue and gold.

INCREASING POWER DEMAND FOLLOWS WORK ON MUNITIONS

**Many Plants Being Converted for Munitions Supply,
and This Tests Capacity of Central
Station Energy**

In the following bulletin, dated Dec. 22, the electrical division of the War Industries Board indicates that many plants are being converted to munitions work and that this is reflected by increasing demands for central station energy:

Although the government departments will operate at regular speed through the holidays, we have had relatively a quiet week, owing to the lesser number of visitors from companies operating for the government.

No doubt many intended trips have been postponed because of inability to obtain accommodations out of Washington. During this period we have been able to arrange our records and data in much better shape for prompt action.

There is no indication of lessening demand for war purposes, but rather an atmosphere of increasing speed. On the other hand, the industry no doubt possesses capacity in excess of direct government needs. Our question, therefore, is, will the indirect demands from secondary sources absorb your available capacity? Many plants are being converted to munition work of one kind or another, and this in turn is reflected in demand for power almost beyond the capacity of some of the central stations to supply.

SHORTAGE OF POWER FOR BALTIMORE INDUSTRIES

**Enforced Policy of Not Storing Reserve Supply,
Coupled with Low Water, Brings Crisis
in Electric Service**

Coal shortage and deficiency in water power became so serious in Baltimore recently that the Consolidated Gas, Electric Light & Power Company was obliged to require industries using electric power to reduce their consumption greatly and in many cases to limit the use to lighting purposes.

President Herbert A. Wagner, in a statement to the public, said that the company had been assured repeatedly that its coal requirements were being taken care of. Nevertheless, it had not been permitted to accumulate any coal in reserve for contingencies. A subsequent statement by Mr. Wagner added:

Referring to the coal supply situation as affecting the power for the Baltimore industries, we are glad to say that coal is coming in now at nearly the normal rate and there is enough coal in sight for several days' supply. Owing to the vigorous action of the United States Fuel Administration, we have fairly definite assurances that the supply in the future will be sufficient and that we shall be permitted to accumulate a reasonable reserve for contingencies. The necessity for a reasonable reserve supply has been urged upon the United States Fuel Administration for the past few months, without result until to-day.

It should be understood that the company is consuming for the production of electric power over 1000 tons of coal a day, and that at the time the large industries were notified to reduce their consumption the company only had sufficient coal on hand to operate about six hours. A large part of the time of the officials of the company has been devoted for the last few months to assure a continuous supply of coal, but the priority orders which the company has been enabled to get through Washington did not permit of any reserve stock of coal to provide for just such contingencies as have come about in the last two days, during which the cold weather has seriously interfered with local delivery.

In the efforts of the management to obtain coal from

other mines than its regular source, the poor quality of coal has damaged some of its boiler furnaces and further handicapped it in its power supply. Coincidentally with these troubles the water supply from the Susquehanna River has been reduced by the cold weather below that ever recorded for this time of the year.

The imperative need of a reserve coal supply for the Consolidated company to meet the war demands in Baltimore and the fact that the United States government is now fully aware of this are clearly shown in a communication from Eugene Meyer, Jr., of the War Industries Board to United States Fuel Administrator Garfield. In this communication Mr. Meyer calls attention to the fact that the coal supply of the company has been taken care of "only to the extent of hand-to-mouth requirements. When the company gets a few carloads ahead the coal company immediately cuts off a supply equivalent to that stock."

At the time this statement was issued practically all of the industries in Baltimore were getting their full complement of power.

PITTSBURGH POWER DEMAND LARGELY EXCEEDS CAPACITY

**Abnormal Consumption Due to the War Loads Gen-
erators in Some Cases 20 to 30 Per Cent
Above Rated Capacity**

Shortage of power in the Pittsburgh district and the consequent urgent necessity for economy in the use of energy has led the Duquesne Light Company to issue the following statement:

So many people without knowledge and without facts are talking about what they think the Duquesne Light Company is capable of doing in the way of furnishing electricity for power for industrial plants and street railway operation that a statement on our part seems necessary. Every industrial plant in the Pittsburgh district which is capable of making anything needed by the government to help win the war is being forced to the limit to speed up output. This has resulted in a demand upon the Duquesne Light Company for power about twice as great as it was a few months ago. This abnormal consumption has brought about a situation where we are called upon to deliver to our customers during the day a maximum demand largely in excess of our total generating capacity.

In other words, every generator that we possess, and all are in first-class working condition, is working beyond its capacity from 7 a. m. continuously, excepting only the noon hour, until 8 p. m. In fact, in some cases our generators are working 20 to 30 per cent above rated capacity. Anticipating a large increase two years ago by reason of the prosperity of the Pittsburgh district, but never figuring upon such a sudden and abnormal demand as is now imposed by increasing war orders, we contracted for one 40,000-kw. generator and one 15,000-kw. generator. The 15,000-kw. generator has been in operation, but delivery of the 40,000-kw. generator has been delayed over one year in spite of anything we or the manufacturer could do and it is only now being installed.

This machine will be placed in operation within a short time, as we are working night and day to hurry its installation. This will only relieve the situation in part, however, as it will largely assume the work of other generators in our power plants that have been badly overloaded.

Our first duty is to comply with government instructions and furnish all of the electric power that we can to permit munitions plants to increase their output. We are doing everything humanly possible to fulfill this obligation to the country and at the same time take care as far as we can of the needs of our consumers who are producing material which the government considers non-essential to win the war. We will be compelled, however, to curtail the amount of electric energy furnished to many of these, especially during the day.

Unfortunately there are many people who have not yet realized that war imposes sacrifices upon all of us. We are

not curtailing service and thereby reducing our revenue for the pleasure of it. This is a time when every one must co-operate to prevent waste in the use of electricity. It is a time when every effort should be made to help and not obstruct. The Duquesne Light Company will do everything in its power to render proper service to every one as far as the unusual war conditions will permit.

Those who can do so should operate as far as possible at night, when the present consumption is not nearly as great as our operating capacity. If our customers will do this and eliminate as much waste during the day as they can they will help a great deal to improve a situation over which we have no control. At the same time they will be doing their part to assist the United States to adequately prepare to win a decisive victory over the nation's enemies.

POWER SHORTAGE IN OHIO IS DUE TO LACK OF COAL

Electric Service Has to Be Withdrawn from a Number of Plants in Cleveland—Conditions at Other Points

Because of scarcity of coal the Cleveland Electric Illuminating Company was compelled to withdraw power and light service from a large number of industrial plants (estimated at 1800 by some) on the evening of Dec. 14. On the following evening the company announced that, operating in this limited way, its supply would not last more than two days, but that coal had been shipped and should be received in time to avert the danger of closing down entirely. Tenants of office buildings and stores were asked to use as few lamps as possible until full service could be restored.

Energy for the greater part of the Cleveland railway system is furnished by the illuminating company, and the prospect of being without light and railway service was alarming to business interests, while 75,000 or 100,000 people were thrown out of employment temporarily.

Receipt of a supply of coal prevented the Columbus Railway, Power & Light Company from closing its plants on Dec. 11. Plans are being put into operation by the company to reduce fuel consumption as much as possible. Railroad service will be cut about one-half after 7 p. m. The skip-stop plan will be adopted for residence sections and some re-routing of cars will be done.

The Hamilton light and water plants had little coal on Dec. 12, and street lamps were turned off that evening until an additional supply could be secured.

The Springfield Light, Heat & Power Company withdrew service from all industrial plants on Dec. 10 so that it would be able to furnish steam heat and power to the business district. Coal supply ran so short that the company feared to operate plants at normal.

Electric roads at Hamilton and Dayton were affected and several interurban railways were compelled to reduce schedules in order to continue operation at all. In some instances limited cars were taken off and in others most of the local cars were held in carhouses.

Gov. James M. Cox about the middle of the week demanded of the federal government a release of coal consigned to lake shipment.

The Northwest draws almost its entire coal supply from Pennsylvania, Ohio and West Virginia coal fields, and most of this is shipped by lake from Ohio ports. If sufficient supply is not sent in this way the North-

west runs short, and that would have been the case this season. Should the winter prove severe it is believed that the supply shipped will be none too large.

However, it is suggested by Ohio observers that the Federal Fuel Administration did not understand the effect that the inflexible priority order would have on points closer to the coal fields. None of the consumers stored the usual coal stock reserve. This was due to the high prices that prevailed early in the spring and to the advice given by authorities who considered quotations too high. Prices were run up by buyers who bid against each other.

The Cleveland Electric Illuminating Company received about 125 cars of coal on Dec. 16, a portion by boat from Lorain and the remainder by rail from orders which had already been placed. Plants closed down the previous day for lack of coal were able to resume operation in full.

The situation is not reassuring at all, but the authorities are exerting themselves to furnish coal needed for future operation and prevent danger of shortage in energy, which is urgently needed in Cleveland to keep industries moving.

For a short time the Northern Traction & Light Company, Akron, was almost out of coal, but it managed to keep plants in operation until a small shipment was received.

While the supply is not expected to be so plentiful as in the past, it is hoped that within a short time the pooling plan established by the coal operators will bring about regularity of delivery and increase the efficiency of the railroad equipment.

NEW ENGLAND COMPANY CURTAILS POWER SERVICE

Coal Shortage, Combined with Unfavorable Water Supply Conditions, Makes Restriction of Energy Sales Necessary

Curtailment of service to industrial power customers has been forced upon the New England Power Company by the coal shortage combined with unfavorable water supply conditions. All such customers are required to discontinue their input of energy from the company lines for motor service by the equivalent of twenty-four hours a week.

S. C. Moore, general manager of the company, informed a representative of the ELECTRICAL WORLD in talking of conditions that dry weather during September, followed by an unsatisfactory run-off in October and early freezing of small streams on the Deerfield and Connecticut River watersheds, has been a serious handicap to the system plants. The coal shortage, which has hit many industrial plants in the territory with which reciprocal power contracts are held, has greatly curtailed the energy available by purchase. So far no lighting customers have been asked to curtail and service is being furnished to electric railways on the usual basis. Central stations, however, have been asked to investigate the use of power on their systems where such companies purchase energy from the New England organizations, so that accurate information can be compiled at headquarters in Worcester relative to the essential or non-essential character of the

demand. The company wrote to industrial power customers, pointing out the abnormal demand for energy growing out of the war and stating that a considerable portion of its output is generated now by steam. Present indications, the letter stated, are that during this winter shipments of coal into New England will be limited, for a time at least, to industries essential to prosecution of the war. On a previous occasion the company had addressed inquiries to some of its customers as to whether or not any government orders were being handled, and it therefore realizes in a general way that its power is being used in the manufacture of much war material.

The letter informed the customer that in order to present an application for priority in coal shipments, should such action become necessary, detailed information is essential immediately as to the amount and scope of war work handled by consumers. A blank was inclosed covering the main items of government and war sub-contracts, amount and nature of material involved, department concerned, probable date of completion and total production, with space for additional information of priority interest. The response was very satisfactory from the industrial customers and the material is now being assembled at headquarters.

The New England Power Company operates under agreements with central stations of its territory whereby power is interchanged as economic conditions require. The largest plant with which the system is thus connected is that of the Narragansett Electric Lighting Company, Providence, R. I. Mr. Moore stated that as soon as a new 45,000-kw. steam turbine now installed in this station can be placed in service the situation will be temporarily improved in central New England, as the New England company's transmission lines between its operating center at Millbury, Mass., and Providence can then be called upon to furnish considerably more energy to the rest of the system.

Arthur B. Lisle, general manager of the Narragansett company, informs the ELECTRICAL WORLD that every possible effort is being made to get this machine into service, but that railroad embargoes are delaying shipment of piping which is essential to operation. Arrangements are being made to transport sections of piping from New Jersey to Providence by motor truck if necessary to withdraw the equipment from the rails. It is expected that at least two weeks will be required to prepare the unit for full-load operation after fittings are installed. The Narragansett company has a fair supply of coal on hand at the moment, but, like other New England utilities, is much worried over the prospect of securing fuel for coming demands.

Temporary improvement is noted in the New England coal situation as we go to press, about 70,000 tons having arrived at Boston by water since Friday of last week. The efforts made at Washington by Governor McCall of Massachusetts and New England Fuel Administrator James J. Storrow of Boston have resulted in substantial relief from the threatened tie-up. Railroad coal movement has been expedited and cross-hauling cut down. Favorable weather has supplied reservoirs of hydroelectric power companies with sufficient run-off water from streams hitherto frozen to enable at least one company to restore full service. The Boston Edison Company, the Bay State Street Railway and the Boston Elevated Railway have received coal shipments

by water this week. Power users are showing a disposition to co-operate in economical utilization of energy. A notable meeting at Springfield, Mass., a few evenings since is leading to close study of possibilities in peak load reduction on both the Springfield Street Railway and the United Electric Light Company systems, through spreading out factory and store closing hours.

RATE SUSPENSION POWER IS DEFENDED IN MASSACHUSETTS

Public Good-Will Cannot Result from Forced Increases Without Utmost Endeavors to Make Justice of Increases Clear

Suspension of a proposed rate increase until the public utility has convinced the regulating tribunal of its necessity was vigorously defended by Chairman F. J. Macleod of the Massachusetts Public Service Commission at a hearing in Boston recently. An important suggestion of Massachusetts electric railways is that the commission shall be deprived of the power to suspend rate changes pending investigation in which the burden of proof is upon the company, and that instead the companies shall have full power to make such changes as they see fit and carry them into effect at once, subject only to future commission revision based on limited jurisdiction, after investigation in which the burden of proof shall be upon the complainants.

Chairman Macleod pointed out that one fundamental weakness of this plan rests upon the questionable assumption that a sure cure for all evils of the electric railway situation lies in rate increase. The law conferring upon the commission power to suspend rates was enacted not before but after experience with the system which it is desired to reinstate. The suspension power now exists in at least twenty-one State commissions, including the Massachusetts Gas and Electric Light Commission. The steam railroads have asked Congress that the suspension power be confined to a period of sixty days from the date rates are filed.

If suspension power in commission rate cases were withdrawn, Mr. Macleod said, proceedings would be greatly protracted. In suspension cases counsel for utilities are astonishingly expeditious. They waste no words, present evidence largely in documentary form, and seldom indulge in cross-examination. If the policy were reversed, counsel would become garrulous, cross-examination would be prolonged, and of direct and rebuttal evidence there would be no end. Without overstepping bounds of legal propriety, skilled attorneys could extend proceedings almost interminably.

The commission, after investigation, might find itself powerless to reduce specific rates found excessive, because the entire rate schedule might be yielding less than a reasonable return. Mr. Macleod said that it is an unwarranted assumption to infer that a public utility must actually fail to earn a reasonable return before it can hope to be permitted to increase rates. The question of financial needs is not the only one usually at issue, the chief difficulty in many cases being to determine whether the burden is fairly apportioned among various localities and classes. Public good-will cannot result from forced increases unaccompanied by utmost endeavors to make the justice of such increases clear.

NEW ENGLAND COMPANIES MEET IN WAR CONFERENCE

Coal Shortage and Other Pressing Problems Discussed in Boston—Try to Decide on Essential Service, Is Advice Given

A war conference of the New England Section of the N. E. L. A. was held at the Engineers' Club, Boston, on Dec. 18, at which coal shortage and other pressing problems were discussed. Prior to the discussion J. F. Zoller, tax expert of the General Electric Company, spoke on the income tax law.

The serious fuel situation in New England was reviewed briefly, and the general opinion was that curtailment of service to non-essential industries must be given consideration, along with the fullest co-operation with the federal government in enforcing "lightless nights."

Even the largest water-power system in the Northeast, that of the New England Power Company, has been obliged to ask industrial power customers to curtail service the equivalent of one working day a week. Line extension work has virtually been stopped short in New England central stations.

R. W. Rollins, president Worcester (Mass.) Electric Light Company, said that power customers do not relish the prospect of curtailment and favor reduction in service to stores.

Eugene Carpenter said that by shutting down at midnight one small station on Cape Cod had saved 35 per cent of its coal consumption, the former service being from dusk to daylight. To burn wood would have cost more than the company's total revenue in this case. Flat-rate bills are discounted on account of the service curtailment.

H. T. Sands of C. H. Tenney & Company, Boston, said that his organization would not be justified in taking on additional power business without assurance by the federal authorities of adequate fuel supply. Curtailment will probably come to customers by classes. The Cambridge Electric Light Company has just refused a 200-hp. organ factory contract as non-essential. Mr. Rollins said that if power customers in Worcester would shut down at 4 p. m. about 7000 kw. of peak would be cut off the day load, with a saving in boiler operation.

Bowen Tufts of C. D. Parker & Company, Boston, urged central stations to do their utmost to solve the problem of essential service themselves, instead of waiting for a government official to take command of local operations. Shifting and rearrangement of loads offer much at this time. R. S. Hale, Boston Edison company, said that the fixing of the \$2 per ton price of coal at the mines by the government had hurt the coal situation. Had the price been \$3, supply conditions would have been improved. The law of supply and demand cannot operate under price limitation by fiat.

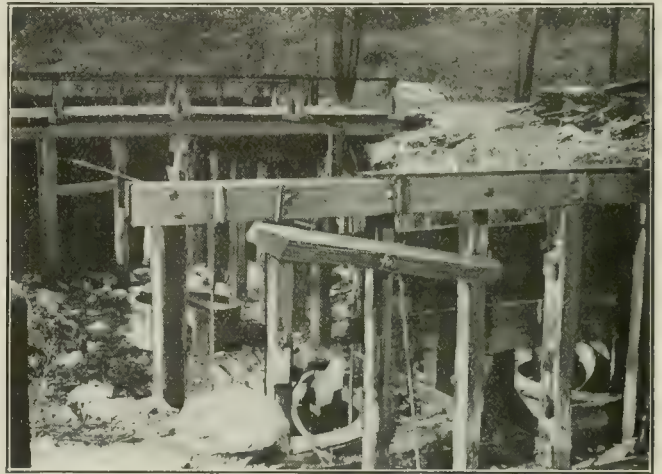
A. B. Lisle, general manager Narragansett Electric Lighting Company, Providence, cited an unusual case where private industrial customers were given power service priority before the government. Near Providence a boiler plant for destroyers is being built, and to furnish continuous power service would have required \$45,000 in additional cables on the Narragansett system. The government preferred to take off-peak power, 600 kw. being available on this basis, to paying

for the new cables needed. A contract was accordingly executed on this basis, other customers in the district having the preference in demand. A general discussion of line extensions closed the meeting.

LITTLE LEFT OF HISTORIC LIGHTING PLANT AT APPLETON

Ruins of One of First Incandescent Electric Lighting Plants in the Country Still on Site of Early Venture

The illustration shows all that is left of what is thought by many to have been the first commercial incandescent electric lighting plant in the world. This picture was taken recently by H. G. D. Nutting at Appleton, Wis. It shows the steel shells of the old vertical waterwheels now broken to pieces and lying on the ground. The wood construction is what is left of the harness and support, and on the other side of the



REMNANTS OF A PIONEER ELECTRIC PLANT

little bridge are the needles holding the water back in the flume, which is still connected with the Fox River.

This plant has been mentioned by many writers and referred to by Samuel Insull in speeches and in reminiscences of early days. While it is held by some that it was the first incandescent lighting station in the world, recent researches of William E. Keily of Chicago, who has given considerable thought and time to investigating historical events in the industry, seem to indicate that this was the third Edison electric lighting station in operation.

According to the best data which Mr. Keily can obtain, the Holborn viaduct in London was started either on Jan. 12, 1882, or April 11, 1882, these two dates being fixed by separate authorities. The historic Pearl Street station in New York was started on Sept. 4, 1882. The record of the Western Edison Light Company of Chicago, which took the contract from the Appleton Edison Light Company for two K dynamos, to be operated from water power and to light 550 lamps, was dated Aug. 15, 1882. Edward T. Ames, still living in St. Joseph, Mich., was sent by the Western Edison Light Company of Chicago to install that machinery. He has stated that the Appleton station was started on Oct. 15, 1882. This makes it the first Edison electric lighting station to be driven by water power and the first Edison station in the West.

STUDY FUEL ECONOMY IN NEW YORK STATE

Empire State Gas & Electric Association, Co-operating with Public Service Commission, Outlines Ways of Saving

The executive committee of the Empire State Gas & Electric Association met in New York on Dec. 21 to consider fuel economy. Its meeting followed a letter received from Seymour Van Santvoord, chairman New York Public Service Commission, Second District, asking for suggestions. Chairman Van Santvoord issued his letter after conference with the New York State Fuel Administrator, acting in co-operation with the Federal Fuel Administrator.

In taking up the subject with the companies, Chairman Van Santvoord expressed his confidence that they are keenly alive to its importance and will be anxious to assist in every way possible.

"Appreciating fully the seriousness of any proposition which may involve diminution of service to which the public has accustomed itself as not unreasonable in quantity," he wrote, "this commission begs you, nevertheless, to give immediate consideration to the question in preparation for early discussion thereof with this department, which in the meantime will be grateful for any suggestions you may be able to submit."

Replying to the letter of Chairman Van Santvoord, the executive committee of the Empire State Association, through Charles H. B. Chapin, the secretary of the association, heartily indorses "any move which will promote economy not only in the consumption of coal in generating plants, but also in the use by the public of gas and electric service, whether such service is produced by coal, water power or other means." In part the letter of Mr. Chapin says:

While your letter mentions merely "economies in fuel consumption," we believe the subject should be broadened to include economies in use of gas and electric service as well as economies in production. Economy is the slogan of the thrift campaign now in progress throughout the country. It is to be measured not by what the individual can afford to spend, but by what the country can afford to permit the individual to spend. Similarly, it is no longer a question of how much gas or electric service a consumer can afford to use, but how much of labor and materials and money, which create the service, the country can spare for the use of such consumer.

This committee believes that the gas and electric companies of the State are alive to the situation and are ready and willing to do their share. If curtailment of service either for purposes of economy or for other reasons will help in winning the war, the service should be curtailed and we are confident that each company will cheerfully co-operate.

On account of the important relation which the fuel item bears to their total operating costs, gas and electric companies are normally operated at as high an efficiency as possible in respect to fuel consumption and therefore the substitution for many purposes of gas and electric service for coal is in itself a measure of fuel conservation.

In the thrift campaign it is being urged that the utilization of men, money and materials for purposes not essential to the conduct of the war is in effect competing with the government. We venture therefore respectfully to suggest that in addition to the subject of "fuel economies" the commission might well give some consideration to other questions, such, for example, as discouraging at this time extensions and improvements to plants and systems not immediately necessary for purposes of fuel conservation or for the promotion of the interests of the country. Similar questions into which these factors enter will occur to you.

Whether or not the above suggestions meet with favorable consideration by the commission, we will hold ourselves in readiness to co-operate and assist in any way in which it is thought our services would be useful.

A suggested program of activities to promote economy in production and use of electric and gas service, sent with the letter of the association to Chairman Van Santvoord, outlines an educational campaign. It is suggested that cards be issued by the Fuel Administration similar to those of the Food Administration, and distributed by companies with bills to consumers. These would stimulate economy in electricity and gas in the home and for industrial purposes. Literature pointing out operating economies could be prepared by the association in conference with commission engineers and sent to companies, particularly those which are small. Literature pointing out possible economies in private heating and power plants could be prepared by the Fuel Administrator in conference with engineers and distributed by the Fuel Administrator. Other suggestions by the association follow:

Curtailment of Non-Essential Uses.—

1. Priority lists to be prepared by Fuel Administrator in conference with commission and association for (a) natural gas, (b) artificial gas, (c) electricity.

2. Commission to be authorized by Fuel Administrator to allow or enforce priority when necessary.

3. Priority to be granted in accordance with such list after consultation by company with commission in each particular situation.

Interconnection of Systems.—Commission to investigate in conference with New York State Electric Railway Association and Empire State Gas and Electric Association the possible economies through the tying in of separate systems, thereby concentrating the generation of power in the most efficient plants and securing fuller benefit of developed water power.

Development of Unutilized Water Power.—Commission to confer with others having this matter under advisement with a view to securing development wherever economically possible and preventing any useless duplication or waste in transmission and distribution.

Census of Available Surplus Power.—A census of surplus capacity in power plants and transmission systems at present available in central stations to be made by the commission's engineers in conference with the association and notification of the situation in different parts of the State sent to the War Industries Board in order that new industries may be advantageously located as relates to the power situation.

EXPORT COMBINATION BILL IS NEAR FINAL PASSAGE

Measure Now Passed by Both House and Senate and Awaiting Conference Between Committees of Congress

The so-called Webb bill, which permits combinations of American business concerns to promote foreign trade and makes inoperative certain features of the trust-laws which have heretofore forbidden such combinations, is nearing its final passage. The measure has been passed by both House and Senate. Certain variations, however, in the Senate and House versions will have to be straightened out in conference. No conference between the committees of the House and Senate has been held yet, and none will be until Congress reconvenes on Jan. 3 from the Christmas recess. The measure has the support of the White House, and it is not doubted that it will be passed at an early date.

WESTERN NEW YORK PLANTS FEEL THE SHORTAGE OF COAL

Appealing to Fuel Administrator, Officials of Small Properties Say that Suspension of Operation Is Possible

Small electric light and power industries throughout western New York are facing serious coal shortage. Appealing to the Fuel Administrator of western New York, representatives of many electric plants said that they will be forced to suspend operation unless assured of sufficient coal to keep fires lighted. Owing to the serious situation, the City Council of Batavia is considering the advisability of using Niagara Falls power for street lamps. The Batavia municipal lighting plant has been closed temporarily for several weeks because of the shortage, and city authorities fear that they will not be able to operate again before next spring.

The LeRoy Hydraulic Electric Gas Company, which supplies rural sections in the vicinity of LeRoy, N. Y., with electric light and power, has applied to the town authorities for permission to construct a coal storage trestle adjoining its plant. The company says that unless it can get sufficient coal during the winter to meet demands, it will be forced to curtail electricity for street lighting.

CAMPAIGN IN CALIFORNIA OF ALL BRANCHES OF INDUSTRY

Executive Committee of Pacific Coast Section of the N. E. L. A. Approves Plan to Spend \$12,000 in Educational Work

After a meeting of the executive committee of the Pacific Coast Section of the National Electric Light Association in San Francisco on Dec. 5 it was announced that plans for a general co-operative campaign had been completed and would be put into effect at once. The move has the support of organizations of manufacturers, jobbers, central stations and dealers and contractors. It contemplates general educational work and is directed particularly toward securing higher efficiency in electrical merchandising.

Plans toward this end began to take definite shape when the California Association of Electrical Contractors and Dealers put \$2,000 in the bank and notified other branches of the industry that this was ready for use in a general co-operative twelve months' campaign if \$10,000 more would be subscribed by the other branches, so that \$12,000 would be available.

The desired total was subscribed as follows in addition to the initial \$2,000: Central stations, \$6,000; jobbers, \$2,500; manufacturers, \$1,500. These funds, averaging \$1,000 monthly for 1918, will be administered by a joint committee representative of the contributing branches.

Two men are to be employed to cover different territories, each to be a manager of the work in his section. It is understood that the managers are to be accorded heartiest co-operation by all concerned. They are to work on problems of the contractor and dealer and of the central station without partiality and to direct effort first to secure more widespread use of electrical energy, electrical appliances and supplies. Endeavor will be made to secure more general and effective use of the latest and best methods of demonstrating appli-

ances and dressing windows, as well as using advertising space and following approved trade methods.

Speaking for the engineering committee of the Pacific Coast Section, J. E. Woodbridge said that the committee on inductive interference had completed its work and presented its report to the Railroad Commission and that other committees were still at work on the following subjects: A safety code for power station work; overhead-line safety code; specifications for materials for poles; insulator deterioration; iron wire for overhead lines, and standardization of pin-type insulators.

The next meeting of the Pacific Coast Section will be held simultaneously with a convention of the California Association of Electrical Contractors and Dealers at Del Monte, Cal., late in April. This will be the first occasion of simultaneous meetings, and it is looked upon as a long stride toward "an all-inclusive organization of the electrical industry."

ENCOURAGING ECONOMY IN USE OF ELECTRICITY

Columbus Railway, Power & Light Company, Urging Conservation Until New Station Adds to Supply, Acknowledges Co-operation of Public

Pending completion and operation of its new power plant, the Columbus (Ohio) Railway, Power & Light Company was obliged to ask consumers to economize in

Electric Power Shortage

The electric power situation in Columbus and the surrounding territory served by this company has become more acute. This is due to the fact that the existing equipment in our power stations cannot be operated at its full capacity because we have been unable to procure a good grade of coal. However much we may regret our inability to meet the demands upon us—and we most certainly do regret it—the situation must be squarely faced and steps taken to conserve the supply of electricity.

We request those who use electricity for power purposes to give their most earnest consideration to ways in which they can make a saving of current in their business.

We request those who use electricity for lighting purposes to burn fewer lights. **Use only one light where formerly two were used.**

The foregoing request is made only with a full knowledge of the gravity of the situation, and because we wish to render to all our patrons the best service which the circumstances will permit.

Our Coal Troubles

The coal we are now receiving is of the most inferior grade we have ever had experience with. Our firemen jokingly refer to it as "fireproof" coal because it is so full of dirt that it will barely catch fire. In fact, some actually had corn growing in it as it stood in the car when received, and tests made of the coal have shown it to contain as high as 25 per cent. of non-combustible material.

It has been due to this fact that several times recently we have been forced to discontinue service to power customers, to operate cars at half speed for short periods and to operate a reduced number of tripper cars during the rush hours. The poor grade of coal makes it utterly impossible to operate our boilers at capacity and lowers the output of our power station system.

PART OF ADVERTISEMENT OF COLUMBUS COMPANY

electricity. In addition to advertising, the company issued formal statements urging economy and sent representatives to impress consumers in the central district with the importance of conservation. A statement said:

The spirit of co-operation which has always been known

to exist in this community has never been more manifest than during this crisis. The Columbus Railway, Power & Light Company has followed up its recent public statements of the condition of affairs and its written requests for assistance to industrial plants and to civic organizations by placing its representatives in the business district, who are calling upon merchants and others, explaining the situation in detail and the absolute necessity for co-operation in reducing the use of electric energy if all of those using it are to secure at least a part of their requirements. They have been met everywhere by merchants with an earnest desire to assist, which is proof positive that Columbus people need only to be shown the necessity for doing a thing and they immediately set in motion the machinery for accomplishing that end.

CHANGES IN PERSONNEL OF ENGINEERING FACULTIES

Further Listing of Resignations, Leaves of Absence, Promotions and Appointments in the Electrical Teaching Body of the United States

Following is the fourth installment of the record of resignations, leaves of absence, promotions and appointments in the electrical engineering faculties of the various colleges and universities of the United States. Previous articles were published in the issues of Nov. 3, page 878, of Nov. 24, page 1022, and of Dec. 1, page 1070.

Columbia University, New York, N. Y.—Morton Arendt, assistant professor, has received a commission as a lieutenant in the navy and has been assigned to duty in connection with the submarine fleet in the construction and maintenance of the machinery of these vessels. F. W. Hehre, assistant professor, has been commissioned a lieutenant, junior grade, in the navy. He is among those recently nominated by the A. I. E. E. for the position of electrical officer in charge of the equipment on shipboard. He is now undergoing military training at Annapolis. Instructor F. L. Mason has been commissioned a lieutenant, junior grade, in the navy and is giving instruction in electrical engineering to the students of the U. S. N. gas-engine school at Columbia University, which is training the crews for the boats of the submarine patrol.

University of Kentucky, Lexington, Ky.—Minott Brooke, instructor in steam engineering, has enlisted in the merchant marine service. The position is now filled by C. C. Harp, who was graduated from the university with the degree of bachelor of mechanical engineering in the class of 1914. Since graduation Mr. Harp has been engineer of the Fayette County buildings.

University of Michigan, Ann Arbor, Mich.—Alfred H. Lovell, associate professor in electrical engineering, is now a major of engineering at Camp Custer, Battle Creek, Mich. Harry S. Sheppard, assistant professor of electrical engineering, is captain in the Signal Officers' Reserve Corps at Washington, where he is engaged in investigation work in military communication. Ward F. Davidson, instructor, is absent on leave and is first lieutenant in the Engineer Officers' Reserve Corps at Chillicothe, Ohio. The staff has been recruited by the addition of Associate Prof. Joseph H. Cannon of the Texas Agricultural and Mechanical College, with the same rank. L. H. Ballard has become an instructor, having come from the Hawthorne works of the Western Electric Company. The two staff additions are not in specific substitution for any absentee, but general additions.

University of Nebraska, Lincoln, Neb.—F. C. Holtz, instructor in electrical engineering for the last two years, is at Camp Funston, Fort Riley, Kan., where his work will be with the Signal Corps. His place at the university has been filled by the appointment of O. E. Edison, lately employed by the Commonwealth Edison Company of Chicago.

University of Oklahoma, Norman, Okla.—Prof. H. V. Bozell, director of the School of Electrical Engineering for the last six years, has resigned to accept a position as assistant professor of the Sheffield Scientific School, Yale

University. L. W. W. Morrow, associate professor and acting director of the School of Electrical Engineering in the university for the last year, has been appointed director of the School of Electrical Engineering, with the title of professor of electrical engineering. Assistant Prof. Abraham Press has resigned to open an office as consulting engineer in New York City. Frank Tappan, formerly instructor at Cornell University, has been appointed associate professor of electrical engineering.

University of Pennsylvania, Philadelphia, Pa.—J. B. Straw, formerly instructor, has been advanced to the grade of assistant professor. Assistant Prof. H. M. Trueblood has resigned to accept a position with the American Telephone & Telegraph Company of New York. C. W. Plass, E. M. Bredin, F. Short and R. H. Kent, instructors, have resigned to accept positions in the government's service. G. A. Hoy was appointed instructor in electrical engineering.

University of Southern California, Los Angeles.—Prof. John Fay Wilson has accepted the position of associate professor of electrical engineering. Professor Wilson occupied for five years a similar position at the University of Michigan and during the past year at Queen's University, Kingston, Canada. He is the author of "Essentials of Electrical Engineering" and "Dynamo Laboratory Outlines."

University of Texas, Austin, Tex.—The teaching force has been reduced considerably, owing to the government School of Military Aeronautics maintained at this institution. This is now taking the entire time of Prof. J. M. Bryant, although he is still connected with this school in an advisory capacity, continuing his rank as professor of electrical engineering. J. W. Ramsay, formerly instructor in electrical engineering, has been commissioned first lieutenant in the aviation section of the Signal Officers' Reserve Corps and is devoting his entire time to instruction with the School of Military Aeronautics. W. J. Miller is the only addition to the teaching force this year. He comes as instructor in electrical engineering from the General Electric Company, Schenectady. Mr. Miller is a graduate of this school and has had several years' experience with the General Electric Company. Prof. J. A. Correll is now chairman of the school. He and Mr. Miller constitute the entire instructing force. This is made possible by the fact that peculiar local conditions, as well as the great draft of upper classmen for the national service, have reduced the enrollment, particularly in the junior and senior classes.

University of Washington, Seattle, Wash.—Associate Prof. E. A. Loew is on a year's leave of absence and is employed by the American Nitrogen Products Company as electrical engineer. No substitute has been appointed as the decrease in enrollment made this unnecessary.

University of Wisconsin, Madison, Wis.—George H. Gray, formerly instructor in electrical engineering, has accepted a position in the engineering department of the American Telephone & Telegraph Company at Omaha, Neb. Prof. R. C. Disque has been granted leave of absence and has accepted a commission as first lieutenant and been stationed with the Signal Aviation Corps of the aviation school at Chanute Field, Rantoul, Ill. Richard H. Jones, who was graduated from the electrical engineering course at the University of Wisconsin in 1915 and has since that time been with the General Electric Company, has been appointed research assistant in electrical engineering.

Virginia Military Institute, Lexington, Va.—Stewart W. Anderson, adjunct professor of physical and electrical engineering, session 1916-17, is now first lieutenant of the 307th Engineers, W. S. R. A. Willard C. Brown, assistant professor of electrical engineering, is now assistant paymaster in the navy.

Washington University, St. Louis, Mo.—Albert S. Blatterman, instructor in electrical engineering, has been granted an indefinite leave of absence in view of his appointment as first lieutenant in the Signal Corps. The commission was not received until about the first of September, and it has since been found impossible to find a substitute.

Worcester Polytechnic Institute, Worcester, Mass.—J. A. Blair and R. E. Lamb, assistants, are now lieutenants in the Coast Artillery at Fort Monroe. Their places have not been filled and probably will not be for the present.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Commission Control Over "Home Rule" Cities.—In a case affecting the city of Grand Junction the Colorado Public Utilities Commission held that it had jurisdiction over all public utilities, whether privately or municipally owned or operated, even though such municipalities are governed under a special charter known as the "home rule" amendment.

Abandonment of Unprofitable Service.—In granting an application of the Batesville Gas Company to discontinue natural-gas service in Batesville and remove its equipment the Indiana Public Service Commission says: "The rule of law is now universally accepted that when private property is devoted to public use it is subject to public regulation and control. Such property is clothed with a public interest when used in a manner to make it of public consequence and to affect an entire community, so that when one devotes property to a use in which the public has an interest he virtually grants to the public an interest in that use and submits it to public regulation and control for the common good to the extent of the interest so granted. When money is invested in the stock and bonds of public utility corporations the investors virtually loan the money to the public, and as long as the investment produces a fair return and retains the element of safety there can be no reasonable ground for complaint by the investor, while, on the other hand, if the investment fails for a number of years to pay a return and the element of safety gradually disappears, then there is just and reasonable ground for complaint being made."

Rules Governing Customers' Deposits.—On Jan. 16, 1918, the Illinois Public Utilities Commission will hold a hearing in Springfield to ascertain views of interested parties relative to "tentative rules governing the establishment of credits and the collection and handling of consumers' deposits for electric, gas, water and heating services." The experience of the commission since organization indicates that definite rules and practices, as applied to the establishment of consumers' credits and the handling of deposits made by consumers as a guarantee for prompt payment of bills, will operate to relieve considerable criticism by consumers and should also operate to protect revenues of utilities. On account of the public nature of their business, utilities are under obligation to furnish service under conditions very different from those which apply to the usual private mercantile business, and it is essential that the utility shall be as-

sured that its consumers have an established credit in cases in which service is rendered in advance of payment. The establishment of rules and regulations should operate to prevent the exercise of unjust discrimination against consumers, and should also operate to keep unpaid or uncollectible bills within limits which may be considered as reasonable and properly to be included in normal operating expenses. Having this end in view, the commission has prepared tentative rules governing the collection and handling of consumers' deposits.

Salaries of Officers.—The proportion of operating revenues paid in salaries was taken into account by the Colorado Public Utilities Commission in a case affecting rates of the Suburban Light & Power Company at Aurora, Col. The decision says: "The commission in this case is confronted with an allowance from salaries of general officers and office clerks in the sum of \$2,295 for the year Sept. 1, 1916, to Aug. 31, 1917. In other words, the salaries of officers and employees of the respondent company represent more than 50 per cent of its total operating revenues, and, in the opinion of the commission, are excessive and cannot be justified when applied to the operating revenues of this company and the value of its property in use and useful. While the commission is of the opinion that no attempt should be made to interfere with the internal management of a public utility by a regulatory body, except perhaps in rare cases, it will not approve salaries to officials which are unreasonably high and not commensurate with the duties performed. The commission recognizes efficient service and in certain cases has made allowance for efficiency, but in no case has it penalized efficient management. But in the event that this commission should take the position that the operating expenses of a public utility should not be duly scrutinized by a regulatory body in a rate-making case, then regulation would be ineffectual. The respondent, whose property in use and useful is found to be of the value of \$16,000, and whose total revenues for the year Sept. 1, 1916, to Aug. 31, 1917, were \$4,271, shows on its books a salary of \$1,100 per annum to its president and \$1,195 to its office clerks. The testimony in this case was to the effect that the president of the corporation gives practically no time to the management of this small property. The testimony shows that the son of the president manages and operates the property and that he devotes only a portion of his time to such end and receives therefor a salary of \$100 per month. It is the opinion of the commission that a property of this character is really a 'one-man property' and should be managed and operated by one man at a salary not to exceed \$1,000 a year." The commission held that rates were unreasonably low and did not afford a fair return to the company and that therefore a revision of the company's schedules should be made. The commission, with this consideration in view, established a new schedule to be put into operation.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Granting of Franchise by Number of Voters.—In an action by an electric light, ice and water company to enjoin a gas company from using the public streets of a town, the allegations of the complaint, showing that the matter of granting the franchise claimed by defendant was approved before granting by a majority of the qualified electors residing within the town who voted thereon at a general election at which the question of the grant was legally submitted, so that the grant of the franchise was made within the authority of the town, by law, were conclusive as to plaintiff, the Supreme Court of Arizona held, in *Nogales Electric Light, Ice & Water Company versus International Gas Company* (168 P. 504). The civil code cannot be construed to require a greater number of votes on the proposition of the grant of a franchise by a municipality to authorize its grant than is required by law, provided that no municipal corporation shall ever grant a franchise without the approval of a majority of the qualified electors residing within its corporate limits who shall vote thereon at a general or special election.

Powers of Commission in Rate Case.—The powers of the Public Utilities Commission are conferred by statute, and it possesses no authority other than that thus vested in it, according to the Supreme Court of Ohio (117 N. E. 381). The commission is not authorized by statute summarily to fix a rate to be charged consumers of natural gas subsequent to the expiration of a contract between the public utility and the municipality served during the period within which the operation of a new ordinance prescribing such rate is suspended by reason of the filing of a referendum petition. In the absence of an effective ordinance prescribing rates for service by a public utility, such rates should be established in accordance with the provisions of the general code. The filing of a referendum petition under the code, thereby suspending operation of an ordinance fixing price of gas after expiration of contract therefor and thus leaving no fixed rate in operation, did not constitute an "emergency" within the code provision which authorizes the commission in case of emergency to alter, amend or, with consent of the public utility concerned, suspend any existing rates, schedules or orders relating to it. An agreement as to a proper schedule of rates must therefore be arrived at in the first instance without the assistance of the commission in such circumstances as those under judicial review.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

The Electrical League of Cleveland.—A. H. Gilbert addressed the Electrical League of Cleveland on Dec. 13 on the subject of "Electricity as a Factor in the Development of Brazil."

Alabama Contractors to Meet.—The Alabama State Association of Electrical Contractors will hold its annual meeting in Birmingham on Jan. 15 and 16. Col. Robley S. Stearnes of New Orleans will preside.

Philadelphia Section of Illuminating Engineering Society.—"Color Science in Illumination" was the subject discussed by Miss Beatrice Irwin at a meeting of the Philadelphia Section of the Illuminating Engineering Society held Dec. 21.

Schenectady Section, A. I. E. E.—S. T. Dodd of the railway and traction engineering department of the General Electric Company addressed a meeting of the Schenectady Section of the American Institute of Electrical Engineers Dec. 21 on the subject of "High-Speed Electric Locomotives."

Electrically Operated Bridges.—The Philadelphia Section of the Association of Iron and Steel Electrical Engineers will hold its next meeting Jan. 5. A paper will be presented on "Electrically Operated Bridges" by J. C. Reed and Merwyn J. Hocker, electrical engineers of the Bethlehem Steel Company, Steelton, Pa.

Annual Meeting of the Florida Engineering Society to Be Held Jan. 7.—The Florida Engineering Society will hold its annual meeting on Jan. 7 at Jacksonville at the Seminole Hotel. The chairman of the local committee on arrangements is C. S. Hammatt, 20 Ocean Street, Jacksonville. J. R. Benton, Gainesville, Fla., is the secretary of this society.

Milwaukee Jovian League.—The Milwaukee Jovian League held a rejuvenation and banquet on Dec. 14. Lieut. William Masson, connected with the British recruiting force in this country, described life in the trenches, from which he has just returned. There were other speakers, most of them regular members of the society who are now in the government's service.

December Meeting of the New York Electrical League.—The New York Electrical League held its monthly meeting at Stewart's on Dec. 5. James M. Wakeman, vice-president, occupied the chair. Mr. Wakeman announced that since the previous meeting of the league the board of directors had met and had applied to the Jovian Order headquarters at St. Louis for a charter. After Frank E. Watts had explained to the meeting why this action had been

taken, a motion was carried unanimously indorsing the action of the board of directors in applying for the charter. Mr. Wakeman also announced that at the board of directors' meeting the following were appointed a nominating committee: George Pells, chairman; Martin Oberlander, and Elliot Reid. George Pells was elected first tribune for New York. James Betts, chairman of the Liberty Loan committee, made a report showing that the league had purchased liberally of the second issue of Liberty bonds. The speaker of the day was Roi B. Woolley, who has recently returned from service in France with the French Field Ambulance Corps.

The Engineer After the War.—E. J. Mehren, vice-president and editorial director of the McGraw-Hill Publishing Company, speaking before the Western Society of Engineers at Chicago on Dec. 17, presented an analysis of the situation engineers may face after the war. In the past, he said, engineers have attacked analytically all problems pertaining to materials. These problems amount to say 75 per cent of the problem of production in which engineers are employed. The other 25 per cent—the human section of the problems—has been turned over to so-called managers really less capable of solving it than the engineers. The world is now beginning to look to the engineers for a 100 per cent solution. It therefore behooves the engineer as a man of vision to look into the future and see if he can discern what conditions he will face in his problem after the war. Three factors in this problem, continued the speaker, will be shortage of labor, a great drive for export trade, and high taxes. Labor will be scarce because of the man power destroyed in war and because of the strict emigration laws which European nations will pass to keep their own people at home, as a reconstruction measure. This will mean more employment of labor-saving machinery. The stage is being set for a great export drive from this country, because, regardless of how long the war lasts, the United States will be in the best position of all nations financially. She will have great natural resources to draw from and she will have the greatest merchant marine in the world excepting England. Taxes will be high because industry will have to meet the interest and principal payments on the government debt. All these things combined produce a condition in which low costs of production—the lowest ever known—will be asked by industry. The engineer with his analytical methods and trained mind is the logical man to get these costs down. To accomplish this great work, however, it will be necessary for the engineer to recognize that his science no longer deals with material alone but that it also deals with labor—the human factor. After he has recognized the new phase in the problem he must get the facts that will aid in the solution of his problem and proceed clear-headedly, retaining always the viewpoint of the labor with which he deals.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

New Office for Massillon Company.—The Massillon (Ohio) Electric & Gas Company on moving from its old office issued a formal invitation to its customers and friends to call at the new quarters, 111 West Main Street.

Relation of Hours of Work to Output and Fatigue.—An "Analysis of British War-Time Reports on Hours of Work as Related to Output and Fatigue" has been made by the National Industrial Conference Board, of which Frederick P. Fish is chairman and Magnus W. Alexander managing director.

Columbus Reduces Street Lighting.—Mayor George J. Karb of Columbus, Ohio, has ordered that only the top lamp in the clusters of street lamps in the business district be used hereafter. This was done as a means of conserving fuel. It will reduce the city street light expense about \$20,000 per year.

Rates Advanced in Kentucky.—At Falmouth, Ky., the City Council has ordered a 25 per cent advance in electric rates. The minimum charge for residence service has been increased from 50 to 75 cents a month. Some time ago the city, in order to conserve fuel, began to turn off street lights at midnight.

Henry L. Doherty Advises Against New Contract at Toledo.—In a communication to the gas and light committee of the City Council at Toledo, Ohio, Henry L. Doherty, chairman of the board of the Toledo Railways & Light Company, advised that no new contract for street lighting be made at this time. While the city is endeavoring to secure a lower rate, Mr. Doherty stated that the company would expect a higher price because of increased cost of materials and labor.

Christmas Tree Distribution.—A Christmas tree distribution of soldiers' "kits" took place at the metropolitan sales headquarters of the General Electric Company, New York, on Dec. 24. The tree, illuminated by floodlights, suitably decorated and dressed, was placed in the corridor on the twentieth floor of the Equitable Building in honor of those of the staff—the "honor roll"—that had entered any branch of the United States service, sixty-nine in all, including one woman. A number of the "boys" in uniform were present and received the "kits" in person, the others being forwarded to the various camps and naval bases. Patriotic and appropriately impressive speeches were made by T. Beran, district manager; C. E. Estabrook of the incandescent lamp department; D. P. Burley, meter specialist, and W. J. Clark, manager of the electric traction department.

A. L. Linn, Jr., has been appointed treasurer of the United Gas & Electric Corporation and the United Gas & Electric Engineering Corporation, to succeed H. J. Pritchard, who has resigned. Mr. Linn was formerly assistant to Horace E. Andrews, president of the New York State Railways and the Mohawk Valley Company, which control the electric railways in Rochester, Syracuse, Utica and Schenectady and the gas and electric utilities in Rochester and vicinity.

Alfred Douglas Flinn, in whom the secretaryships of the United Engineering Society, the Engineering Foundation and the Engineering Council will be joined, was born in New Berlin, Pa., in 1869, and was graduated from Worcester Polytechnic Institute in 1893. In August, 1895, he became a member of the engineering staff of the Metropolitan Water Works, Boston, and he remained with that organization until 1902. He rose steadily until he became principal office assistant under

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

Lee H. Newbert, formerly in charge of sales of the Pacific Gas & Electric Company, San Francisco, Cal., has been appointed commercial manager, succeeding Stanley V. Walton, whose resignation takes effect Jan. 1. Mr. Newbert will combine the duties of his present department with those of the commercial department.

Robert E. Dillon has been promoted to succeed C. H. Parker as assistant superintendent of the generating department of the Edison Electric Illuminating Company of Boston. Mr. Dillon is a graduate of the Massachusetts Institute of Technology of the class of 1910 and has been connected with the lighting company since early in 1911.

W. J. Canada is severing his connection with the Bureau of Standards to enter the work of the American International Shipbuilding Corporation at Philadelphia. Mr. Canada was for some time electrical engineer with the insurance interests in the Rocky Mountain section of the country, being stationed at Denver. He left this work two or three years ago to become associated with the Bureau of Standards, where he was chiefly engaged in the compilation of the National Safety Code as assistant to Dr. Rosee.

Edward H. Tenney has been promoted from assistant chief engineer to chief engineer of the Union Electric Light & Power Company of St. Louis, succeeding John Hunter, who has taken charge of the New Jersey district of the government emergency ship construction. Mr. Tenney, who is thirty-six years old, was graduated from Oberlin in 1903, after which he took post-graduate work in engineering at Ohio State University, from which he was graduated as mechanical engineer in 1905. In the same year he entered the employ of the Union Electric Light & Power Company in the drafting department. The following year he was transferred to the Ashley Street station of the company in charge of installation of boilers and piping, and in 1908 he was made test engineer of the company. Three years later he had general supervision of power plant work, and in 1915, when it was decided to rebuild and increase the capacity of the Ashley Street station, Mr. Tenney was made general superintendent of the plant in responsible charge of operation and construction. In addition to his work with the lighting company, Mr. Tenney is also a lecturer for a mechanical engineering special course at Washington University. Besides, he is the author of a book entitled "Ten Methods for Steam Power Plants."

William A. Del Mar, late assistant electrical engineer to the Interborough Rapid Transit Company of New York, has resigned to become chief engineer to the Electric Cable Company and the Habirshaw Electric Cable Company, Inc. Mr. Del Mar, who is a native of San Francisco, was graduated in 1900 from the City and Guilds College of London. After completing a course in the testing department of the General Electric Company, he became associated successively with the Manhattan Railway Company, the New York Central Railroad and the Interborough Rapid Transit Company. He made a specialty of transmission and distribution work while with the New York Central Railroad, and was selected by the late H. G. Stott to design the distribution system of the new Interborough subways and to redesign those of the old subways and elevated lines. Mr. Del Mar is author of a book on wires and cables entitled "Electric Power Conductors" and of the articles on wires and



A. D. FLINN

the chief engineer, Frederic P. Stearns, in charge of designs on the Wachusett dam, Weston aqueduct and other structures coming under the authority of the Metropolitan system. During his latter years with this organization he lectured on waterworks and sewerage in Lawrence Scientific School, Harvard University. On leaving the Metropolitan Water and Sewerage Board he became managing editor of the *Engineering Record* and continued in that capacity until August, 1904, when the position of general inspector of the Croton aqueduct commissioners was offered to him. He remained in that position for about a year and upon the organization of the Board of Water Supply of the City of New York, which was established in 1905, he became department engineer in charge of the headquarters department. He continued as department engineer until August, 1914, when he was made deputy chief engineer. He has continued in that capacity until his election to the secretaryships referred to in this article. Mr. Flinn is a member of the board of direction of the American Society of Civil Engineers and chairman of its committee on library.



W. A. DEL MAR

cables in Pender's "Handbook." He was for several years chairman of the wire and cable committee of the Association of Railway Electrical Engineers, and in that capacity was active in the standardization of specifications for wires and cables. He is also secretary of the joint rubber insulation committee, which has prepared standard specifications and an analytical procedure for high-grade rubber insulation. He has been a member of the standards committee of the American Institute of Electrical Engineers since 1913, and has taken an active part in its work, especially in matters relating to railroad standards and wires and cables. He is chairman of both the sub-committee on railway standards and the sub-committee on wires and cables. In the latter capacity he is assisting the Navy Department in the design of cables for the new electrically driven warships. Mr. Del Mar is also a member of the board of directors of the American Institute of Electrical Engineers. In his new position he will have charge of engineering work and will establish a research laboratory for investigating problems relating to wires, cables and insulating materials.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

INCANDESCENT LAMP INCREASE ANNOUNCED

New Prices on These Goods Which Are to Go Into Effect Jan. 1, 1918, Show Advances in the Neighborhood of 10 per Cent

On Wednesday a new price list on Mazda and graphitized-filament incandescent lamps, dated Dec. 22 and effective Jan. 1, 1918, was announced, bearing, as was predicted here several months ago, an increase generally around 10 per cent. With the exception of the standard 60-watt size, Schedule 6, gas-filled lamps, and Schedule 7, large-size gas-filled lamps, all list prices were advanced. The 60-watt standard size, however, was reduced in price from 36 cents to 35 cents per lamp. Prices in Schedule 6 and Schedule 7, large sizes, remained unchanged. A complete list of the new prices will be given in the next issue of the ELECTRICAL WORLD.

Miniature lamps, with the exception of all gas-filled types and certain of the vacuum types in Schedules 4 and 5, which remained unchanged in price, advanced in price at the same time. The new discounts on miniature lamps to purchasers without contracts are 25 per cent for unit packages (the same as last year) and 40 per cent on ten or more unit packages, which is 5 per cent more than was previously allowed. To contract purchasers the discounts range from 42 per cent to 56 per cent on unit-package purchases in amounts over \$500, but on broken packages in amounts over \$500 list 32 per cent to 46 per cent. Under \$500 list the non-contract consumer discounts will prevail.

THE CONDITION OF COPPER WIRE SUPPLY AND DEMAND

Anticipated That the New Government Price on Copper Will Not Be Found to Affect the Price of Wire

Following the conference of the Board of War Industries with the producers of copper Dec. 14, it was surmised that a change in the price established several months ago might follow. As yet no change has occurred, and there is a division of opinion among authorities on the subject whether a revision will be made Jan. 1. One of the best informed experts is of the opinion that if a new price is announced it will be a higher one. Should this be so it will not affect the market on wire. Base remains at 32 cents to 34 cents. There is a large demand for armored cable on order of the government for the submarines, and therefore it can only be promptly and efficiently met by the manufacturers direct.

Code wire used in building construction, which is almost negligible, is also selling heavily for governmental work. Hard-drawn wire for leading-in wire and copper-clad for telephone and regular signal wire are being called for. Copper-clad is being used more than hard-drawn. Underground cable, made of oiled cambric and lead-covered—power cables and feeders—is also in special demand, with heavy sales reported.

Deliveries are spoken of as fairly satisfactory, code going out of stock in large quantities. On steel-tape cable shipments can be made in from six to eight weeks, provided that the steel can be had. No positive promises can be made on these goods, delays being occasioned by the quantity and size designated. Primary hands are under the impression that not much wire is in the jobbers' stocks or with the dis-

tributing houses. It is believed that the copper situation is not so trying as it threatened to be a few weeks back. One jobber said that wire had loosened up and dropped a few points in price, and that deliveries were reaching almost a normal condition.

JOBBER LIQUIDATION OF SPECULATIVE STOCK

Tendency Decried by Trade Generally on Ground That Demand Relative to Supply Will Take Care of Any Stock Surplus

While, generally speaking, the stock in jobbers' hands of electrical supplies, with of course some exceptions, is down to normal or below normal, it is known that certain houses that speculated heavily for future deliveries when prices were lower have now unusually large stocks of certain products. In certain commodities, such as armored cable and sockets, there is now a plentiful supply to be had on almost every hand. In wire, conduit, porcelain and some other commodities, however, the case is exactly the reverse and stocks generally are pretty low.

There has been a tendency for many of the jobbers who have been so fortunate as to accumulate an overstock in these supplies to misunderstand the favorableness of their position, to the extent of underselling the current market, thereby liquidating their stock as fast as they could. With the conditions of supply and demand as they are to-day, and with a shortage so acute in most electrical staples, the practice of underselling the market is naturally being severely condemned by the more progressive and reliable members of the trade. The demand in relation to supply is sufficient to reduce this overstock in a short time. For that reason it is being urged by leading manufacturers and jobbers that those having large stocks hold them for current prices and do not release them at anything lower.

MANUFACTURERS WORKING CLOSER TO GOVERNMENT

Possibility Exists, Should Volume of Orders Greatly Increase, of Allocating Work According to Factory Conditions

By working closer to the government through the electrical division of the War Industries Board the electrical manufacturers have been better able to know the government's needs and to take care of them. At present the manufacturers will receive lists of government requirements daily. However, should the demand become large in volume, it is contemplated that weekly allocations of orders shall be made.

Similar action was taken earlier in the year on a number of electrical supplies by manufacturers' committees. The results accomplished were much more satisfactory to the government and to the manufacturers than the previous method of awarding government contracts. Now there is a possibility of extending this plan to the entire industry. Through this procedure the government can obtain its requirements in the minimum time and at the minimum cost. Furthermore, no manufacturer is unduly loaded up with government work.

To buyers other than the government the results are desirable, for deliveries, while longer perhaps throughout the entire field, are nevertheless surer.

The demand for electrical goods for war purposes is increasing. Still, there appears to be an electrical manufacturing capacity in excess of direct government needs. Manufacturers are being asked by the War Industries Board whether the indirect demands from secondary sources will absorb the available capacity.

NEW COMPETITION AMONG THE FUSE MANUFACTURERS

Standard Producers to Place Refillable Types on Market in the Near Future, Probably During the Coming Week

The revelations of the last two weeks have brought to a head the intention of manufacturers of standard or non-refillable fuses to put on the market types of refillable fuses also which have been in the process of development for some time. The Chicago Fuse Company, one of the manufacturers of the standard line, expects to put a line of the refillable fuses on the market in a day or two. Last week the Economy organization gave notice to the trade that it had purchased the Detroit fuse, one of the well-known standard types.

While the other fuse manufacturers have not as yet disclosed their program, so far as could be learned on inquiry all makers of the one-time type of fuse expect to bring out shortly, probably by the first of the year, a renewable or refillable type. In fact, reports say, they had been working along these lines when the foregoing sale came along. Just what the selling policies of the various companies interested may be is not yet definitely known. It is believed, however, that prices and sales activities will remain undisturbed, for the present at least. The presumption is that with a greater number of both types in the market a greatly increased production will follow. Under the stress of competition this may lead to a revision of prices downward. In the meantime considerable jockeying is said to be going on between the fuse concerns to ascertain what schedule will be adopted by other manufacturers.

METAL MARKET SITUATION

Resale of Copper to Manufacturing Consumers Proceeding Easily—Tin Is Scarce and High

Copper is in a much easier and more favorable position now than for three years past. The resale of the metal is progressing in a manner to satisfy the authorized distributors, dealers and legitimate commercial consumers. In addition to the 5 per cent allowed above the official price to cover the expenses of handling and profit, freight may be added to point of destination and a charge of \$2.50 for 1250 lb. may be made when ingots are shipped that must be packed to conform to transportation rules. Terms are net cash at time of shipment, or interest at 6 per cent if credit is extended.

The changes in the other metals, with tin partly out of the market, as none is offering, are only a point or two.

NEW YORK METAL MARKET PRICES

	Dec. 17			Dec. 24		
Copper:	£	s	d	£	s	d
London, standard spot....	110	0	0	110	0	0
Prime Lake	Govt. price	23.50		Govt. price	23.50	
Electrolytic	Govt. price	23.50		Govt. price	23.50	
Casting	Govt. price	23.50		Govt. price	23.50	
Wire base	27.00	to 29.00*		27.00		
Lead, trust price		6.25			6.25	
Nickel, ingot		50.00			50.00	
Sheet zinc, f.o.b. smelter....		19.00			19.00	
Spelter, spot		7.67½			7.67½	
Tin, Straits		\$8.00†			\$5.00†	
Aluminum, 98 to 99 per cent.	34.00	to 36.00		34.00	to 36.00	

OLD METALS

Heavy copper and wire.....	22.00	to 22.50	22.00	to 22.50
Brass, heavy	14.00	to 15.00	14.00	to 15.00
Brass, light	9.50	to 10.50	9.50	to 10.50
Lead, heavy	5.75	to 5.87½	5.75	to 5.87½
Zinc, old scrap	5.00	to 5.50	5.00	to 5.50

*Nominal. †None offering.

THE WEEK IN TRADE

GRATIFYING reports are proof of a generally excellent selling season for the holiday week throughout the country. Household specialties and novelties were in strong demand, owing in great measure to the spirited publicity campaign carried on by the manufacturers and followed up by jobbers and dealers in local application. A few spots were weak on these goods, but they were the exception and not the rule. The outlook on staple lines for the coming year is bright, with the distributing houses ordering adequate stocks of fans, fuses, dry batteries, sockets, conduit, wire, etc., with a view of as early deliveries as conditions will allow. Shipments delayed by freight congestion are not going forward in an altogether satisfactory manner, and the immediate prospect of an improvement is not apparent.

The financial situation is not complained of by either manufacturers, jobbers or dealers. Collections and credits are reported as well in hand.

NEW YORK

Few jobbing houses have reason to complain of business during the year-end week. With few exceptions, and among them certain holiday specialties, electrical goods have not sold up to expectations, but the average was nevertheless quite high, all things being taken into consideration.

Outside of nearby points deliveries are growing more acute. Western shipments are in better shape than goods coming East, though jobbers and dealers have been fairly well taken care of. Cases are reported where bonuses have expedited the prompt delivery of merchandise.

Collections are described as quite up to the mark. Credits are carefully looked after with commensurate results.

TRANSFORMERS AND GENERATORS.—The delivery of transformers and generators of medium size is improving. An order for transformers recently placed is promised for April, 1918, delivery if government priority orders do not intervene. In that event shipment will be postponed indefinitely.

COLLECTIONS AND CREDITS.—Credit departments of the principal jobbing firms report collections as in a good position. Dealers are meeting their paper promptly, as business is excellent. Credits, while carefully scrutinized, are along satisfactory lines.

GEARS AND PINIONS.—Quotations on gears and pinions are being made in a gingerly manner by producers and suppliers. The market is rather unsettled, and on a recent proposal for bids not one had been received from the manufacturers after an interval of two weeks. No contract would be accepted or delivery promised.

FANS.—The new fan contracts for 1918 are about ready to go out, in some instances have already reached the jobbing houses and distributors. The increases in prices, announced exclusively in a recent issue of the *ELECTRICAL WORLD*, are not deterring the buyers.

HOLIDAY SPECIALTIES.—It was expected that a heavy business on holiday specialties would be realized, and with a number of jobbers and dealers this is so. An unexpected falling off in certain localities has occurred, however, and considerable stock will be carried over.

CONDUIT.—According to several jobbers, who may have been cramped for a sufficient quantity of conduit, it is now in an easier position, with satisfactory deliveries.

LAMPS.—The situation has bettered. On some sizes there is yet a shortage. Other types are reported to be plentiful.

DRY BATTERIES.—The sale of dry batteries for a week or two was active. Prices are slightly unsettled, but no advances are reported.

FUSES.—Heavy stocks of fuses are being carried by New York jobbers, some totaling \$8,000 to \$10,000. Manufacturers are said to have had an excellent year and look forward to a better one in 1918.

CHICAGO

Last-minute reports from the retail trade in the Central Western territory seem to indicate that Christmas shopping in electrical goods for 1917 is just about equal to what it was last year. In some quarters the comment is heard that the trade is somewhat lighter, but when it is remembered that 1916 was a banner year this can perhaps be explained easily. Staple and semi-luxury goods were among the best sellers.

While engaged in its Christmas retail sales the trade is also viewing the approach of 1918. Although it is admittedly dangerous to prophesy, the opinion is volunteered that business next year will continue at practically its present volume and prices for at least some months. Central stations are, of course, known to be reducing expenditures, but it is certain that more than 50 per cent of the normal capital requirements of some large plants must of necessity be spent. In addition to this, the industrial outlook is very bright, which seems to indicate that not only will factory supplies move readily but also that industrial workers will have money with which to fill domestic needs.

CHRISTMAS TREE OUTFITS.—In accordance with custom nearly every one who had any stock of Christmas tree outfits reduced prices for the week just before Christmas. This practice never, as far as can be observed, has influenced sales, yet it is followed annually by practically the entire trade.

PORTABLE LAMPS.—This is one item which is enjoying ready sale in spite of the fact that it might be construed to be in the luxury class. The fact that it also has a practical and utilitarian value seems to have made it a popular compromise between the usual type of gift and the necessity.

MOTOR-DRIVEN SEWING MACHINES.—Retail trade on these devices is showing marked increase.

HEATING APPLIANCES.—Sales in some quarters are reported not up to expectation.

CONDUIT.—Prices remain the same, and in some quarters deliveries are getting worse.

COPPER WIRE.—Wire is still on a 34-cent base with not a great deal of activity in the field.

WASHING MACHINES.—The demand continues to exceed the supply even with all factories operating at top speed.

GLASS INSULATORS.—Since the recent price increase there has been little activity, and none is expected, since the majority of these goods are now purchased by railroads.

ELECTRIC RANGES.—Orders for two carloads were received by a Chicago factory this week. One was for immediate shipment and one for shipment in the middle of March.

BOSTON

While this year's Christmas trade appears to be running somewhat behind that of 1916, the total volume of sales is large, and the last few days of Christmas week showed rapid gain in the rate of turnover. Jobbers report a healthy demand for electrical conveniences, especially of the labor-saving kind. Electrical outfits for Christmas tree use have been moving exceptionally well, and a fine business has been done by many concerns, wholesale and retail, in portable lamps. Stocks of small motors up to 25-hp. rating are increasing. Owing to coal scarcity, many central stations are letting their appliance business run along largely of its own momentum, though other companies are vigorously pushing the lighter equipment of relatively low energy consumption. Deliveries are getting poorer, chiefly on account of railroad congestion. Collections are reported slower. As before, government demand occupies the forefront, and much more electrical material remains to be purchased for the Squantum destroyer plant and other war installations.

Jobbers' stocks are fairly large. The lamp situation is much improved compared with last year in the larger sizes, and the outlook is for continued heavy business in at least the early part of 1918. Money is high, and is being accumulated in many quarters for the next government bond issue.

DELCO LIGHTING SETS.—Twelve hundred of these have been sold in New England in the last fourteen months, the standard rating being 0.75 kw. A price advance from \$420

to \$465 takes place Jan. 24. Bad roads in the rural districts handicap winter sales somewhat, but the use of kerosene in these units has helped the coal situation this fall without question.

FLASHLIGHTS.—Standard lines are moving well, but novelties are going slower. The military and naval market is excellent, especially for Christmas giving.

SECOND-HAND EQUIPMENT.—Business is quieter, the lull being due to the withholding of orders as the year closes. One dealer reports a stock of 600 electric motors, including some units of 50-hp. to 150-hp. rating. Generators are in fair supply and a few boilers are available.

RADIATORS.—Trade is well maintained. Prices hold firm and stocks are in good shape despite the early winter.

MOTORS.—Stocks are increasing in units up to 25 hp. Manufacturers have been concentrating upon the production of smaller sizes, with good results. Much attention is being given to improved driving conditions, and readjustments in many hastily equipped plants are in order to increase production and incidentally to save power and fuel per unit of output. Prices are still holding steady.

WIRE AND CABLE.—Stocks of the smaller sizes are fairly good, but larger sizes are difficult to obtain without priority orders. Shipments are about the same as hitherto. An 18,000-lb. order of weatherproof for government use was brought into New England by express a few days since. Commercial orders are hard to execute in the face of government calls. Rubber-covered quoted firm at 33 cents and weather-proof at 29 cents. Jobbers are not stocking much large wire.

CONDUIT.—A shortage is reported in the larger sizes, with substantial local stocks of ½-in. and ¾-in. The demand for the former is heavy. Prices are somewhat disturbed by the practice of some brokers in quoting new business on the basis of undelivered shipments at lower figures than now prevail. The non-maintenance of stocks by manufacturers' agents who do a brokerage business by handling less-than-carload orders on the basis of carload quotations is receiving some criticism as a policy.

ATLANTA

Business emanating from government sources indicates a slight slowing up, due, no doubt, to the holiday season.

The overshadowing feature in trade this week is the large volume of business being done in specialties. Jobbers and dealers state that more electrical appliances are being purchased for gift purposes this year than ever before. The recent cold spell has further stimulated the sale of heaters of all descriptions. Irons, percolators, grills, portables and shaving mugs are moving rapidly, and it is expected that the inventoried value of such articles carried over to 1918 will show a big decrease over other years.

Manufacturers report that the volume of general supply orders during the last week has been holding up fairly well, but while the aggregate is comparatively large the individual orders show a marked decrease in amount per order. This condition is expected, however, during the pre-inventory period. Reports from the various manufacturers indicate that collections are excellent and slightly better than November. This is accounted for by the fact that the manufacturers are exerting extra effort before the close of the calendar year and that large amounts have been borrowed on short-term notes to provide the necessary capital for raw materials which had to be purchased to cover the present abnormal demand.

FANS.—Manufacturers have about completed making 1918 fan contracts with jobbers and dealers. Substantial orders are being placed and delivery quotas are slightly in excess of 1917, anticipating better fan weather in 1918.

HEATING PADS.—The demand for these in the last week has been away above normal, and local stocks are getting low. The jobbers state that the increased business emanates from outlying small central stations.

ANNUNCIATORS.—Business in this line is good and price cuts little figure with the type of industries demanding this class of goods. Prices average from 20 to 40 per cent upon standard equipment and 100 per cent advance over last year on specials.

CROSS-ARMS.—The decreasing demand on government construction has caused a slump in sales, and local stocks are beginning to accumulate. Prices have remained unchanged for the past sixty days.

CARBON LAMPS.—Renewed activity is noted in the call for 16-cp. equivalents from certain quarters owing to inability of dealers to deliver the 25-watt and 40-watt tungsten lamps quickly.

BELL-RINGING TRANSFORMERS.—The increasing cost of dry cells together with uncertain deliveries has tended to swing a large portion of this type of business to transformers. Sales up to date show an increase of approximately 80 per cent over 1916. Prices remain steady, shipments are good, and prompt deliveries are being made.

SAFETY LOCK BOXES.—Ordinances passed in Atlanta and Jacksonville recently requiring duplex and other types of apartments to use the combination switches in safety boxes has stimulated this line, and a substantial business is being transacted. Deliveries have been fairly prompt and local stocks are in good shape.

CONDUIT.—Conditions in delivery seem to be growing steadily worse, and jobbers state that no definite promises of shipment can be secured from any source. Prices remain firm.

SEATTLE

The week of Dec. 17 to 24 was featured along electrical lines by enormous sales of holiday merchandise, particularly toaster stoves, flatirons, percolators, warming pads, vacuum cleaners and table lamps. The volume of sales of electric washing and sewing machines increased over the last two weeks. Retailers who have been conducting a heavy advertising campaign during the last three weeks report that Christmas sales of electrical goods have never before been equaled. The predicted eleventh-hour rush for electrical presents began Dec. 21 and increased until closing hours Saturday. Electrical dealers state that the increase in business as compared with the 1916 season is from 40 to 60 per cent. While movement of novelty goods is better than last year, the percentage is not so high as compared with the sales of better-grade electrical merchandise.

Sales of staples to shipyards and industrial plants in Portland during the week showed noticeable increase due to the award of several contracts for wooden and steel vessels. Wholesalers in the Northwest are busy with the invoice period, and retailers as well as wholesalers are beginning to stock heavily, fearing the expected order from Washington eliminating non-essentials. Northwest dealers are becoming converted to the belief that the war will extend over a long period and are trying to prepare for this contingency.

Plans for the immediate establishment of another large wooden-shipbuilding plant in Seattle were announced during the week. This is the third project of this kind reported recently. There are thirty-four plants engaged in wooden-ship construction in Washington, and approximately one-third are constructing vessels for the United States Shipping Board. Wooden and steel shipbuilders of Seattle, Tacoma and vicinity have jointly notified the Shipping Board that they will guarantee to launch and finish 600,000 dead-weight tons of steel ships and 400,000 tons of wooden ships during 1918.

Reports from Spokane state that building is on the increase and that permits for the last month were 500 per cent greater than for the same period last year. Building at Tacoma is also on the increase owing to the proximity of American Lake Cantonment and new shipyards there. Homes under construction are of good type and contain all modern equipment. Tacoma and Spokane electrical retailers report increased sales of fixtures and other equipment for new building. The Seattle Chamber of Commerce and Commercial Club is preparing to solve the problem of housing from 15,000 to 20,000 men who are to be sent here by the government to work in the shipyards at an early date.

As a means of speeding production of spruce for airplane building the government has announced a substantial bonus on all deliveries prior to Feb. 28, also a new and higher price per 1000 ft. It is stated that spruce production has so far amounted to only 40 per cent of government requirements.

The freight situation in the Northwest is becoming more aggravated daily. During last week Seattle was almost cut off from Eastern train service by floods and washouts of bridges and tracks, thereby increasing freight congestion. Collections are up to market. Credit men are endeavoring to close the business with as good showing as possible.

SAN FRANCISCO

The freight-car embargo and general freight congestion have heretofore affected the San Francisco electrical field chiefly in the time advisable to allow for advance orders, but actual delays in delivery are now complained of and an immediate effect on the market has resulted. The general feeling is that transportation conditions are certain to get worse before they improve, and with factory conditions remaining the same the prospects as to stock and deliveries are declining. However, there continues to be a brisk demand in many lines and salesmen are being coached in keeping customers content with the best available terms of delivery or with partly filled orders.

A feature of the San Francisco situation this week uppermost in the construction field is the proposed strike of iron workers, about 10,000 of whom are reported to have decided to walk out unless their demands are granted. This strike order would include certain classes of electricians and would indirectly affect others by temporarily closing down work. Christmas trade as a whole was reported by the jobbers to have been somewhat below expectation, although in some few lines it was well above average. For example, enormous quantities of pocket flashlights were sold. The buying was generally for staple articles. Conservation seemed to be the keynote among Christmas shoppers this year. In some quarters there is a rather depressed view of January prospects, but it is being pointed out that with a conservative market the reaction after the holidays will be less than usual, and it is notable that collections are invariably better in January than in December.

CREDITS AND COLLECTIONS.—Little change in the financial situation occurred this month. Manufacturers' agents who deal largely with firms enjoying excellent credit report good conditions, and the jobbers who have for months practiced a conservative policy state that while caution is advisable there is no complaint about the present situation.

SMALL MOTORS.—Meager stocks in sizes up to 10 hp. are available. One manufacturer is quoting three to four months' delivery on sizes under 50 hp. and seven to eight months on larger units. Many orders are coming in for motors to be brought to San Francisco and held for shipping instructions pending the delivery of the machinery which the motors are to drive.

ELECTRIC SIGNS.—Although no coal is used for generating electricity in San Francisco territory, there has been some doubt about the application of the Fuel Administrator's orders on sign lighting, and this has seriously crippled the sign business. One co-operative sign campaign was canceled by the power company and business has fallen off practically 50 per cent in many quarters.

STORAGE BATTERIES.—Automobiles are used all the year round in California. This is cited as the cause of a demand for batteries in San Francisco that continues increasing after the Eastern peak has passed. One firm now has en route to San Francisco three carloads of battery parts and materials for assembly there, as well as two carloads of made-up batteries, furnished by the Eastern plant to supply the San Francisco demand until that branch can catch up.

WIRELESS APPARATUS.—Although the general rule on all vessels taken over by the United States Shipping Board is that the navy standard radio sets are to be installed, it has not been found advisable to adhere absolutely to this rule. In fact, one firm in San Francisco has recently closed contracts for installing radio sets on a number of vessels now under the jurisdiction of the Shipping Board. The report of German raiders in the Pacific has also notably increased the demand for radio sets for privately owned vessels too small to be included under the jurisdiction of the United States Shipping Board.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B.&S. Size	List per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor

No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil.....	List to \$61.00
Coil to 1000 ft.....	5% to \$59.17
	No. 12 Solid
Less than coil.....	List to \$71.00
Coil to 1000 ft.....	5% to \$68.87

Twin-Conductor

	No. 14 Solid
Less than coil.....	List net to \$105.00
Coil to 1000 ft.....	\$70.00 to 10%
	No. 12 Solid
Less than coil.....	List net to \$135.00
Coil to 1000 ft.....	10% to \$130.95

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil.....	List +10%
Coil to 1000 ft.....	—10%
	No. 12 Solid
Less than coil.....	+10%
Coil to 1000 ft.....	—10%

Twin-Conductor

	No. 14 Solid
Less than coil.....	+10%
Coil to 1000 ft.....	—10%
	No. 12 Solid
Less than coil.....	+10%
Coil to 1000 ft.....	—10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+20% to 12%
1/5 to std. pkg.....	List to 20%
Std. pkg.....	28% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.285	.295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.3175	.3275
Barrel lots.....	.2875	.2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, Per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/4-in. s. stp.....	\$75.00	\$69.75
3/8-in. d. stp.....	75.75	72.00
1/2-in. s. stp.....	100.00	93.00
1/2-in. d. stp.....	100.00	96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/4-in. single strip....	\$75.00	\$63.75
3/8-in. double strip....	78.75	71.25
1/2-in. single strip....	100.00	85.00
1/2-in. double strip....	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
5/8.....	.15	2.....	.55
3/4.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

	Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$25.00-\$55.00	\$20.50-\$24.75	\$20.00-\$22.00
1/4-in.—	\$28.00-\$60.00	\$20.00-\$22.00	\$22.00-\$24.00

NET PRICE 1000 FT.—CHICAGO

	Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.....	\$55.00	\$25.00-\$37.50	\$22.50-\$24.75
1/4-in.....	\$60.00	\$27.00-\$30.00	\$25.00-\$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List Elbows, List

1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.50
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb....	4% to 6%	7% to 9%
2500 to 5000 lb....	6% to 8%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb....	1.3% to 3.7%	4.3% to 6.7%
2500-5000 lb....	3.3% to 5.7%	6.3% to 8.7%

(For galvanized deduct six points from above discounts.)

FLAT IRONS

NEW YORK

List price.....	\$5.00 to \$6.00
Discount.....	30%

CHICAGO

List.....	\$5.00 to \$6.00
Discount.....	30%

FUSES, INCLOSED

	250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100		\$0.25
35-amp. to 60-amp.....	100		.35
65-amp. to 100-amp.....	50		.90
110-amp. to 200-amp.....	25		2.00
225-amp. to 400-amp.....	25		3.60
450-amp. to 600-amp.....	10		5.50
	600-Volt		
3-amp. to 30-amp.....	100		\$0.40
35-amp. to 60-amp.....	100		.60
65-amp. to 100-amp.....	50		1.50
110-amp. to 200-amp.....	25		2.50
225-amp. to 400-amp.....	25		5.50
450-amp. to 600-amp.....	10		8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.00 to \$5.75
1/5 to std. pkg.	4.50
Standard package, 500.	List, each, \$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500.	List, each, \$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List.
Regular, clear:		Each
10 to 40-watt—B.	100	\$0.27
60-watt—B.	100	.36
100-watt—B.	24	.65
75-watt—C.	50	.65
100-watt—C.	24	1.00
200-watt—C.	24	2.00
300-watt—C.	24	3.00
Round bulbs, 3 1/4 in., frosted:		
15-watt—G	25	.50
25-watt—G	25	.50
40-watt—G	25	.50
Round bulbs, 3 1/2 in., frosted:		
60-watt—G	30	.72
Round bulbs, 4 in., frosted:		
100-watt—G	35	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$30.00 to \$33.98
Coil to 1000 ft.	25.50 to 25.82

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$30.00 to \$36.24
Coil to 1000 ft.	22.50 to 27.18

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	\$20.00 to \$29.00
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CHICAGO

Net per 100	\$19.25
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OUTLET BOXES

Nos.	List.
101—A, A1 1/2, 4 S.C., 6200, 320	per 100 \$30.00
102—B.A., 6200 S.E., 300, A.X., 1 1/2, 4 S.	30.00
103—C.A., 9, 4R, B 1 1/2	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list	25%	20%
\$10.00 to \$50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list	40%	35%
\$10.00 to \$50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$20.00 to \$38.00
1/5 to std. pkg.	19.00 to 20.00
Standard package, 2200.	List per 1000, \$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80
1/5 to std. pkg.	14.80
Standard package, 2200.	List per 1000, \$20.

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net	Std. Pkg.	3500 Std. Pkg.	4000
		5 1/2 N. C.—Solid Nail-it—N.C.		

Less than 1/5 std. pkg.	\$27.50 to \$29.00	\$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

	Per 1000 Net	Std. Pkg.	3500 Std. Pkg.	4000
		5 1/2 N.C.—Solid Nail-it—N.C.		

Less than 1/5 std. pkg.	\$11.85	\$30.75
1/5 to std. pkg.	11.10	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/4-in. cap key and push sockets	500	\$0.33
1/4-in. cap keyless socket	500	.30
1/4-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	14%
1/5 to std. pkg.	20%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	\$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00

Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

Less than \$10 list	List net to + 5%
\$10 to \$25 list	11%
\$25 to \$50 list	14% to 15%

Less than \$10 list	5% to 10%
\$10 to \$25 list	16%
\$25 to \$50 list	24% to 25%

DISCOUNT—CHICAGO

Less than \$10 list	+ 5%
\$10 to \$25 list	11%
\$25 to \$50 list	14%

Less than \$10 list	5%
\$10 to \$25 list	16%
\$25 to \$50 list	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+ 20% to list
1/5 to std. pkg.	List to — 15%
Std. pkg.	List to — 30%

SWITCH BOXES, SECTIONAL CONDUIT

	List
Union and Similar—	Each
No. 155	\$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list	List	List
\$2.00 to \$10.00 list	10% to 20%	5%
\$10.00 to \$50.00 list	20% to 30%	15%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list	25%	15% to 20%
\$2.00 to \$10.00 list	25%	20%
\$10.00 to \$50.00 list	25% to 35%	20% to 25%

TOASTERS, UPRIGHT

NEW YORK

List price	\$6.00
Discount	30%

CHICAGO

List price	\$5.50 to \$6.00
Discount	30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools	\$0.44 1/4 to \$0.65
No. 18, full spools	0.43 1/4 to 0.55

CHICAGO

	Per Lb. Net
No. 18, less than full spools	\$0.64 to \$0.65
No. 18, full spools	0.54 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net			
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.	1000 to 5000 Ft.
11.	\$15.00-\$18.00	\$13.00-\$14.00	\$11.25-\$12.00	
12.	23.25- 27.09	21.31- 23.22	19.35- 20.85	
10.	32.40- 37.80	29.70- 32.40	27.00- 29.25	
8.	45.70- 53.34	41.90- 45.73	38.00- 41.38	
6.	72.40- 84.42	66.35- 72.40	60.30- 65.50	

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14....	\$18.00	\$13.50	\$12.00
12....	26.95-27.79	23.85-26.95	19.85-23.10
10....	33.24-37.65	30.47-32.27	27.70-30.32
8....	47.04-53.05	43.12-45.47	39.20-45.72
6....	68.25-84.01	62.05-67.64	55.85-72.01

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$35.25 to \$40.00
25 to 50 lb.	36.25 to 39.00
50 to 100 lb.	34.25 to 38.00

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	\$40.00 to \$40.35
25 to 50 lb.	39.00 to \$39.35
50 to 100 lb.	22.30 to 38.35

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Threaded Catch Socket

A threaded catch socket designed in such a way that it can be easily assembled and so that the shell cannot be pulled apart by many times the strain to which it will be subjected in service is now being made by the General Electric Company of Schenectady, N. Y. Lugs on the cap fit into the body of the shell, and a threaded ring holds the cap firmly in place.

This improved socket design is offered in place of ordinary types where the threaded feature mentioned is essential. This type of socket is made in key, keyless and pull designs and in locking types, key and keyless.

Porcelain Locking Socket

Pass & Seymour of Solvay, N. Y., have recently placed on the market their "Shurlok" porcelain socket. It is pointed out that the advantage of this locking socket is that it provides a practical means of locking the lamp in the socket so that it cannot be removed without the use of the master key.

The Shurlok screw with the special head is carefully designed so that it cannot become lost or misplaced. The lamp base is carefully positioned in the socket shell by especially placed ribs or corrugations on the inside of the porcelain shell which prevent the lamp from being forced out of perfect alignment with the socket. The porcelain boss or extension is of rugged construction, and it is claimed that the socket will not be damaged by the ordinary rough usage that it is subjected to and that therefore it will have a longer life than is often the case with sockets less strongly constructed.



RESISTS CHEMICAL ACTION

The porcelain shell is not disintegrated by acids, fumes or gases. The standard porcelain socket or receptacle is composed of a body and the cap or base. When the lamp is removed the retaining screws are made accessible, and the socket must be installed before a lamp can be used. In locking

the lamp in by means of "Shurlok" the shell and cap of the socket are locked so that they cannot be taken apart. A wide variety of locking sockets and receptacles are now obtainable because the porcelain "Shurlok" body is interchangeable with the complete line of porcelain caps and bases made by this company.

Flood-Lighting Unit

As a further development of its line of "Golden Glow" and "Crystal Mirror" flood-lighting projectors, the Electric Service Supplies Company has placed on the market a new flood-lighting unit to be known as type FL-1419. This new type of projector is particularly designed for short-range work where a wide beam dispersion is desired. It is equipped with 14-in. (35.6-cm.) long-focus-type parabolic



FOR SHORT-RANGE WORK

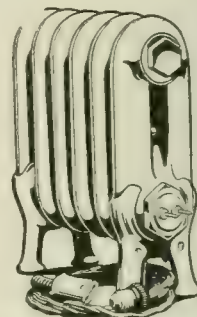
"Golden Glow" or "Crystal Mirror" reflectors, which project respectively powerful dispersed beams of rich golden light and white brilliant light.

This company in its recent catalog on flood-lighting projectors classified the different flood-lighting subjects into two divisions, namely, those in which the human eye is brought into continuous use to observe detail and those in which the human eye figures only momentarily or where lighting the subject as a whole is the main consideration. In the first classification "Golden Glow" light is strongly recommended, and in the latter class the white, brilliant light from "Crystal Mirror" projectors is desirable.

This new type meets a demand for a more powerful projector than any heretofore cataloged by this company, it being adapted to use with 500-watt to 1500-watt type C Mazda (or nitrogen-filled) lamps.

Portable Nitrogen Radiator

The Willis Manufacturing Company of Cleveland, Ohio, is offering to the trade the portable electric nitrogen radiator shown in the accompanying illustration. This radiator is said to be the only auxiliary electric heating ap-



CONTAINS HEATING ELEMENT SURROUNDED BY NITROGEN GAS

paratus filled with nitrogen gas which is built on scientific principles adopted by heating engineers of standing—i. e., the radiator. It maintains an average temperature of 350 deg. Fahr. (176.7 deg. C.), it is said. The radiator contains an electric heating element surrounded by nitrogen gas. The gas fills the entire inside of the radiator, which is hermetically sealed. The gas serves to carry the heat from the heating element to the radiating surfaces at a temperature higher than that of a steam radiator. One feature pointed out for this device is that there is no way by which clothing, drapery or anything else can catch fire, as it has no exposed red-hot open wires. The cost of operation of this radiator is very low. The stock radiators are made in four, six, eight and ten sections. Special radiators may be built in any size or type desired.

Portable Motor-Operated Bench Planer

The J. D. Wallace Company of Chicago has developed a portable motor-operated bench planer and joiner for light woodworking operations. The device and motor are a single unit with direct drive through a flexible coupling which delivers approximately 100 per cent of the power applied.

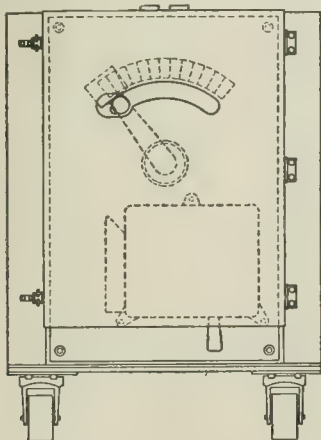
A feature of the machine is that three knives are operated on the cutter head if an alternating-current motor is used and two if a direct-current motor furnishes service. The direct-current motor makes 4000 r.p.m. and the alternating-current motor 3600 r.p.m. Fractional-horsepower motors made by the General Electric Company are used.

Portable Outlet Panels for Electric Welding Service

For an electric welding outfit to be of its maximum service it must be so arranged that it can be taken to the work no matter where that is to be performed. A recently developed portable outlet panel manufactured by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., takes care of this situation with a minimum of expense and with all the simplicity of the familiar distributing system for storage-battery charging, it is claimed.

Two types of portable outlet panels are furnished, both being mounted on light trucks. They consist of a control panel mounting a handle-trip railway-type circuit breaker having overload release with magnetic blowout and a thirteen-point face plate connected to a resistor mounted in the rear of the panel. The face of the panel is protected by a metal cover through which the handles of the rheostat and circuit breaker project. The resistor is made up of grids and is protected by a cage of expanded metal. The type E panel is intended for metal electrode welding only, having a capacity of from 80 amp. to 170 amp. With this outfit one metal electrode holder and one shield are supplied. For a wider range of work a type F panel should be used. This will handle metal electrode work from 80 amp. to 160 amp. and light graphite electrode work up to 300 amp. The outfit includes one metal electrode holder, one graphite electrode holder and one mask.

In installing an electric welding system using these portable panels the best method, the makers say, is to place a Westinghouse arc-welding motor-generator set at some central point. Where suitable low-resistance ground connection can readily be made throughout the shop, as, for instance, where metal floors or cast-iron bedplates are in general use, or in a railway shop



PANEL IS MOUNTED ON LIGHT TRUCK

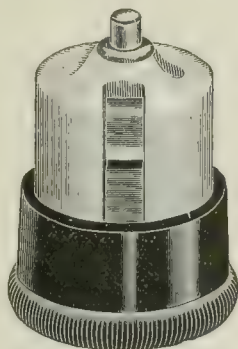
where the track system can be used, only one connector need be extended to the various receptacles. The iron floor plates may be arc-welded to each other and isolated sections tied together by an iron rod or heavy copper cable, while the track rails may be bonded by arc-welding the fish plates to the rails.

Receptacles should then be provided at suitable points throughout the shop of a capacity appropriate for the service for which they are intended. These receptacles may readily be mounted out of doors if they are provided with protection from the weather. Only single-pole receptacles and a single wire cable to the portable panel need be provided. This cable should be of sufficient length so that the panel may be placed as near as possible to the work in order to save steps and valuable time for the welding operator. The flexible cable leading from the panel to the electrode holder should be as short as is consistent with the class of work to be done.

Where metal floors or tracks are not available the ordinary two-wire system of distribution with double-pole outlets and two-wire cables should be provided.

Snap Attachment Plug

One of the latest electrical products of the Sales Development Company of 299 Madison Avenue, New York City, is an attachment plug that snaps into the ordinary Edison socket with a slight pressure of the finger. A sleeve contact is made through a bronze spring



NO TWISTING OF WIRES RESULTS WHEN ATTACHING THIS PLUG

mounted upon the side of the plug. This spring also serves to hold the plug securely in the socket. The tip contact has a play of approximately 3/16 in. (4.8 mm.) and is so controlled by the spring that perfect contact is made even when the plug is pushed into the socket only far enough to hold by the first thread. Since this attachment may be pushed directly into a socket, no twisting of the wires results. This snap plug, the manufacturer points out, may also be easily inserted into a socket which has a shade mounted upon it. Heavily glazed porcelain is employed so that the plug may be kept clean without undue effort.

Canopy Tap

The Bryant Electric Company of Bridgeport, Conn., has added to its "New Wrinkle" line of wiring devices a canopy tap of wide application which can be readily attached to any ceiling or side-wall fixture where a current tap is desired. The new tap receives any "New Wrinkle" body, and many useful combinations can be made. By

connecting the tap in series with the fixture and combining with a "New Wrinkle" key or pull switch for wall fixtures or a "New Wrinkle" pull ceiling switch for ceiling fixtures, conve-



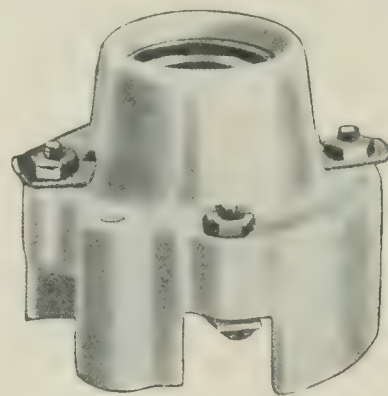
MANY COMBINATIONS CAN BE MADE WITH THIS TAP

nient means is provided for controlling single or group lamp fixtures at the fixture without expensive wiring—an especially valuable feature in rooms having no flush switches.

The new device, which is known as the "BZ New Wrinkle canopy tap," is National Electrical Code standard and consists of a "New Wrinkle" ring and a porcelain base, which are easily and firmly attached to the outlet box by means of stamped steel rings, rings being made to fit 3 1/4-in. and 4-in. (8.2-cm. and 10-cm.) boxes. In lath and plaster construction, the rings are omitted and the base is attached by wood screws. After notching the canopy to fit over the neck of the tap it can be replaced flush with the ceiling or wall, resulting in a neat and unobtrusive job.

Thermo Sign Flashers

The prominent features of the flasher shown in the accompanying illustration are that it consumes no energy when the lamp is out, thus saving 35 to 50 per cent in energy consumption. The socket flashers are built for 25, 40 or 60-watt lamps, as well as for 25-40 watt and 40-60 watt lamps. The second mentioned will operate either a 25-watt or a 40-watt lamp with change in adjustment, the last either a 40-watt or a 60-watt lamp. The device consists of two parallel bars made from the same



BURNS NO ENERGY WHEN LAMP IS OUT

die and stock, so that they will expand and contract together under any climatic changes, making the length of the flash and its duration always uniform in times per minute regardless of the sign load. This flasher is made by the M. C. Ryan Company of Phoenix, N. Y.

Trade Notes

JOHN L. COLLINS has taken new and better quarters at 405 Sun Building, Lowell, Mass.

CHASE & HOWLAND, New Bedford, Mass., have formed a partnership for the practice of industrial engineering.

THE GENERAL ELECTRIC COMPANY, Harrison, N. J., has issued, as of December, 1917, what is termed a "Conservation Number" for the "Edison Sales Builder."

THE NAGLE CORLISS ENGINE WORKS of Erie, Pa., builders of air compressors, vacuum pumps and engines, has opened an office in the Bourse Building, Philadelphia.

THE ARTHUR JONES ELECTRIC COMPANY of Chicago had an informal housewarming and dance in honor of the opening of its new plant, at 2837-2843, South State Street, Dec. 22.

N. B. PAYNE has opened an office in the Havemeyer Building, 25 Church Street, New York, as an electric crane specialist. Mr. Payne was formerly associated with Manning, Maxwell & Moore, Inc., New York City.

G. A. SCHNEIDER, formerly of the Western Electric Company's San Francisco sales organization, has been appointed manager at its Buffalo house, succeeding J. W. Tabb, who has been transferred to the New York house.

THE RIDGWAY DYNAMO & ENGINE COMPANY, Ridgway, Pa., announces the appointment of the Blake Electric Manufacturing Company, No. 1 Rowe's Wharf, Boston, as its sales representative for the New England States.

R. T. GRAY, 1644 First National Bank Building, Chicago, who was formerly connected with the Shuman Advertising Agency, has opened an advertising agency under his own name to handle technical advertising copy exclusively.

P. H. BOOTH, now an officer of the Hot-point Electric Heating Company, will be a vice-president as well as sales manager of the new Edison Electric Appliance Company, of which a full account was given in the ELECTRICAL WORLD for Dec. 15.

W. C. CARTER has been placed in charge of the sales office at Grand Rapids, Mich., of the Westinghouse Electric & Manufacturing Company for the handling of western Michigan business. This office is under direction of the company's Detroit office.

THE BLAW-KNOX COMPANY has closed its Philadelphia office for the present, and Mr. Pulis, who had been in charge, is transferred to its San Francisco office, to take the place of Mr. Burrows, who is going into the service of the government.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., has completed and has about ready for operation the new factory site located east of the present office building. The structure will give additional working space of about 20,000 sq. ft.

THE BROWN COMPANY, Portland, Me., formerly the Berlin Mills Company, has acquired the property and business of the Burgess Sulphite Fibre Company. The new company will be carried on under the same control and management as heretofore, dealing in, among other things, a line of fiber conduit.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., has recently completed an eight-story reinforced-concrete building. The buildings contain more than 20 acres of floor space. The yard space covers an area of 4 acres and tracks from two railroad lines run directly into the yards of the works.

H. T. GLOVER, formerly sales manager of the Esterline Company, Indianapolis, Ind., who enlisted last June with the Canadian Expeditionary Force, is about to start for Europe, if he has not already done so. He is a member of the divisional signallers of the Canadian forces. Mr. Glover is a British subject, which accounts for his enlistment in Canada.

J. J. PORTLEY, recently connected with the selling force of the Western Electric Company, Minneapolis, Minn., and also previously representing the company on the Pacific Coast and in Chicago, is now in charge of the appliance department at 463 West Street, New York City. Mr. Portley will devote his entire time to mapping out and putting into execution energetic sales campaigns on these specialties.

THE GENERAL ELECTRIC COMPANY of Lynn, Mass., will soon begin the construction of three new buildings. The plans call for a two-story brick and con-

crete office building, 142 ft. by 60 ft.; a one-story building, 226 ft. by 582 ft., to be constructed of steel, brick, concrete and cement plaster, to be used for general manufacturing purposes, and a two-story building, 67 ft. by 340 ft., to be used for a cleaning and core shop.

THE HESS-BRIGHT COMPANY of Philadelphia, Pa., has closed its retail office at 934 North Broad Street, that city, owing to the enlistment of Rush S. Whiteside, the local manager, and G. L. Jenks, his assistant, in the aviation section of the United States Army. The Ahlberg Bearing Company of Chicago will open a branch house at the same address, and will represent the Hess-Bright Company as local distributors for the retail trade.

W. G. LAWRENCE has opened an office in the Spitzer Building, Toledo, Ohio, to engage in electrical engineering, and will make a specialty of power plant designing, street lighting and supervision of construction and electrical installations. One of the associates of Mr. Lawrence is H. A. Seward, who recently came to Toledo from Chicago to join this firm. Mr. Lawrence, also a Chicago engineer, established himself in Toledo several years ago.

THE GOULDS MANUFACTURING COMPANY of Seneca Falls, N. Y., has put into effect, beginning Jan. 1, 1918, a bonus system whereby all hourly, piece work and salaried employees rated at \$40 a week or under will receive quarterly a bonus of 10 per cent on their total salary for the previous three months. This bonus is contingent upon a stipulated amount of time being put in at actual work during the year and is aimed to encourage full-time work.

S. F. FORBES, former manager of the Los Angeles office of Fairbanks, Morse & Company, is now the Pacific Coast manager, with that city as his headquarters. He will have jurisdiction over the San Francisco, Portland, Seattle, Spokane and Los Angeles offices. The territory covered includes California, Arizona, Nevada, Oregon, Washington, Alaska, Hawaiian Islands, northern Idaho and western Montana, besides Baja California, Sinaloa and Sonora, Mexico.

L. E. VAN NORMAN, chief of the division of information, Washington, D. C., has compiled a war trade manual for shippers. Since some of the data in the "Rules and Regulations of the War Trade Board," which has been distributed very widely throughout the country, have now been superseded by new rulings and lists, the division of information of the board is preparing a "War Trade Board Manual for Shippers," which will contain only data in force at the time of its publication.

THE AMERICAN CHAMBER OF COMMERCE of Mexico has just been organized in the City of Mexico by American residents, companies and individuals. This chamber will publish printed matter about the country and its resources. Plans are being made for a periodical market reporter and news bulletin. An especial aim will be to furnish to the United States reliable business information about Mexico and also to keep in touch with the needs of its own country. The chamber will open a reading room, with American newspapers and magazines on file.

THE THORDARSON ELECTRIC MANUFACTURING COMPANY of Chicago has recently undergone a reorganization in all departments. A. S. Lindstrom, who is now general manager of the company, had become quite well known in the industry through his connection with the St. Louis and San Francisco World's Fairs. At the St. Louis fair Mr. Lindstrom was assistant chief of the Electricity Building. Later he became connected with the Western Electric Company in the Southwestern States, where he was engaged in marketing telephone apparatus. In the same territory he financed, built and operated four independent telephone companies. Later he was made assistant chief and director of high-voltage research work in the Machinery Palace at the San Francisco fair. After the fair, he became Western representative for the Thordarson Electric Manufacturing Company, which position he held until he came to Chicago to take up his present work. H. A. Johnson, the new sales manager of the company, has been employed in central station operating and general commercial activities with the Public Service Company of Northern Illinois, the Hot Point Electric Heating Company and the Electric Appliance Company. C. B. Olson, purchasing agent of the company, is new in the industry. He is also vice-president of the Olson Rug Company. C. R. Oschgar is production manager. The company has also appointed Mr. Alumbough as Central Western representative and Mr. Gibson as Eastern representative. W. I. Otis and the Western Engineering Sales Company continue to represent the Thordarson company on the Pacific Coast.

Trade Publications

TURBO-GEAR.—The Poole Engineering and Machine Company of Baltimore, Md., is distributing its bulletin No. 100, descriptive of its turbo-gear.

CENTRIFUGAL PUMPS.—The Manistee Iron Works Company of Manistee, Mich., has issued bulletin No. 53, descriptive of its single-stage centrifugal pumps.

ELECTRIC FURNACES.—The Electric Furnace Company of Alliance, Ohio, has prepared a bulletin descriptive of its Bailey automatic electric furnaces for the heat treatment of high explosive and shrapnel shells.

FIXTURES.—The Peter Forg Manufacturing Company of Somerville, Mass., has prepared a bulletin descriptive of its universal adjustable electric light fixtures, which are adapted for use in factories, offices, architect's designing and reading rooms, hotels and dentists' rooms, etc.

BUCKETS.—Catalog 44, descriptive of Hayward buckets for industrial plants, has been recently issued by the Hayward Company, 50 Church Street, New York City. This book not only gives photographs of such installations but also gives blueprint elevations and plans of the several forms of Hayward buckets operated by overhead traveling cranes, monorail hoists, inclined-boom unloaders, etc.

CALENDAR.—The Youngstown Sheet & Tube Company, Youngstown, Ohio, has issued a very attractive calendar for 1918. It is featured by twelve large two-color illustrations of as many different operations in the manufacture of iron and steel. The plates were made from photographs taken in the works of the company and are both handsome and instructive. The calendar will be sent to any address on receipt of 4 cents in stamps to pay cost of mailing.

LEFAX DATA BOOKS.—The Lefax Company of Philadelphia, is distributing catalog sheets for the following firms for Lefax loose-leaf books: SKF Ball Bearing Company, Hartford, Conn., ball bearings, hangers and fall blocks; Electric Weighing Company, New York, automatic belt conveyor scales; Atlantic Terra Cotta Company, New York, firebrick. It is pointed out that each of these sheets is punched and indexed for filing in the Lefax data books in use by so many engineers, although they would, of course, interest any person having occasion to use such products.

INDUSTRIAL APPARATUS.—In its catalog 8-E, just issued, the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has grouped all of the industrial electric heating apparatus which it manufactures. The line includes steel-clad heaters for many industrial processes, immersion-type water heaters, stoves of various forms, chocolate warmers, tailors' irons and electric oven heaters for use in enameling. Data are given for the calculation of the proper amount of heating to provide for water and for the heating of buildings. Several pages are devoted to the subject of electrically heated ovens, covering the design and construction of the ovens themselves, a discussion of the various types and their uses, and the efficiencies in operation which can be secured. Westinghouse electrical heaters, which are of the ribbon type, are described and also the company's system of thermostatic control. A considerable number of circuit diagrams are given, showing various methods of applying these control devices. Inclosed with the catalog is a data blank showing the information which should be furnished by any user of electrically heated ovens in order to enable the company to arrive at the proper number and type of heaters for his service. This catalog is a valuable addition to the library of any man whose work includes the application of heat at moderate temperatures for industrial purposes.

New Incorporations

THE STANDARD ELECTRIC MANUFACTURING COMPANY of Jersey City, N. J., has been chartered with a capital stock of \$200,000 by Jules E. Brand, H. A. Black and Walter T. Hilton, all of Jersey City, N. J.

THE CLEVELAND (OHIO) CONTROLLER & MANUFACTURING COMPANY has been chartered with a capital stock of \$20,000 by L. C. Spieth, L. A. O'Neil, N. M. Strine, M. E. Gleason and M. G. Egan.

THE EBERT ELECTRIC COMPANY of Cray, N. D., has been incorporated with a capital stock of \$5,000 by J. H. Smith, F. R. Stevens and John W. Ebert.

THE N. DICKINSON COMPANY, 367 High Street, Newark, N. J., has been organized by N. Dickinson for the purpose of manufacturing lighting specialties.

THE AMHERST (WIS.) ELECTRIC SERVICE COMPANY has been incorporated with a capital stock of \$25,000 by B. E. Dwinell, Hugh Evans and others.

THE BULLITT COUNTY ELECTRIC LIGHT COMPANY of Shepherdsville, Ky., has been chartered with a capital stock of \$9,000 by S. W. Bates, C. L. Croan and S. H. Ridgway.

THE HERNDON (VA.) LIGHT & POWER COMPANY has been incorporated with a capital stock of \$15,000. The incorporators are: C. N. Florence, president, and E. E. Gillette, secretary.

THE HOFFMAN-HARBER COMPANY of Fort Wayne, Ind., has been incorporated to deal in electrical apparatus. The incorporators are: Henry Hoffman, Fred Harber and Howard Benninghoff.

THE AKRON (OHIO) BATTERY & ELECTRIC COMPANY has been chartered with a capital stock of \$2,500 by W. C. Kimball, E. J. Schultz, E. S. Sheck, O. E. Sellers and N. E. Herwick.

THE RAILWAY UTILITIES & EXPORT COMPANY of New York, N. Y., has been chartered with a capital stock of \$10,000 by F. H. Martinell, H. C. Niemeyer and G. A. Reiss, 165 Broadway, New York.

THE MANHATTAN STORAGE BATTERY COMPANY of New York, N. Y., has been chartered with a capital stock of \$9,900 by A. J. Picard, E. J. Stern and A. Hirst, 2008 Broadway, New York, N. Y.

THE DAYTON (OHIO) ELECTRICAL MANUFACTURING COMPANY has been

organized by H. G. Catrow, William V. Knoll, Vincent G. Apple, I. Webb and Earl H. Turner. The company is capitalized at \$125,000.

THE B. B. BELL COMPANY of Los Angeles, Cal., has been incorporated with a capital stock of \$30,000 to manufacture lighting fixtures, etc. The incorporators are B. B. Bell, E. F. Bell and D. S. Collins of Los Angeles.

THE ALAMO FARM LIGHT COMPANY of Wilmington, Del., has been incorporated with a capital stock of \$60,000 to conduct electric light plants. The incorporators are: F. D. Buck, M. L. Harty, K. E. Longfield, all of Wilmington, Del.

THE G. A. ELECTRIC MANUFACTURING COMPANY of Cincinnati, Ohio, has been incorporated by George R. Adams, Sr., George R. Adams, Jr., Julius H. Schatzman, E. C. Daupre and George Code. The company is capitalized at \$10,000.

THE CITIES FUEL & POWER COMPANY of Dover, Del., has been incorporated by L. B. Phillips and J. B. Bailey of Dover, Del. The company has capital stock of \$10,000,000 and proposes to operate plants to generate and distribute electricity and gas.

THE HORN & BRANNON MANUFACTURING COMPANY of Trenton, N. J., has been incorporated by Herman Corn and Frederick Pfeffer of Philadelphia, Pa. The company is capitalized at \$60,000 and proposes to manufacture gas and electric fixtures, etc.

THE ATLANTIC ELECTRIC GOODS COMPANY of Queens, N. Y., has been incorporated with a capital stock of \$50,000 by P. J. Shelley, J. J. Wesley and C. L. Eidlitz, St. Regis Hotel, New York, N. Y. Joseph J. Wesley of Douglaston, and P. J. Shelley of Oceanside.

THE BOS GENERAL CORPORATION

OF AMERICA, of New York, N. Y., has been incorporated by W. A. Noble, F. and R. Bos, 90 West Street, New York, N. Y. The company is capitalized at \$100,000 and proposes to do a general electrical and mechanical engineering business.

THE PORTER ELECTRIC LINE COMPANY of Stebbinsville (not a post office), Wis., has been chartered with a capital stock of \$10,000 to develop a water power at Stebbinsville and furnish electricity to rural districts within a radius of 10 miles of Stebbinsville. Fred Miller is president.

THE NEW YORK ELECTRIC RECTIFIER CORPORATION of Newark, N. J., has been incorporated by James M. Clark of East Orange; George W. Downs of Madison, and Frank E. Richards of Glen Ridge, N. J. The company is capitalized at \$50,000 and proposes to manufacture electrical apparatus.

THE IOLA (WIS.) LIGHT & POWER COMPANY has been incorporated by Edwin J. George, Bertha and Erna Nehls. The company is capitalized at \$25,000 and proposes to construct and operate a hydro-electric and an auxiliary steam-generating plant, saw and planing mill and other industries.

THE MOUNTAIN STATES POWER COMPANY of Wilmington, Del., has filed articles of incorporation with a capital stock of \$15,000,000 to generate and distribute electricity for lamps, heaters and motors. The incorporators are: C. L. Rimlinger, M. M. Clancy, Clement M. Egner of Wilmington, Del.

FREDERICK N. WHITNEY of Brooklyn, N. Y., has filed articles of incorporation with a capital stock of \$25,000 to build heating, lighting, ventilating, water supply, sewage disposal plants, etc. The incorporators are: F. N. Whitney, L. C. Whitney, 1233 Pacific Street, Brooklyn, and H. W. Hase, 305 Sixth Avenue, Brooklyn, N. Y.

New England States

HOULTON, ME.—A large dam has been completed at Aroostook Falls for the Maine & Aroostook Power Company, which supplies electricity for lamps and motors in Houlton, Van Buren and all intermediate towns, and also for the Aroostook Valley Railroad, which operates heavy freight and passenger traffic through Northern Aroostook with terminals at Washburn, Caribou and New Sweden. The company, it is understood, will build an extension to its power plant.

SKOWHEGAN, ME.—The Central Maine Power Company is planning a water power development at Skowhegan, involving an expenditure of about \$1,000,000. The company owns all the water power rights in the town, the Savage Manufacturing Company and the Skowhegan Pulp Company's power rights, and it has recently purchased the Bombaze Rapids, three miles above Norridgewock. Under the proposed plans the main dam at Skowhegan Falls is to be raised 7 ft. Part of the dam is built of concrete and this only will be raised, while the other half will be entirely rebuilt. It is estimated that 25,000 hp. can be developed. Definite plans have not yet been decided upon.

CAMBRIDGE, MASS.—A permit has been granted to the Worthington Pump & Machinery Corporation, as agent for the United States government, for a power plant building, 70 ft. by 90 ft., one story and mezzanine, to be erected on Binney Street, between Third and Fifth Streets. The cost is estimated at \$60,000. The Aberthaw Construction Company is architect and builder.

EVERETT, MASS.—The General Electric Company is planning to erect a new foundry, one story, at its local plant, to cost about \$35,000.

GREENFIELD, MASS.—The Greenfield Electric Light & Power Company has disposed of its inside wiring business and electrical fixtures and appliances and will close its salesrooms. This is a war measure which has been decided upon by reason of so many men employed by the company having entered military service.

NEW BEDFORD, MASS.—Plans have been filed by the Harry M. Hope Engineering Company for the erection of the new power station to be erected at the foot of Middle Street for the Union Street Railway Company. The new building will be 98 ft. by 126 ft. and will cost about \$300,000.

CHESHIRE, CONN.—The power house at the Farnum lime plant was recently damaged by fire, causing a loss of about \$5,000. The electric plant was put out of commission.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

NORWICH, CONN.—Work, it is expected, will begin in the spring on the new steam power plant of the Eastern Connecticut Power Company at Thamesville. From the proposed power station a high-tension transmission line will be erected to furnish energy to the Groton Iron Works with which the Shore Line Electric Railway Company has a ten-year contract. The balance of the power generated at the plant, it is expected, will be made use of by the various public utilities companies in the territory through which the Shore railway company operates, which has already high-tension lines extending on the west to Guilford, east to Rhode Island and north to Putnam and South Windham.

STAMFORD, CONN.—The John Davenport Company of Stamford, which has taken over the Ross Engineering Company of Bridgeport and the Steinmetz Electric Truck Company of Newark, N. J., contemplates the construction of a new factory, 90 ft. by 300 ft. The company will manufacture gasoline engines and electric trucks.

WATERBURY, CONN.—Contract has been awarded by the International Silver Company of Meriden to Lewis A. Miller, 21 Church Street, Meriden, for the construction of a new one-story power house, about 45 ft. by 80 ft., at its local plant on Silver Street.

Middle Atlantic States

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company will soon begin work on the installation of two 600-hp. boilers, together with stokers and forced draft fan. The company has recently been awarded a contract by the Binghamton Cold Storage Company to supply electrical service to the amount of 100 hp.

BOMBAY, N. Y.—Application has been filed with the Public Service Commission by the Bombay Electric Corporation for permission to issue \$2,000 in capital stock, of which it is proposed to use \$700 at once.

BROOKLYN, N. Y.—The installation of a new electric-lighting system at the local navy yard, to cost about \$8,000, is under consideration by the Bureau of Yards and Docks, Navy Department, Washington, D. C.

BROOKLYN, N. Y.—Plans have been filed by the Transit Development Company, a subsidiary of the Brooklyn Rapid Transit Company, for an addition to its electric generating system at Kent and Division Streets.

BUFFALO, N. Y.—Plans are being prepared by the Kittinger Furniture Company, 15 Front Avenue, Buffalo, for the construction of an addition to the power house at its plant at 1893 Elmwood Avenue.

JOHNSTOWN, N. Y.—The City Council has accepted the new contract presented by the Fulton County Gas & Electric Company for lighting the streets of the city. The new contract calls for 19 type C lamps of 600 cp., 72 lamps of 400 cp. and 280 incandescent lamps of 60 cp. The lamps under the new contract will be arranged throughout the city under the same system as that used at present.

LOCKPORT, N. Y.—The Lockport Light, Heat & Power Company has filed a petition with the Public Service Commission for permission to issue \$150,000 in capital stock.

NEW YORK, N. Y.—Preparations are being made by the Washburn Wire Company, 117th Street, New York City, manufacturer of insulated wire, etc., for rebuilding its plant, recently destroyed by fire. The cost of the new plant is estimated at \$350,000.

THIELLS, N. Y.—Bids will be received by Frank A. Vanderlip, president of the board of managers of Letchworth Village, Thiells, 7 Wall Street, New York, N. Y., until Jan. 3 for construction, heating, plumbing and electric work for attendants' home and service building at Letchworth Village. Drawings and specifications are on file at the office of the board of managers, 7 Wall Street, New York City, and at the New York office of the Department of Architecture, 1224 Woolworth Building. Copies may be obtained at the Department of Agriculture, Capitol, Albany, N. Y. Lewis F. Pilcher is State architect.

HIGHTSTOWN, N. J.—The Borough Council is considering improvements to the water-works system, including the installation of new power equipment.

HOPEWELL, N. J.—The Borough Council has awarded the Public Service Electric Company a contract for lighting the streets of the borough for a period of one year.

JERSEY CITY, N. J.—Plans are being considered by the City Commission for the installation of an underground conduit system for its police and fire-alarm department to replace the present overhead wires, together with other improvements.

PRINCETON, N. J.—The installation of an underground conduit system on Stockton Street has been completed. The Borough

Council is planning to place the remaining overhead transmission wires in underground conduits.

SKILLMAN, N. J.—The Philadelphia & Reading Railroad Company of Philadelphia, Pa., is planning to erect a new power house and signal tower at Skillman for which plans have been prepared.

TRENTON, N. J.—A portion of the car barns and shop of the Trenton & Mercer County Traction Corporation on Lalor Street was destroyed by fire on Dec. 14, causing a loss of about \$70,000. The company has recently awarded a contract for an additional 2000-hp. generating unit at its power house on Lincoln Avenue.

ALTOONA, PA.—The Penn Central Light & Power Company has filed notice with the Public Service Commission of an issue of \$15,000 in bonds for improvements, extensions, etc.

GREENSBURG, PA.—The County Commissioners have awarded a contract for the installation of 16 ornamental lamps around the court house square to the Greensburg Gas & Electric Company at \$60 each per year.

LANCASTER, PA.—Notice has been filed by the Conestoga Traction Company with the Public Service Commission of an issue of car-trust certificates to the amount of \$50,000 for improvements, extensions and other purposes.

NEW CASTLE, PA.—Notice has been filed by the Mahoning & Shenango Railway & Light Company with the Public Service Commission of an issue of \$250,000 in bonds. The proceeds to be used for extensions and improvements.

PHILADELPHIA, PA.—Plans have been prepared by the Bell Telephone Company Seventeenth and Arch Streets, for extensive alterations and improvements to its administration building at Eleventh and Filbert Streets.

PHILADELPHIA, PA.—An ordinance has been passed by the City Council providing for improvements to the electric street-lighting system, which will include the installation of additional lighting units and the relocation of certain lamps forming part of the system.

PHILADELPHIA, PA.—The United States government has requested the Philadelphia Electric Company not to take on any new electrical contracts whatever, and to conserve as much as possible with regard to those already in force. This order was given for war purposes, particularly for the development of the building at Hog Island and the construction of the large ships there.

READING, PA.—The Wilmington & Northern Railroad Company has awarded a contract to the Tri-County Electric Company for furnishing electricity to operate the pumps at the new water station now being erected for the Reading-Wilmington line of the company.

SCRANTON, PA.—The Scranton Electric Company is installing several large boilers at its power plant.

NEW CASTLE, DEL.—The Penn Seaboard Steel Corporation, 111 Broadway, is reported, is planning to erect a new steel mill and power house between Wilmington and New Castle at a cost of about \$2,000,000. The power house will cost about \$300,000.

BALTIMORE, MD.—Plans have been prepared by the Consolidated Gas, Electric Light & Power Company for the erection of a new electric distributing station at Custom House Avenue and Water Streets, to cost about \$10,000.

SECURITY, MD.—Work is progressing rapidly on the improvements to the local power plant of the Hagerstown & Frederick Railway Company, which when completed will double the output now obtained from the plant.

BLUEFIELD, W. VA.—The Norfolk & Western Railway Company is contemplating the construction of approximately 16 miles of new track from Kimball to Farm and Wilcox, during 1918.

CHARLESTON, W. VA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., has awarded contract for construction of an electric conduit system at the United States naval projectile plant to the G. E. Engineering Company, New York, N. Y., at \$8,988.

FAIRMONT, W. VA.—The Monongahela Valley Traction Company contemplates the construction of 4 miles of new track in Fairmont during 1918 and to rebuild 1 mile of new track.

HERNDON, VA.—The Herndon Light & Power Company, recently incorporated with a capital stock of \$15,000, proposes to construct and operate an electric-light plant in Herndon. C. N. Florence is president and F. E. Gillette is secretary.

North Central States

GRAND RAPIDS, MICH.—The Grand Rapids Railway Company, it is reported, is considering the construction of a cross-town extension to the northeastern section of the city.

GRAND RAPIDS, MICH.—The new junction dam on the Manistee River of the Consumers' Power Company is nearly completed and, it is expected, that it will be put into service early in January. It is estimated that about 22,000 hp. will be developed, which will be transmitted to Grand Rapids via Croton. The company has two new developments under construction on the Au Sable River. One of these, which it is estimated will develop about 10,000 hp., will be completed the latter part of January. Power generated at this plant will be utilized in the eastern part of the State.

AKRON, OHIO.—Extensions are being made to the local plant of the Wellman-Seaver-Morgan Company of Cleveland, which will include a power house, a galvanizing plant and a crane runway.

CANTON, OHIO.—The power plant at Windsor, after having been closed for several months, has resumed operations and is now supplying energy in Canton.

PORTSMOUTH, OHIO.—The Portsmouth Street Railroad & Light Company is planning to build 2 miles of new track between Portsmouth and Union Mills during 1918.

OWENSBORO, KY.—Notice has been filed by the Owensboro Home Telephone & Telegraph Company of an increase in capital stock from \$10,000 to \$100,000, the proceeds to be used for extensions, improvements, etc.

SHEPHERDSVILLE, KY.—The Bullitt County Electric Company, recently incorporated, proposes to operate an electric plant in Shepherdsville and surrounding towns. The incorporators are: S. M. Bates, C. L. Croan and S. H. Higway. The company is capitalized at \$9,000.

FORT WAYNE, IND.—The Board of Works has awarded the contract for the construction of an addition to the municipal electric-light plant to Buesching & Hagerman, at \$26,015. The contract for smoke-stack was awarded to the Custodis Company, at \$8,440.

CHICAGO, ILL.—The general contract for the construction of a factory, 87 ft. by 250 ft., one-story, to cost about \$30,000, in connection with a plant being erected on Waller Avenue and Taylor Street for the Hughes Electric Heating Company, 5660 Taylor Avenue, has been awarded to the Abraham Lund Company, 19 South La Salle Street.

CHICAGO, ILL.—Plans are being prepared, it is reported, by the Chicago Surface Lines for extensive additions to its carhouses at North Clark Street and Schreiber Avenue, to provide space for about 300 cars. A one-story power house and two-story office building will probably be included in the project. No construction work, it is understood is contemplated in the near future. The cost of the entire work is estimated at about \$500,000.

EAST ST. LOUIS, ILL.—The Excelsior Tool & Machine Company is planning extensions to its plant, including the erection of an addition to its foundry building, a two-story pattern shop, storehouse, stockroom and garage, for which, it is understood, bids have been asked. The company also contemplates the construction of a large core oven and will install a 10-ton and a 2-ton electric crane. T. F. Phillippi is president and manager.

HILLSBORO, ILL.—The Southern Illinois Light & Power Company of Hillsboro has applied to the Public Utilities Commission for permission to erect an electric transmission line from DuQuoin to Pinckneyville to furnish electricity for lamps and motors to adjacent territory.

AMHERST, WIS.—The Amherst Electric Service Company, recently incorporated with a capital stock of \$25,000, proposes to operate an electric plant in Amherst. Among the incorporators are: B. E. Dwinell, Hugh Evans and others.

IOLA, WIS.—The Iola Electric Light & Power Company is planning to change its plant from direct to alternating-current system. New machinery, including engines, generators and transformers will be installed. Meters and poles will be required. J. N. Cadby, Washington Building, Madison, is consulting engineer.

RACINE, WIS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 7 for conduit and wiring system, lighting fixtures, etc., for the United States post office and custom house in Racine. Drawings and specifications may be obtained at the above office or the custodian of the building at Racine.

STEBBINSVILLE, WIS.—The Porter Electric Line Company, recently incorporated with a capital stock of \$10,000, is planning to develop water power at Stebbinsville and furnish electricity to rural districts within 10 miles of Stebbinsville. Fred Miller is president of the company. Stebbinsville has not a post office.

DEER RIVER, MINN.—Owing to the difficulty in securing equipment, etc., the installation of the second generating unit in the power plant of the Minnesota Utilities Company has been delayed. When completed a 24-hour service will be established.

DULUTH, MINN.—The Duluth Edison Electric Company has petitioned the City Council for permission to extend its three-phase, 2300-volt feeder line through New Duluth past the pumping station of the Light and Water Department.

LOUISBURG, MINN.—Bonds to the amount of \$2,500 have been voted for the installation of an electric-light system in Louisburg.

ST. PAUL, MINN.—With the understanding that no work will be attempted until after the war, the City Council has requested the Department of Public Works to report on the feasibility of establishing a municipal lighting, heating and power plant.

SEBEKA, MINN.—The Council has asked the Little Falls (Minn.) Water Power Company of Minnesota to erect an electric transmission line to Sebeka to furnish electrical service here.

VIRGINIA, MINN.—The power plant of the Virginia & Rainy Lake Lumber Company was damaged recently by an explosion. The company supplies power to operate the municipal electric-light plant. The reserve plant of the city has been put into commission.

GARNER, IOWA.—The local electric-light plant of the Iowa Falls Electric Company was recently destroyed by fire, causing a loss of about \$10,000.

LE MARS, IOWA.—The new power plant of the Iowa Light, Heat & Power Company will be completed about Jan. 1. The electric transmission line to Remsen is nearly finished and will soon be connected with the plant. When completed the power station will supply electricity in Alton, Orange City, Remsen and Kingsley. Other towns will be added later. Additional units, it is expected, will be added next spring.

MANCHESTER, IOWA.—The Iowa Electric Company of Cedar Rapids, owner of the local electric plant, has submitted a proposal to the City Council to sell the plant to the city. The company recently acquired the properties of the Manchester Light, Heat & Power Company and of E. W. Hoag in Manchester.

OZARK, MO.—The Finley Light Company, recently incorporated with a capital stock of \$10,000, proposes to operate a mutual electric-light plant. John C. Rogers, D. W. Bingham and others are incorporators.

GROTON, S. D.—The Groton Light, Heat & Power Company is contemplating the erection of an electric transmission line from Ashton to Conde and from Conde to Verdon and Ferney, thence to Groton and on to Andover.

BAYARD, NEB.—Bonds to the amount of \$4,500 have been voted for the installation of an ornamental lighting system.

LARNED, KAN.—Plans are being considered to extend the electric transmission line of the municipal electric-light plant from the State Hospital of the Insane, located 3 miles west of Larned, to the town of Gillespie, a distance of 11 miles, to furnish electricity in the latter place.

Southern States

GREENSBORO, N. C.—The Greensboro Supply Company, it is reported, is in the market for the following second-hand machinery: One 300 to 400-kw., three-phase, 60-cycle, 550 or 2300-volt, revolving field alternator, directly connected to cross-compound condensing Corliss engine; one 500-kw., three-phase, 60-cycle, 550-volt, revolving field alternator, direct-connected to a simple engine. Complete specifications to be furnished, giving condition of equipment.

CHARLESTON, S. C.—Contract has been awarded by the Navy Department, Washington, D. C., for improvements to the power plant at the Charleston Navy Yard to Gillis & Geoghegan, 537 West Broadway, New York City, at \$119,875.

COLUMBIA, S. C.—Surveys have been completed by the Columbia Railway & Navigation Company for its proposed electric interurban railway from Columbia to Greenwood, via Lexington and Saluda, a

distance of about 75 miles. Construction of the railway has been deferred on account of financial, material and labor conditions. T. C. Williams is vice-president and general manager and Frank H. Halskell is chief engineer of Columbia.

ATLANTA, GA.—The Alabama Street substation of the Georgia Railway & Power Company was recently damaged by fire, causing a loss of about \$2,000.

EAST POINT, GA.—The Couch Mills Company is planning to erect two mill buildings, one 200 ft. by 60 ft. and the other 150 ft. by 50 ft. The equipment will include 108 looms equipped for electric-motor drive. Most of the machinery, it is understood, has been purchased. J. L. Denman of East Point is engineer.

SAVANNAH, GA.—The Savannah Electric Company is considering the construction of an extension to Fort Wentworth, a distance of about 5 miles.

ARCHER, FLA.—The Maddox Foundry & Machine Company, it is reported, would like to receive prices on equipment for electric-lighting plant, direct current. H. Maddox is president and manager.

BONIFAY, FLA.—Bids will be received by the Town Council at the office of the town clerk until Jan. 3 for the construction of an electric-light plant and waterworks system. Plans and specifications may be obtained at the office of the J. B. McCrary Company, engineer, Third National Bank Building, Atlanta, Ga. Charles E. Terry is town clerk.

JACKSONVILLE, FLA.—Plans are being considered by the committee on water and electricity for the erection of an electric transmission line to the State Fair Grounds.

KINGSFORT, TENN.—The new electric-lighting system installed by the Kingsport Utilities Company from Dale Street to the plant of the Federal Dyestuff & Chemical Corporation has been put into operation. It is expected to have the entire lighting system for the business and residential sections in service by the first of the year.

FOLEY, ALA.—The city of Foley is considering issuing \$3,000 in bonds, the proceeds to be used to construct or purchase an electric-light plant.

HANCEVILLE, ALA.—The Stouts Mountain & Hanceville Railroad Company, it is reported, contemplates the construction of a railway between Hanceville and Stoutsville, a distance of 6 miles. Charles F. Wheelock of Birmingham is reported interested.

MOBILE, ALA.—The Mobile & Ohio Railroad Company is contemplating improvements to grain elevator, involving an expenditure of about \$100,000. It is proposed to rebuild a 250,000-bu. elevator and equip it with electrically-operated machinery. R. V. Taylor is vice-president.

NEW ORLEANS, LA.—Bids will be received by the Board of the Port of New Orleans, Suite 200, New Orleans Court Building, until Jan. 9 for furnishing and installing a complete fire protection and sprinkler system, including motor-driven centrifugal underwriters' pumps and complete electrical installation for same, for portions of the cotton warehouses and terminals now under construction on the east bank of the Mississippi River between Valence and Soniat Streets. Plans and specifications are on file at the office of Ford, Bacon & Davis, 921 Canal Street, copies of which may be obtained upon deposit of \$25.

SHEFFIELD, ALA.—Definite steps have been taken by the United States government for the construction of a cyanamide plant at Muscle Shoals, near Sheffield, to cost \$30,000,000. Electricity to operate the proposed plant will be supplied by the Alabama Power Company, which has a three-year contract to furnish the service. Work has already begun on the erection of a transmission line from Warrior to the Muscle Shoals. The transmission line from the steam plant will be 190 miles long, including the new circuit from Warrior to Sheffield, which is 90 miles.

KENSETT, ARK.—E. D. Hardin, recently granted a franchise to supply electricity in Kensett, is planning to install an electric-light and power plant.

NEWPORT, ARK.—The Littleton Brothers Company, it is reported, is in the market for cotton gin and power plant equipment to replace that destroyed by fire recently. The loss is estimated at \$12,500.

NEW ORLEANS, LA.—The New Orleans Railway & Light Company is planning to rebuild 5.7 miles of track during 1918.

NEW ORLEANS, LA.—Preparations are being made for the installation of the new ornamental lighting system on the principal thoroughfares of New Orleans leading from the Union Station to Canal Street. The plan provides for the erection of ornamental standards, each mounted with a 500-cp. nitrogen lamp.

DURANT, OKLA.—The Consumers' Light & Power Company is planning to rebuild and equip that portion of its electric plant damaged by fire.

TULSA, OKLA.—The Tulsa Street Railway Company is considering double-tracking its line on Main Street.

BRYAN, TEX.—The Bryan & Central Texas Interurban Railway Company contemplates the construction of 4 miles of new track between Newsome and Wilcox during 1918.

FORT WORTH, TEX.—The City Commission will ask the Northern Texas Traction Company to extend the Arlington Heights car line to Lake North, a distance of 8 miles. The company now operates a bus line from the end of the car line to the beach.

MART, TEX.—The installation of additional machinery at the waterworks station is under consideration by the City Council.

PORT ARTHUR, TEX.—The Port Arthur Light & Power Company is contemplating the installation of a water-treating plant, to cost about \$16,000.

Pacific and Mountain States

SEATTLE, WASH.—Plans are being prepared by Daniel Huntington, city architect, for the construction of a new substation for the Municipal Lighting Department at West Forty-ninth Street and Fourteenth Avenue. N. W. The cost of the station with equipment is estimated at about \$75,000. The proposed station will distribute electricity in the Ballard district as well as for the operation of the Ballard extension of Division "A" of the municipal street railway system. Bids, it is understood, will be asked for soon after the first of the year.

SEATTLE, WASH.—Plans are being considered for increasing the transportation facilities to the Duwamish Valley district in Seattle, where the new industrial plants have been located. One of the plans presented is the use of two five-car electric trains twice each day to run from Fifth Avenue and Jackson Street to Ninth Avenue South, skirting the foot of Beacon Hill and turning off at Lucille Street to run west to First Avenue South, and thence south on First Avenue to Fidalgo Street. The cost of installing this line is estimated at \$65,000. The other is to use the shuttle system running along Lucille Street and First Avenue South, making transfer connections with the Georgetown and South Park cars, the cost of which is estimated at \$45,000.

TACOMA, WASH.—Norton L. Taylor, engineer in the Department of Light and Water, has been appointed as special engineer to make surveys and estimates on increasing the storage capacity of the Nisqually basin of the power plant.

ASTORIA, ORE.—The Pacific Power & Light Company is considering making extensions to its local service to meet the increasing demands for electricity for industrial purposes.

ANAHEIM, CAL.—Preparations are being made for the installation of new machinery in the municipal electric-light plant, including a tandem cross-compound engine, an electric generator, exciter, boilers, pumps, etc., for which bids have been received.

BELLA VISTA, CAL.—The planing mill and electric plant of the Shasta Land & Timber Company was recently damaged by fire, causing a loss of about \$70,000. The plant was under lease to the Shasta Commercial Company. Post office address Bella Vista, R. F. D. from Palo Cedro.

MERCED, CAL.—The San Joaquin Light & Power Company is erecting an electric transmission line from the new power house at the site of the Merced Stone Company's interests to Coulterville. The company has a franchise at the latter place and will install an electric street-lighting system.

SAN FRANCISCO, CAL.—Application has been made by the Pacific Gas & Electric Company to the Railroad Commission for authority to issue \$3,000,000 in bonds, at not less than 85. Of the proceeds it is proposed to use \$1,500,000 for electrical equipment and extensions, \$1,000,000 for its gas department and \$200,000 for miscellaneous purposes, during 1918.

SAN FRANCISCO, CAL.—At a meeting of the electrical interests with the State Railroad Commission held recently plans for combining all electrical power resources of California under one general management for the duration of the war, looking toward obtaining greater economy in operation and increased production were considered. F. Emerson Hoar, electrical engineer of the

commission, was authorized to draw up a plan under which the combination can be effected.

SAN FRANCISCO, CAL.—The Southern Pacific Company, it is reported, will soon begin the work on erecting a high-tension transmission line from its Fernside power house to Webster Street, Alameda, and to remove the existing high-tension line from Lincoln Avenue. The cost of the transmission line is estimated at \$60,000. The proposed new line will transmit energy from the main plant to the substations at West Oakland and Thousand Oaks. E. H. Miller is engineer in charge.

SANTA BARBARA, CAL.—The City Council is considering the installation of a municipal electric-light plant in Santa Barbara. The construction of a hydroelectric plant at Mission Tunnel is under consideration.

SANTA MONICA, CAL.—The City Commissioners have granted Erminio Gamberi a 25-year franchise to operate electric trams on the Ocean Front Promenade in Santa Monica.

PASADENA, CAL.—The Southern California Edison Company has submitted a new offer to the city for the purchase of the company's distributing system within the city limits. The former price named was \$500,714; the new offer is \$488,223. Further the company offers to sell energy on a 15-year contract, instead of a 30-year basis as was originally proposed. The city refused the first offer and began to purchase power from the city of Los Angeles.

MONTOUR, IDAHO.—Surveys are being made for the installation of an electrically-driven pumping plant for R. E. Noland to irrigate 2200 acres of land south and east of Montour. The cost is estimated at about \$30,000. George Knowles is engineer.

NAMPA, IDAHO.—Plans have been completed by the Carnation Milk Products Company of Seattle for the erection of a plant in Nampa, to cost about \$175,000. The plans include a three-story boiler house, 50 ft. by 100 ft.

SHELLEY, IDAHO.—The installation of a municipal electric-lighting plant in Shelley is under consideration.

YUMA, ARIZ.—The Southern Sierras Power Company has abandoned temporarily its project of extending its electric transmission line from Yuma through Gila-bend to Ajo on account of the difficulty in securing equipment. The proposed line was to supply electricity to operate irrigation pumping plants and mining machinery.

HARLOWTON, MONT.—The city has awarded a contract to the Montana Power Company for the installation of an ornamental lighting system, to cost about \$4,000.

MISSOULA, MONT.—The Missoula Light & Water Company has filed a notice of increase in capital stock from \$1,000,000 to \$1,500,000.

DENVER, COL.—The installation of a lighting system similar to that used at the San Diego Exposition (flood system) in the civic center has been decided upon by the Park Board. Underground wires to maintain the system have already been installed. Under the present plans the cost of maintenance is estimated at \$4,000 per year.

Canada

BROCKVILLE, ONT.—Brockville will soon be linked up with the Ontario systems of the Hydro-Electric Power Commission by the transmission of 10,000 hp. from the Cedar Rapids Transmission Company, which at present is developing and furnishing from 60,000 to 80,000 hp. to the aluminum and other plants at Massena, N. Y.

MERLIN, ONT.—A movement has been started by the ratepayers to secure hydro-power service in Merlin.

MINDEN, ONT.—A committee has been appointed to secure an extension of the electric transmission line of the Hydro-Electric Power Commission of Ontario from Kinmount Junction to Minden.

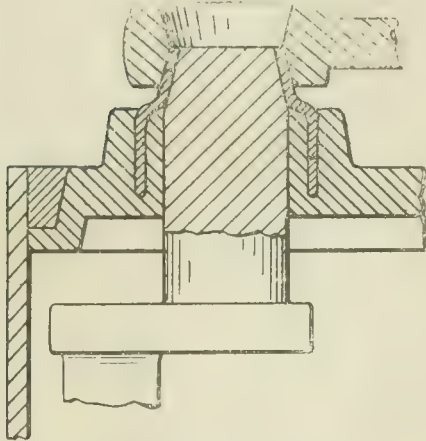
WARKWORTH, ONT.—Steps have been taken to secure electrical service for the village of Warkworth and farmers residing along the line in Percy Township which will be erected from Campbellford.

WINDSOR, ONT.—The Water Commissioners have decided to install at once two high-power electrically-driven pumps on account of shortage of fuel. The present steam plant will be held for auxiliary purposes.

VALLEYFIELD, QUE.—The power house of the Montreal Cottons, Ltd., was recently destroyed by fire. Arrangements are being made to equip the plant for electrical operation.

(Closed Dec. 1, 1917)

- 1,248,749. **ELECTRIC SIGNAL SYSTEM**; Nathan H. Siren, Needham, Mass. App. filed Feb. 8, 1915. Particularly for use where a multiplicity of code signals is required.
- 1,248,768. **STORAGE BATTERY**; Theodore A. Willard, Cleveland, Ohio. App. filed Jan. 10, 1916. Means for sealing the terminal posts in the cover.
- 1,248,782. **CALLING MECHANISM FOR PARTY-LINE EXCHANGES**; Clarence A. Anderson, Chicago, Ill. App. filed March 30, 1911. Improvements.
- 1,248,787. **ELECTRICAL SWITCH**; Frank J. Backscheider, Cincinnati, Ohio. App. filed June 30, 1913. Switch in which the circuit may be automatically and instantaneously broken under predetermined conditions.
- 1,248,800. **ELECTRICALLY HEATED PRESS FOR CLAYWARE**; Sebastian G. Brinkman, Ford, N. J. App. filed Sept. 6, 1917. Improvements.
- 1,248,812. **ELECTRICALLY UNITING METALS**; Frederick A. Costello, Southbridge, Mass. App. filed Jan. 3, 1911. United by the melting away of the uniting material.
- 1,248,813. **ELECTRIC WELDING AND SOLDERING**; Frederick A. Costello, Southbridge, Mass. App. filed Dec. 22, 1913. Improvements.
- 1,248,828. **IGNITION DEVICE**; Burns Dick, St. Louis, Mo. App. filed July 19, 1915. Improved means for automatically causing the maximum explosion pressure to occur at an efficient point of the crank revolution under all load conditions.
- 1,248,829. **CONDENSER TERMINAL AND METHOD OF FORMING SAME**; Burns Dick, St. Louis, Mo. App. filed Sept. 17, 1915. Method of forming foil condenser terminals integral with the foil itself.
- 1,248,834. **AUTOMATIC TRUNKING SYSTEM**; Edward D. Fales, La Grange, Ill. App. filed May 17, 1909. Improvements.
- 1,248,840. **IGNITION SYSTEM**; Valere A. Fynn, St. Louis, Mo. App. filed April 13, 1914. Battery ignition system.
- 1,249,027. **SWITCH**; John F. Cavanagh, Meriden, Conn. App. filed Oct. 4, 1916. For automobiles.
- 1,249,032. **METHOD OF METERING TELEPHONE TRAFFIC**; Edward E. Clement, Washington, D. C. App. filed Feb. 23, 1905. Methods of registering messages and their duration.
- 1,249,036. **TELEPHONE SYSTEM**; Hiram D. Currier, Chicago, Ill. App. filed Oct. 1, 1913. Simplified arrangement of control circuits in connection with an operator's link circuit.
- 1,249,043. **LIMIT-SWITCH MECHANISM**; William N. Dickinson, Brooklyn, N. Y. App. filed June 17, 1916. For elevators, dumbwaiters or similar apparatus.
- 1,249,053. **WIRE-ASSEMBLING MACHINE**; Charles R. Evans, Akron, Ohio. App. filed March 12, 1917. Improvements in the feeding mechanism.
- 1,249,055. **PULL-SWITCH INDICATOR**; Gilbert W. Goodridge, Bridgeport, Conn. App. filed April 9, 1914. Improvements.
- 1,249,068. **PUSH-BUTTON**; John Gramm, New York, N. Y. App. filed Dec. 14, 1916. Bell-ringing circuits.
- 1,249,083. **TELEGRAPHY**; Ernest S. Heurtley, Oxford, Eng. App. filed June 24, 1916. Improved method of transmitting more than one message or impulse at the same time and in the same direction over one conductor and selecting out these



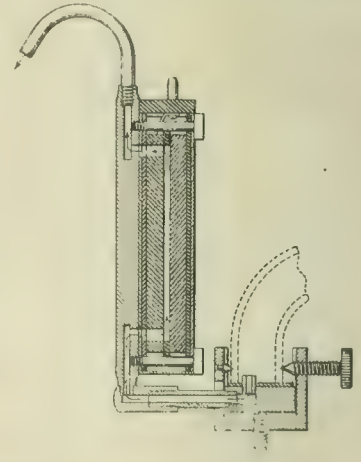
1,248,768—Storage Battery

- 1,249,117. **PULL-CHAIN SWITCH**; Charles J. Klein, Milwaukee, Wis. App. filed Sept. 16, 1911. Having a quick break or quick make-and-break action.
- 1,249,135. **ELECTRICAL SYSTEM**; Leon J. Le Pontois, Lakewood, Ohio. App. filed Dec. 7, 1910. Useful as a combined lighting and ignition system.
- 1,249,145. **MACHINE-SWITCHING TELEPHONE EXCHANGE SYSTEM**; Alben E. Lundell, New York, N. Y. App. filed Aug. 22, 1916. Improvements.
- 1,249,146. **TELEPHONE EXCHANGE SYSTEM**; Alben E. Lundell, New York, N. Y. App. filed Dec. 2, 1916. Improvement in the circuits and control of selective signaling apparatus of party lines in an automatic telephone system.
- 1,249,152. **MAGNETO CONSTRUCTION**; Samuel C. McKeown, Sumter, S. C. App. filed Dec. 20, 1913. Various parts are rigidly held in operative relation to each other without the use of screws, rivets or other means.
- 1,249,154. **ELECTRIC SWITCH**; James L. McQuarrie, Montclair, N. J. App. filed Sept. 22, 1916. Improvements.
- 1,249,155. **ELECTRIC SWITCH**; James L. McQuarrie, Montclair, N. J. App. filed Sept. 22, 1916. For use in automatic and semi-automatic telephone systems.
- 1,249,157. **CONTACT INTERRUPTER FOR THE ELECTROMAGNETIC PRODUCTION OF MUSICAL SOUNDS**; Alcide H. Maitre and Victor H. G. Martin, Rouen, France. App. filed March 27, 1914. Improved.
- 1,249,159. **TWO-WIRE AUTOMATIC TELEPHONE SYSTEM**; Talbot G. Martin, Chicago, Ill. App. filed March 21, 1908. Provides a two-wire system in which automatic party-line service can be given the subscriber thereof.
- 1,249,162. **SIGNALING SYSTEM**; Carl F. Mead, Cleveland, Ohio. App. filed Sept. 16, 1912. For offices, factories and banks.
- 1,249,223. **BATTERY CHARGER**; Arthur P. Smith, Portland, Me. App. filed April 17, 1916. For intermittently inserting sets of batteries into a circuit, with the resulting increase of the life of the batteries.
- 1,249,229. **DIRECTION SIGNAL FOR AUTOMOBILES**; Joseph C. Snow, Brockton, Mass. App. filed Aug. 16, 1916. Improvements.
- 1,249,236. **ELECTRIC VIBRATOR**; Rude Stockinger, Manitowoc, Wis. App. filed May 3, 1917. For vibrating pattern plates disposed in molds.
- 1,249,245. **ELECTRIC SWITCH**; John W. Teare, Kiowa, Tex. App. filed Feb. 3, 1917. For use in connection with telephones.
- 1,249,247. **ATTACHMENT PLUG**; George B. Thomas, Bridgeport, Conn. App. filed Sept. 9, 1916. Jack-blade type.
- 1,249,268. **STORAGE BATTERY**; Theodore A. Willard, Cleveland, Ohio. App. filed Dec. 21, 1914. Means for preventing a high rise in temperature by providing for very rapid dissipation of heat.
- 1,249,274. **MEANS FOR FIRE CONTROL FOR DRIFTABLE DEVICES**; Edward F. Chandler, Woodhaven, N. Y. App. filed Jan. 12, 1915. For accurately directing the course of torpedoes.
- 1,249,285. **ELECTRIC WATER HEATER**; Milton H. Shoenberg, San Francisco, Cal. App. filed Aug. 27, 1917. Heating chamber which is entirely inclosed by electrodes through which an electrolytic action may be obtained without decomposition of the electrodes.
- 1,249,286. **ELECTROPLATING APPARATUS**; Elmer B. Stone, New Britain, Conn. App. filed Nov. 7, 1916. Provides means by which hollow articles may be advantageously treated.
- 1,249,313. **SWITCH BOX**; John C. Boyton and Oris H. Nickerson, Cleveland, Ohio. App. filed Jan. 23, 1914. Removable sides.

Record of Electrical Patents

Notes on United States Patents

- 1,249,359. **SECTION INSULATOR**; George B. Ely, Elkhart, Ind. App. filed March 13, 1916. Overhead construction for electric trolley lines.
- 1,249,386. **TELEPHONE-SWITCH MECHANISM FOR PREVENTING CORD TWIST**; Hans Hansen, Kansas City, Mo. App. filed March 12, 1917. Located in the base of a desk telephone instrument.
- 1,249,389. **ELECTRIC FIXTURE**; Gustav A. Harter, Chicago, Ill. App. filed Aug. 18, 1913. Shades may be separately adjusted.
- 1,249,398. **SOUND-REPRODUCING MACHINE**; William F. Hitchcock and Joseph F. Hitchcock, Rochester, N. Y. App. filed Nov. 27, 1914. Electrically driven.
- 1,249,409. **SOUND-TRANSMITTING APPARATUS**; Alva D. Jones, Philadelphia, Pa. App. filed March 2, 1914. Talking machine.
- 1,249,414. **PROCESS OF MAKING TALKING-MACHINE RECORDS**; John Kaiser, New York, N. Y. App. filed May 31, 1917. Involving the production of an original record by electrolysis.
- 1,249,429. **MULTIPLE LIGHTNING ARRESTER**; Wilbur S. Lewis, Lakewood, Ohio. App. filed Feb. 16, 1916. Adapted to be used for protecting telephone and telegraph lines.
- 1,249,430. **TEST CLIP**; Wilbur S. Lewis, Cleveland, Ohio. App. filed Oct. 3, 1916. Improvements.
- 1,249,464. **LAUNDRY APPLIANCE**; Helen M. Nolen, Toledo, Ohio. App. filed July 7, 1916. Irons.
- 1,249,479. **ELECTRIC FURNACE FOR PRODUCING ENDOTHERMIC GAS REACTIONS**; Richard Pfahler, Charlotte, N. C., and In-



1,249,285—Electric Water Heater

- genuin Hechenbleikner, Great Falls, S. C. App. filed Aug. 26, 1913. Improvements.
- 1,249,482. **RADIO TELEGRAPHY AND TELEPHONY RECEIVER**; Greenleaf Whittier Pickard, Amesbury, Mass. App. filed March 20, 1914. Improvements.
- 1,249,526. **ELECTRIC SWITCH**; William G. Shelton, New York, N. Y. App. filed Sept. 11, 1916. Means for starting an electric motor at higher than its normal running speed, whereby it instantly overcomes the inertia of the driven part.
- 1,249,530. **ELECTROMAGNETIC SHIP'S LOG**; Charles G. Smith, Cambridge, and Joseph Slepian, Boston, Mass. App. filed Dec. 20, 1915. Method of measuring the speed of a ship.
- 1,249,532. **ELECTRIC WELDING**; Herbert M. Smith and William W. Stanley, Great Barrington, Mass. App. filed April 14, 1916. Improved method of welding together metallic sheet edges or parts, so as to obtain a better and more uniform weld.
- 1,249,570. **SIGNALING SYSTEM**; Stanley S. A. Watkins, Mount Vernon, N. Y. App. filed Dec. 29, 1916. Telephone.
- 1,249,574. **ELECTRIC LAMP**; George E. Werner, Los Angeles, Cal. App. filed Sept. 26, 1916. For vehicles.
- 1,249,582. **TELEPHONE EXCHANGE SYSTEM**; Joseph L. Wright, Cleveland, Ohio. App. filed Nov. 11, 1912. Semi-automatic.
- 1,249,732. **MAGNETO**; Louis J. Flint, Detroit, Mich. App. filed Sept. 28, 1914. Improvements.
- 1,249,842. **FIRE AND TEMPERATURE ALARM**; George L. Smith, London, Eng. App. filed Dec. 4, 1915. Improvements.
- 1,249,849. **TELEPHONE MOUTHPIECE**; Louis Steinberger, Brooklyn, N. Y. App. filed Feb. 10, 1912. Sanitation is improved.

(Issued Dec. 11, 1917)



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